GeoMax Zoom80

Technical Reference Manual

Version 4.0.0

Introduction

Purpose

Congratulations on the purchase of a Zoom80 series instrument.

☞ To use the product in a permitted manner, please refer to the detailed safety directions in the User Manual.

Product identification

The type and the serial number of your product are indicated on the type plate. Enter the type and serial number in your manual and always refer to this information when you need to contact your agency or GeoMax authorized service workshop.

Type: ___________________________

Serial No.: ___________________________

Symbols

The symbols used in this manual have the following meanings:

Type	Description
☞	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

Trademarks

- CompactFlash and CF are trademarks of SanDisk Corporation
- *Bluetooth*® is a registered trademark of Bluetooth SIG, Inc

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Validity of this manual

This manual applies to Xsite onboard running on Zoom80 instruments.
Due to the different instruments and equipment, some parts of the manual may not be valid.
Where there are differences between the instruments they are clearly described.

Table of Contents

In this manual

1 Instrument Protection with PIN

Description

- The instrument can be protected by a **P**ersonal **I**dentification **N**umber.
- If the PIN protection is activated, the instrument will always prompt for a PIN code entry after starting up and before **Zoom80 Main Menu** comes up.
- If a wrong PIN has been typed in five times, a **P**ersonal **U**nbloc**K**ing code is required.
- Refer to "17.6 Start Up & Power Down" for information on activating PIN protection.
- This chapter explains the workflow of entering PIN and PUK.

Access

- **Zoom80 Enter Security PIN Code** is automatically accessed during starting up the instrument when **<Use PIN: Yes>** in **CONFIGURE Start Up & Power Down**, **PIN Code** page and a PIN has been defined before. Refer to "17.6 Start Up & Power Down".
- **Zoom80 Enter Security PUK Code** is automatically accessed during starting up the instrument when a wrong PIN code has been typed in five times.

Zoom80
Enter Security PIN Code

OK (F4)
To accept the PIN code and to continue with the subsequent screen.
SHIFT QUIT (F6)
To turn off the instrument.

Description of fields

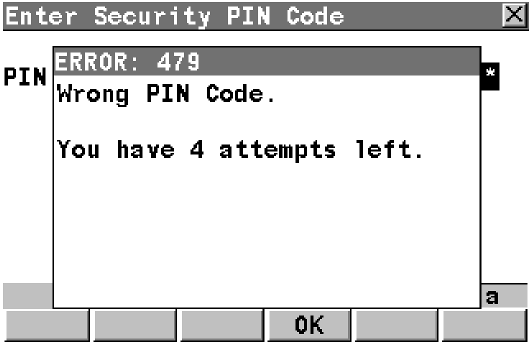
Field	Option	Description
PIN Code	User input	The PIN code as previously defined in **CONFIGURE Start Up & Power Down**, **PIN Code** page. The correct PIN code must be typed in within five attempts or the PUK code is required.

Next step

IF the PIN code entered is	THEN
correct	**Zoom80 Main Menu** is displayed. Refer to "5 Main Menu".

IF the PIN code entered is	THEN
wrong	refer to paragraph " Zoom80 Enter Security PIN Code Error: 479".
wrong the fifth time	the PUK code is required. Refer to paragraph " Zoom80 Enter Security PIN Code Error: 478".

Zoom80 Enter Security PIN Code Error: 479

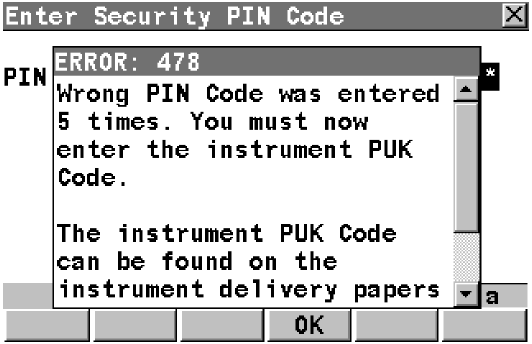


OK (F4)
To return to **Zoom80 Enter Security PIN Code** where a PIN code can be typed in again.

Next step

IF the PIN code entered is	THEN
correct	**Zoom80 Main Menu** is displayed. Refer to "5 Main Menu".
wrong the fifth time	the PUK code is required. Refer to paragraph " Zoom80 Enter Security PIN Code Error: 478".

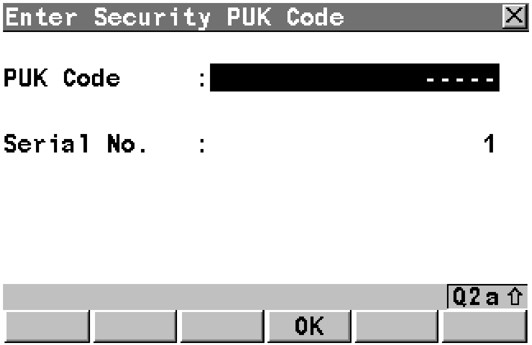
Zoom80 Enter Security PIN Code Error: 478



OK (F4)
To continue with the subsequent screen.

Next step
OK (F4) to access **Zoom80 Enter Security PUK Code**.

Zoom80 Enter Security PUK Code



OK (F4)
To accept the PUK code and to continue with the subsequent screen.

SHIFT QUIT (F6)
To turn off the instrument.

Description of fields

Field	Option	Description
PUK Code	User input	The PUK code as generated by GeoMax. The PUK code comes with the instrument.
Serial No.	Output	The serial number of the instrument. This is needed to obtain PUK from GeoMax.

Next step

IF the PUK code entered is	THEN
correct	the old PIN code is cleared and the PIN protection is deactivated. **Zoom80 Main Menu** is displayed. Refer to "5 Main Menu".
wrong	Zoom80 keeps asking for the correct PUK code. **SHIFT QUIT (F6)** to turn off the instrument.

2 Configurable Keys

2.1 Hot Keys

Description

- Two levels of hot keys exist:
  - The first level are the keys **F7, F8**, ..., **F12**.
  - The second level is the combination of **SHIFT** and **F7, F8**, ..., **F12**.

Functionality

- Hot keys provide a shortcut for quickly and directly carrying out functions or starting application programs assigned to the keys. The assignment of functions and application programs to hot keys is user configurable.
- Refer to "17.3 Hot Keys & User Menu" for the configuration of hot keys.

Using the hot keys

- The first level is accessed by pressing **F7**, **F8**, ..., **F12** directly.
- The second level is accessed by pressing **SHIFT** first followed by **F7**, **F8**, ..., **F12**
- Hot keys can be pressed at any time. It is possible that a function or application program assigned to a hot key cannot be executed in certain situations.

Define hot key/user menu step-by-step

This step-by-step description shows how to assign the **CONFIGURE Coding & Linework** screen to the **F7** key and to the first line of **Zoom80 User Menu: Job Name**.

Step	Description
1.	Select **Main Menu: Config...\General Settings...\Hot Keys & User Menu**.

Step	Description
2.	**CONFIGURE Hot Keys & User Menu** For **Hot Keys/Shift Hot Keys** select **<F7: CONF Coding & Linework Settings>**. For **User Menu** select **<1: CONF Coding & Linework Settings>**.
3.	**CONT (F1)**
4.	Press **F7** to access **CONFIGURE Coding & Linework**. OR Press **USER** and 1 to access **CONFIGURE Coding & Linework**.

2.2 USER Key

Description

The **USER** key opens the user defined menu.

User defined menu

The user defined menu can be configured to contain the most used functions or application programs. The user defined menu can not be accessed while in a **CONFIGURE XX** screen. Refer to "17.3 Hot Keys & User Menu" for the configuration of the user defined menu.

Functionality of the user defined menu

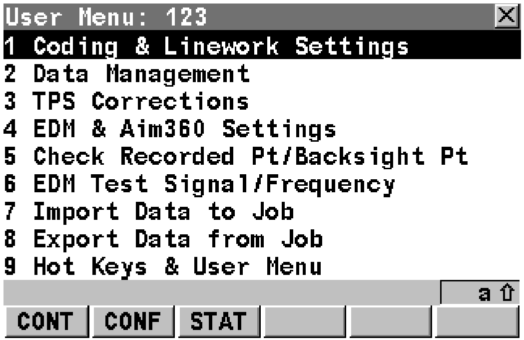
Selecting an option in the menu carries out the function or starts the application program assigned to the option.

Access

Press **USER** to access **Zoom80 User Menu: Job Name**.

Zoom80 User Menu: Job Name

This is an example of what a user defined menu can look like. The softkeys and their order is fixed. The functions and application programs which are assigned to the individual places in the user defined menu can differ depending on the configuration.



CONT (F1)
To execute the selected function.
CONF (F2)
To configure the user menu.
STAT (F3)
To access the **Status Menu**.

Define USER key step-by-step

To define the **USER** key is the same as for the hot keys. Refer to paragraph "Define hot key/user menu step-by-step".

3 Quick Settings - SHIFT USER

3.1 Overview

Description

Frequently used settings can be accessed quickly and changed with three key strokes. For example press **SHIFT USER** and **1** to turn the Aim360 on or off. The change is immediately applied and the screen where **QUICK SET Change Settings to:** was accessed from opens. The workflow is not interrupted.

This screen displays the possible settings to change to. All possible settings have two states and allow very quick setting changes. Highlight a field and press **ENTER** to change to the displayed setting or press the number next to the function.

☞ Changes made on the **QUICK SET Change Settings to:** screen are stored in the active configuration set.

3.2 QUICK SET Change Settings to:

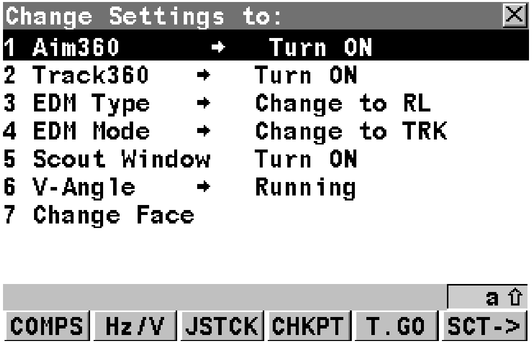
Access

Press **SHIFT USER**.

QUICK SET Change Settings To:

The appearance of the **QUICK SET Change Settings to:** screen may change, depending on whether the instrument is equipped with Scout360 or not.

Refer to "29 Functions" for information on functions and to "16 Config...\Instrument Settings..." for information on instrument settings.



COMPS (F1)
To turn the instrument using compass readings.

Hz/V (F2)
To turn the instrument to a specific entered position.

JSTCK (F3)
To turn the instrument using the arrow keys.

CHKPT (F4)
To check a point or the instrument orientation.

T.GO (F5) or **T.INT (F5)**
T.GO (F5) to start an Aim360 search, to set **<Automation: Track360>** and to lock onto the reflector.
T.INT (F5) to interrupt Track360.

SCT-> (F6)
Starts a prism search with Scout360.

SHIFT SCT<- (F5)

Starts a prism search with Scout360 anticlockwise.

Description of fields

Field	Option	Description
Aim360	→ **Turn ON**	To activate Aim360, **<Automation: Aim360>.**
	→ **Turn OFF**	To deactivate Aim360, **<Automation: None>**.
Track360	→ **Turn ON**	To activate Track360, **<Automation: Track360>**.
	→ **Turn OFF**	To deactivate Track360, **<Automation: None>**.
EDM Type	→ **Change to IR**	To activate measurements to reflectors, **<EDM Type: Reflector (IR)>**.
	→ **Change to RL**	To activate reflectorless measurements, **<EDM Type: Reflctrless (RL)>**. Deactivates Aim360 and Track360, **<Automation: None>**.
EDM Mode	→ **Change to TRK**	To activate tracking with continuous measurements, **<EDM Mode: Tracking>**.

Field	Option	Description
	→ **Change to STD**	To activate single measurements, **<EDM Mode: Standard>**.
Scout Window		Available on Zoom80 R.
	→ **Turn ON**	To activate the Scout window, **<Scout Window: On>**. Prisms are searched for with Scout360 in the Scout window when **SCT-> (F6)** is pressed. If **<Scout Window: On>** is selected and reflectorless measurements is still set, **<EDM Type: Reflctrless (RL)>**, then this is changed to measurements to reflectors, **<EDM Type: Reflector (IR)>**.
	→ **Turn OFF**	To deactivate the Scout window **<Scout Window: Off>**. A 360° search is performed when **SCT-> (F6)** is pressed.
V-Angle	→ **Hold**	The displayed value for the vertical angle is held after **DIST (F2)** and until **REC (F3)** is pressed, **<V-Angle: Hold after DIST>**.

Field	Option	Description
	→ **Running**	The displayed value for the vertical angle is updated after **DIST (F2)** is pressed, **<V-Angle: Running>**. Be aware that after restarting the instrument this setting remains and is not changed.
Change Face	no choices	To change the face of the telescope.

Next step

IF	THEN
a setting is to be changed	type the selection number in front of the item or highlight the item and press **ENTER**.
the instrument is to be automatically turned to a specific position	**COMPS (F1)**, **Hz/V (F2)** or **JSTCK (F3)** to access the subsequent screen. Refer to "3.3 Quick Setting Functions".
a point or the instrument orientation is to be checked	**CHKPT (F4)** to access the **QUICK SET Check Recorded Pt/Backsight Pt** screen. Refer to "3.3 Quick Setting Functions".
prism is to be locked onto	press **T.GO (F5)** to activate Track360 and start an Aim360 search. Refer to "3.3.5 Track360".

IF	THEN
Track360 is to be interrupted	press **T.INT (F5)** to interrupt Track360. Refer to "3.3.5 Track360".
Scout360 is to be started clockwise	**SCT-> (F6)** to search for a prism with Scout360. Refer to "3.3.6 Scout360".
Scout360 is to be started anticlock-wise	**SHIFT SCT<- (F5)** to search for a prism with Scout360. Refer to "3.3.6 Scout360".

3.3 Quick Setting Functions

3.3.1 Orientation With Compass

Description

By using a conventional magnetic compass while remotely controlling the instrument, it is possible to determine the general direction towards which the instrument should turn in order to perform a target search to locate the prism.

Access

Press **COMPS (F1)** in the **QUICK SET Change Settings to:** screen. Refer to "3.2 QUICK SET Change Settings to:".

OR

Press a hot key configured to access the screen **QUICK SET Orientation With Compass**. Refer to "2.1 Hot Keys" for information on hot keys.

☞ The instrument must be connected to a radio to be remote controlled with the Getac.

Orientation with compass step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**PROG**. Select Setup application program to set up the instrument.	40
2.	**Main Menu: Survey** **CONT (F1)** to access **SURVEY Survey Begin**.	
3.	**CONT (F1)** to access **SURVEY Survey: Job Name**. Turn the telescope until **<Hz: 0.0000 g>**.	

Step	Description	Refer to chapter
4.	Look through the telescope with **<Hz: 0.0000 g>** to select an object which is easily recognisable.	
5.	Standing at the instrument point the compass to the selected object and turn the rotating dial until the "N" lines up with the north end of the compass needle. ☞ The compass dial must not be turned once the "N" is lined up with the north end of the compass needle.	
6.	Go to the reflector.	
7.	**SHIFT USER** to access **QUICK SET Change Settings to:**.	
8.	**QUICK SET Change Settings to:** **COMPS (F1)** to access **QUICK SET Orientation With Compass**.	3.3.1
9.	**QUICK SET Orientation With Compass** From the reflector aim the "N" of the compass towards the instrument. Read the horizontal angle as pointed to by the north end of the compass needle. **<Hz-Compass:>** The horizontal angle read from the compass while aiming to the instrument. **<V-Compass:>** If the compass works as a clinometer, those values can also be used.	

Step	Description	Refer to chapter
	The horizontal and vertical angle reads from the compass are always displayed in degree regardless of the system settings.	
10.	**CONT (F1)** to access **SURVEY Survey: Job Name**. The instrument turns to the reflector. For **<Automation: Aim360>** an Aim360 measurement is performed. If no prism was found, the instrument turns to the position typed in for **<Hz-Compass:>** and **<V-Compass:>**. For **<Automation: Track360>** the instrument locks on the prism and the Track360 icon is displayed. If no prism was found, the instrument turns to the position typed in for **<Hz-Compass:>** and **<V-Compass:>**.	

3.3.2 Positioning Hz/V

Description

The **QUICK SET Positioning Hz/V** screen is used when the instrument is remote controlled and the telescope should be turned to a certain direction.

On the **Absolute** page, angular values for **<Hz-Angle:>** and **<V-Angle:>** related to the set orientation can be typed in.

On the **Relative** page, angular difference values for **<ΔHz:>** and **<ΔV:>** relative to the current telescope position can be typed in.These values are added to the current telescope position to calculate the new direction for the telescope to turn to.

Access

Press **Hz/V (F2)** in the **QUICK SET Change Settings to:** screen. Refer to "3.2 QUICK SET Change Settings to:".

OR

Press a hot key configured to access the screen **QUICK SET Positioning Hz/V**. Refer to "2.1 Hot Keys" for information on hot keys.

Hz/V positioning step-by-step

Step	Description
1.	**QUICK SET Change Settings to:**
2.	**Hz/V (F2)** to access **QUICK SET Positioning Hz/V, Absolute** page.
3.	• To position with absolute Hz/V angles continue with step 4. • To position with relative Hz/V angles continue with step 6.
4.	**QUICK SET Positioning Hz/V, Absolute** page **<Hz-Angle:>** Oriented horizontal direction for the instrument to turn to.

Step	Description
	<V-Angle:> Vertical direction for the instrument to turn to>.
5.	Continue with step 8.
6.	**PAGE (F6)** to access **QUICK SET Positioning Hz/V, Relative** page.
7.	**QUICK SET Positioning Hz/V, Relative** page **<ΔHz:>** Angular difference for the horizontal angle to turn to. **<ΔV:>** Angular difference for the vertical angle to turn to.
8.	**CONT (F1)**. The instrument turns to the reflector. For **<Automation: Aim360>** an Aim360 measurement is performed. If no prism was found, the instrument turns to the position typed in for **<Hz-Angle:>** and **<V-Angle:>** or **<ΔHz:>** and **<ΔV:>**. For **<Automation: Track360>** the instrument locks on the prism and the Track360 icon is displayed. If no prism was found, the instrument turns to the position typed in for **<Hz-Angle:>** and **<V-Angle:>** or **<ΔHz:>** and **<ΔV:>**.

3.3.3 Move by Joystick

Description

In **QUICK SET Move by Joystick** the instrument can be turned using the arrow keys on the keyboard of the instrument or the Getac or the arrow keys displayed on the touch screen.
When **QUICK SET Move by Joystick** is accessed, the NavLight is turned on automatically. When leaving the screen, the NavLight is turned off.

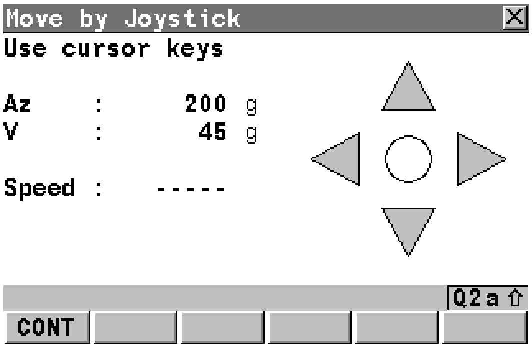
Access

Press **JSTCK (F3)** on the **QUICK SET Change Settings to:** screen. Refer to "3.2 QUICK SET Change Settings to:".

OR

Press a hot key configured to access the screen **QUICK SET Move by Joystick**. Refer to "2.1 Hot Keys" for information on hot keys.

QUICK SET Move by Joystick



CONT (F1)
To exit **QUICK SET Move by Joystick**.

Description of fields

Field	Option	Description
Speed	Output	Displays the rotating speed of the instrument. Press the same arrow key to change the speed from ----- to slow to medium to fast.

Next step

CONT (F1) to exit the **QUICK SET Move by Joystick** screen.

Move by joystick step-by-step

Step	Description
1.	**QUICK SET Change Settings to:**
2.	**JSTCK (F3)** to access **QUICK SET Move by Joystick**.
3.	**QUICK SET Move by Joystick** Use the arrow keys to start the telescope movement. Press an arrow key again to speed up the movement. Press any of the other arrow keys while the instrument turns to stop the movement.
☞	The behaviour of the touch screen when working with the Getac is similar. Additional to the arrow keys a stop key is displayed as a round key in the middle of the arrow keys. Press the stop key to stop the instrument movement.

3.3.4 Check Recorded Point / Backsight Point

Description

- The **QUICK SET Check Recorded Pt/Backsight Pt** screen is to check if a measured point is identical to a point already stored in the job or if the instruments orientation to a backsight point is still correct.

Access

Press **SHIFT USER** and **CHKPT (F4)**.

OR

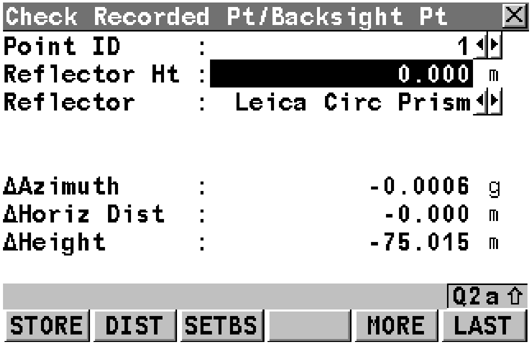
Press a hot key configured to access **QUICK SET Check Recorded Pt/Backsight Pt**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

QUICK SET Check Recorded Pt/Backsight Pt



STORE (F1)
To exit **QUICK SET Check Recorded Pt/Backsight Pt**.

DIST (F2)
To measure a distance.

SETBS (F3)
To set the station and orientation of the instrument by taking a single measurement to a known backsight point. Refer to "40.4.3 Known Backsight Point".

MORE (F5)
To display additional information.

LAST (F6)
To recall **<Point ID:>** of the last checked point.

SHIFT POSIT (F4)
To position to the selected point.
For **<Automation: Aim360>,** the instrument does an Aim360 search.
For **<Automation: Track360>** the instrument tries to lock on to a reflector.

Next step

Refer to paragraph "Check point step-by-step" for information on how to check a recorded point.

Check point step-by-step

Step	Description
1.	**QUICK SET Change Settings to:**
2.	**CHKPT (F4)** to access **QUICK SET Check Recorded Pt/Backsight Pt**.
3.	**QUICK SET Check Recorded Pt/Backsight Pt** **<Point ID:>** Point ID to be checked. **<Calculated Az:>** Calculated azimuth between station and backsight point. **<Current Az:>** Current orientation. **<ΔAz:>** Difference between calculated azimuth and current orientation.
4.	**POSIT (F5)** to position to the point.
5.	**DIST (F2)** to measure a distance.

Step	Description
☞	**SETBS (F3)** to set the station and orientation of the instrument by taking a single measurement to a known backsight point.
6.	**CONT (F1)** to return to the screen **QUICK SET Change Settings to:** was accessed from.

☞ If a stored point was checked, the **<Point ID:>** for that point is remembered and recalled when **LAST (F6)** is pressed.

3.3.5 Track360

T.GO (F5)	When **T.GO (F5)** is pressed, an Aim360 search is performed, the instrument locks onto the reflector without a measurement. **<Automation: Track360>** is set.
	T.GO (F5) can be used to lock onto a prism located on an unstable surface for example on a boat or near to the instrument.
T.INT (F5)	When the instrument is locked onto the prism this lock can be interrupted with pressing **T.INT (F5)**.
	T.INT (F5) can be used to interrupt the instrument from being locked onto the reflector, for example, to mark a ground point.
	Distances to side shot points cannot be measured while the lock mode is interrupted with **<Automation: Track360>**.

3.3.6 Scout360

Description

Available on Zoom80 R. When **SCT-> (F6)** is pressed, the instrument searches for the prism with Scout360. When **SHIFT SCT<- (F5)** is pressed, searches for the prism in anticlockwise direction. Refer to "29.2.2 Scout360" for more information on the functionality of Scout360.

☞ This quick setting is independent from a hot key definition for the direction which the instrument turns during the search routine.

3.4 Working examples

3.4.1 Working Example 1 - Aim360

Description

Application:	Measure points with Aim360.
Working technique:	Application program Survey.
Goal:	Find prism with Aim360.

Requirement

<Automation: Aim360>.
This working example can also be applied if the instrument is remotely controlled by an Getac.

Prism search with Aim360 step-by-step

Step	Description
1.	Press **ALL (F1)** in **SURVEY Survey: Job Name**. ☞ Press **DIST (F2)** to measure a distance.
2.	The instrument searches for the prism with Aim360 search in the Aim window.
3.	If a prism was found • Distance and angles are measured and stored. • The instrument points in the direction of the prism and does not follow the prism when it is moving.
4.	If no prism was found • The instrument turns to the starting position of the Aim360 search.

3.4.2 Working Example 2 - Track360

Description

Application: Measure points with Track360.

Working technique: Application program Survey.

Goal: Find prism with Track360 activated.

Requirement

<Automation: Track360>.
This working example can also be applied if the instrument is remotely controlled by an Getac.

Prism search with Track360 step-by-step

Step	Description
1.	Press **ALL (F1)** in **SURVEY Survey: Job Name**. ☞ Press **DIST (F2)** to measure a distance. ☞ Press **T.GO (F5)** to lock onto the reflector without measurement.
2.	The instrument searches for the prism with Aim360 search in the Aim window.
3.	If a prism was found • Distance and angles are measured and stored. • The instrument locks on to the prism and follows its movements. The Track360 icon is displayed.
4.	If no prism was found • The instrument turns to the starting position of the Aim360 search.

3.4.3 Working Example 3 - Loss of Track360

Description

Application:	Points were measured with Track360 until loss of lock.
Working technique:	Application program Survey.
Goal:	Prism search after loss of lock.

Requirements

- **<Automation: Track360>**
- The instrument is locked onto the prism.
- The instrument is remotely controlled by an Getac.
- **<Predict for: 3 s>**

Prism search after loss of Track360 step-by-step

Step	Description
1.	Move the prism behind an object to make the instrument lose lock.
2.	The prism path is predicted for three seconds. The instrument turns with the calculated velocity and direction of the lost prism during this time.
3.	If a prism was found during prediction, • the instrument locks on to the prism and follows its movements. The Track360 icon is displayed.

Step	Description
4.	If no prism was found during prediction, a search is started depending on the setting of **<Search with:>** in **CONFIGURE Automatic Prism Search** • For **<Search with: No Search>**: No search is started. • For **<Search with: Aim360>**: An Aim360 search is started in a dynamic Aim window which is calculated depending on the velocity of the prism. • For **<Search with: Scout360>** and **<Scout Window: On>**: The prism is searched for with Scout360 in the Scout window. • For **<Search with: Scout360>** and **<Scout Window: Off>**: The prism is searched for with Scout360 in a dynamic Scout window • For **<Search with: Last Point>** and **<Automation: Track360>**: The instrument turns back to the last stored point.
5.	If prism was not found with **<Search with:>**, • The instrument telescope stays at the end position of prediction. • The NavLight is activated.
☞	Refer to "3.4.2 Working Example 2 - Track360" for information on how to enable lock.

3.4.4 Working Example 4 - Scout360

Description

Application:	Search for a prism with Scout360.
Working technique:	Application program Survey.
Goal:	Find prism with Scout360.

Requirement

- Zoom80 R is used.
- **<Scout Window: Off>**

Prism search with Scout360 step-by-step

Step	Description
1.	**QUICK SET Change Settings to:** **SCT-> (F6)**
2.	The instrument searches for the prism with Scout360. The search consists of a short swing in anti-clockwise direction followed by a complete 360° turn in the other direction.
3.	If a prism is detected the movement is stopped and an Aim360 search is performed. For **<Automation: None>** the Aim360 is turned off again. For **<Automation: Aim360>** measurements can be performed. For **<Automation: Track360>** the instrument locks onto the reflector and follows the movement of the prism.
4.	If no prism was found, the instrument telescope turns to the start position of the search.

4 User Interface

4.1 Keyboard

Keys

Key	Description
Hot keys **F7**-**F12**	• User definable keys to execute commands or access chosen screens.
Alphanumeric keys	• To type letters and numbers.
CE	• Clears all entry at the beginning of user input. • Clears the last character during user input.
ESC	• Leaves the current menu or dialog without storing changes made.
USER	• Calls the user defined menu.
PROG (**ON**)	• If the instrument is off: to turn the instrument on. • If the instrument is on: to access the **Programs** menu.
ENTER	• Selects the highlighted line and leads to the next logical dialog/menu. • Starts the edit mode for edit fields. • Opens a list box.
SHIFT	• Changes between the first and the second level of function keys.
Arrow keys	• Move the focus on the screen.

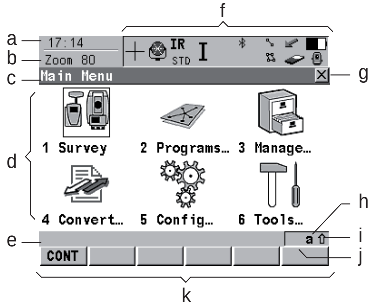
Key	Description
Function keys **F1-F6**	• Correspond to the six softkeys that appear on the bottom of the screen when the screen is activated.

Key combinations

Keys	Description
PROG plus **USER**	Turns the instrument off, when in **Zoom80 Main Menu**.
SHIFT F12	Calls **STATUS Level & Laser Plummet**.
SHIFT F11	Calls **CONFIGURE Lights, Display, Beeps, Text**.
SHIFT USER	Calls **QUICK SET Change Settings to**.
SHIFT ▲	Pages up.
SHIFT ▼	Pages down.

4.2 Screen

Screen



a) Time
b) Caption
c) Title
d) Screen area
e) Message line
f) Icons
g) ESC ☒
h) CAPS
i) SHIFT icon
j) Quick coding icon
k) Softkeys

Elements of the screen

Element	Description
Time	The current local time is shown.
Caption	Shows location either in **Main Menu**, under **PROG** key or **USER** key.
Title	Name of the screen is shown.
Screen area	The working area of the screen.
Message line	Messages are shown for 10 s.
Icons	Shows the current status information of the instrument. Refer to "4.4 Icons". Can be used with touch screen.
ESC ☒	Can be used with touch screen. Same functionality as the fixed key **ESC**. The last operation will be undone.

Element	Description
CAPS	The caps mode for upper case letters is active.The caps mode is activated and deactivated by pressing **UPPER (F5)** or **LOWER (F5)** in some screens.
SHIFT icon	Shows the status of the **SHIFT** key; either first or second level of softkeys is selected. Can be used with touch screen and has the same functionality as the fixed key **SHIFT**.
Quick coding icon	Shows the quick coding configuration. Can be used with touch screen to turn quick coding on and off.
Softkeys	Commands can be executed using **F1**-**F6** keys. The commands assigned to the softkeys are screen dependent. Can be used directly with touch screen.
Scroll bar	Scrolls the screen area up and down.

4.3 Operating Principles

Keyboard and touch screen

The user interface is operated either by the keyboard or by the touch screen with supplied stylus. The workflow is the same for keyboard and touch screen entry, the only difference lies in the way information is selected and entered.

Operation by keyboard

Information is selected and entered using the keys. Refer to "4.1 Keyboard" for further details of the keys on the keyboard and their function.

Operation by touch screen

Information is selected and entered on the screen using the supplied stylus.

Operation	Description
To select an item	Tap on the item.
To start the edit mode in input fields	Tap on the input field.
To highlight an item or parts of it for editing	Drag the supplied stylus from the left to the right.
To accept data entered into an input field and exit the edit mode	Tap somewhere else on the screen outside of the input field.

Turn instrument on

Press and hold **PROG** for 2 s.

Turn instrument off step-by-step

Step	Description
☞	The instrument can only be turned off in **Zoom80 Main Menu**.
1.	Press and hold both **USER** and **PROG** simultaneously.
2.	Press **YES (F6)** to continue or **NO (F4)** to cancel.

Lock/Unlock keyboard

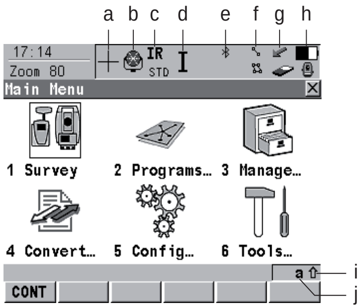
Option	Description
Lock	To lock the keyboard press and hold **SHIFT** for 3 s. The message ’Keyboard locked’ is momentarily displayed on the Message Line.
Unlock	To unlock the keyboard press and hold **SHIFT** for 3 s. The message ’Keyboard unlocked’ is momentarily displayed on the Message Line.

4.4 Icons

Description

The screen icons display the current status information of the instrument.

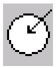
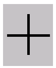
Allocation of icons

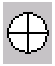
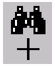
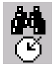
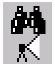
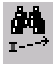


a) Aim360/Track360/Scout360
b) Reflector
c) EDM
d) Compensator/face I&II
e) Remote control
f) Bluetooth
g) Line/area
h) CompactFlash card
i) Battery
j) **SHIFT**
k) Quick coding

Aim360/Track360/ Scout360

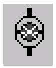
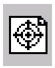
Tapping the icon leads to **QUICK SET Change Settings to**.

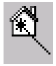
Icon	Description
	Aim360 active.
	Low Visibility mode is active.
	Short Range mode is active.
	Track360 active.

Icon	Description
	Track360 active. Prism being followed.
	Track360 active. Prism lost. Instrument locks onto reflector if in field of view.
	Aim360 Searching.
	Scout360 active. Available on Zoom80 R.
	Prediction.

Reflector

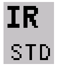
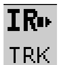
Tapping the icon leads to **MANAGE Reflectors**.

Icon	Description
	360° Prism.
	Circ Prism.
	Mini Prism.
	ReflTape.

Icon	Description
	Reflectorless.
	User defined prism.

EDM

Tapping the icon leads to **CONFIGURE EDM & Aim360 Settings**.

Icon	Description
	EDM type: Reflector IR, possible modes are: STD - Standard, FAST - Fast, TRK - Tracking, AVG - Averaging, SYNC - SynchroTrack
	Red laser is turned on.
	EDM type: Reflectorless RL, possible modes are: STD - Standard, TRK - Tracking, AVG - Averaging
	EDM type: Long Range LO, possible modes are: STD - Standard, AVG - Averaging
	Auto points are being recorded by time.
	Auto points are being recorded by distance or height.
	Auto points are being recorded by stop & go.

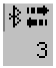
Compensator/ face I&II

Tapping the icon leads to **CONFIGURE Compensator**.

Icon	Description
	Compensator is turned off.
	Compensator is turned on, but is out of range.
I II	The current face of the instrument is shown, if the compensator and the Hz-correction are turned on.

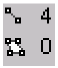
Bluetooth

Tapping the icon leads to **STATUS Bluetooth**.

Icon	Description
	The Instrument is Bluetooth capable.
	The Bluetooth connection on Port 3 is established and is ready to be used.
	The Bluetooth connection on Port 3 is established, active and is communicating data.

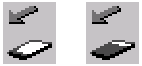
Line/area

Tapping the icon leads to **MANAGE Data: Job Name**.

Icon	Description
	The number of lines and areas which are currently open in the active job is shown.

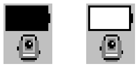
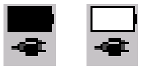
CompactFlash card

- The capacity of used space is shown in seven levels.
- Tapping the icon leads to **STATUS Battery & Memory**.

Icon	Description
	The CompactFlash card is inserted and can be removed.
	The CompactFlash card is inserted and cannot be removed. It is strongly recommended not to remove the CompactFlash card to avoid loss of data.
No icon	No CompactFlash card is inserted.

Battery

- The status and source of the battery is displayed. If an external battery is connected and an internal battery is inserted, then the internal battery is used.
- Tapping the icon leads to **STATUS Battery & Memory**.

Icon	Description
	An internal battery is inserted and in use.
	An external battery is connected and in use.

SHIFT

- Tapping the icon shows additional softkeys.

Icon	Description
⇧	Additional softkeys are available in the currently visible screen.
⬆	The **SHIFT** key has been pressed.

Quick coding

- The quick coding is displayed. Visible during Survey and other application programs where it is possible to measure a point with quick codes.
- Tapping the icon turns the quick coding on or off.

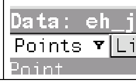
Icon	Description
Q1	Quick coding is turned on. Quick codes with one/two/three digit are used from the active codelist.
Q1	Quick coding for quick codes with one/two/thre digit is turned off.

4.5 Symbols

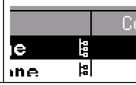
Description

The symbols provide information regarding settings.

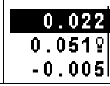
Filter

Symbol	Description	Example
	The filter symbol is shown on the **Points**, **Lines**, **Area** or **Map** page if a point, line or area filter is active.	

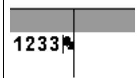
Attributes

Symbol	Description	Example
	The attribute symbol is displayed in **MANAGE Codes** to indicate codes that have attributes attached.	

Limits

Symbol	Description	Example
	Indicates a defined limit has been exceeded.	

Staked out

Symbol	Description	Example
	This symbol is used in **MANAGE Data: Job Name** to indicate points which have been staked out. The staked out flag can be reset in **MANAGE Stakeout Filter**.	

5 Main Menu

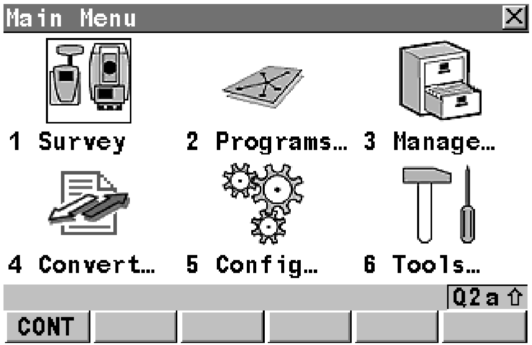
5.1 Main Menu Functions

Description

The main menu is normally the first screen displayed when the instrument is switched on.
If the PIN protection is active, **Zoom80 Enter Security PIN Code** is displayed first. After typing in the correct PIN code, the main menu is displayed.

If desired, the instrument can be configured to start up with a user defined screen. Refer to "17.6 Start Up & Power Down".

Main Menu



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Description of the main menu functions

Main menu function	Description	Refer to chapter
Survey	• To start measuring.	5.2
Programs...	• To select and start application programs.	5.3
Manage...	• To manage jobs, data, codelists, configurations sets and reflectors.	5.4
Convert...	• To export data from a job on the instrument to a file on the CompactFlash card in a customised ASCII format or in DXF format. • To import ASCII, GSI or DXF data from a file on the CompactFlash card to a job on the instrument.	5.5
Config...	• To access all configuration parameters related to a survey, the instrument and the interfaces.	5.6
Tools...	• To format the memory device. • To upload files relevant for the instrument functionality, for example, firmware and language files. • To transfer non data related files between instrument and CompactFlash card.	5.7

Main menu function	Description	Refer to chapter
	• To perform arithmetic operations such as addition, subtraction, multiplication, division, statistical functions, trigonometric functions, conversions or roots. • To view files on the CompactFlash card. • To type in or load a licence key. • To calibrate the instrument.	

5.2 Survey

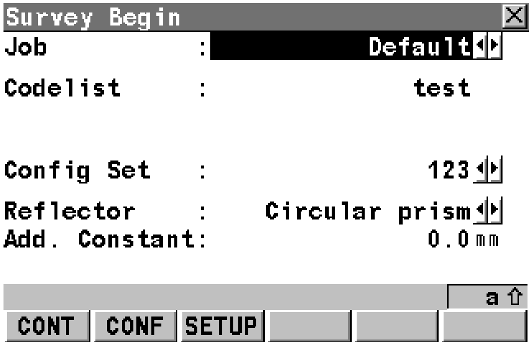
Access

Select **Main Menu: Survey**.

Description

Survey provides the functionality used to perform the survey.

SURVEY Survey Begin



CONT (F1)
To accept settings and to continue with screen **SURVEY Survey: Job Name**.

CONF (F2)
To configure auto point and remote point measurements functionality.

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

Next step

For **Main Menu: Survey** Refer to chapter 42

5.3 Programs...

Access

Select **Main Menu: Programs...**.

OR

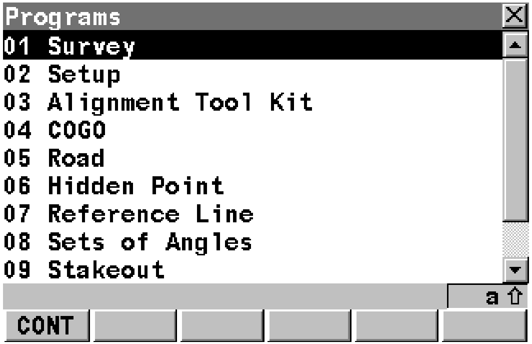
Press **PROG**.

Description

Programs... accesses the application programs menu. The screen of the application programs menu is called **Zoom80 Programs**.

Zoom80 Programs

The application programs menu contains all loaded application programs including Survey and Setup. They are listed in the order in which they were loaded.



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Programs...\Survey**	Refer to chapter 42
For **Main Menu: Programs...\Setup**	Refer to chapter 40
For **Main Menu: Programs...\Alignment Tool Kit**	Refer to chapter 34
For **Main Menu: Programs...\COGO**	Refer to chapter 32

For **Main Menu: Programs...\Road**

☞ This program could contain the following:

- Road Refer to chapter 35
- Tunnel Refer to chapter 36

For **Main Menu: Programs...\Hidden Point** Refer to chapter 33

For **Main Menu: Programs...\Reference Line** Refer to chapter 37

For **Main Menu: Programs...\Sets of Angles**

☞ This program could contain the following:

- Sets of Angles Refer to chapter 39
- Monitoring Refer to chapter 39

For **Main Menu: Programs...\Stakeout** Refer to chapter 41

For **Main Menu: Programs...\Survey Cross Section** Refer to chapter 45

For **Main Menu: Programs...\Volume Calculations** Refer to chapter 47

5.4 Manage...

Access

Select **Main Menu: Manage...**.

Description

Manage... is used to manage the following:

- jobs.
- data.
- codelists.
- configuration sets.
- reflectors.

Management functions include creating, selecting, editing and deleting.

Zoom80 Management

CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Manage...\Jobs**	Refer to chapter 6.
For **Main Menu: Manage...\Data**	Refer to chapter 7.

For **Main Menu: Manage...\Codelists**	Refer to chapter 8.
For **Main Menu: Manage...\Configuration Sets**	Refer to chapter 11.
For **Main Menu: Manage...\Reflectors**	Refer to chapter 12.

5.5 Convert...

Access

Select **Main Menu: Convert...**.

Description

Convert... provides access to data exchange options.

Zoom80 Convert Data

CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Convert...\Export Data from Job**	Refer to chapter 13.
For **Main Menu: Convert...\Import Data to Job**	Refer to chapter 14.

5.6 Config...

Access

Select **Main Menu: Config...**.

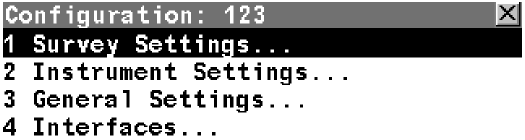
OR

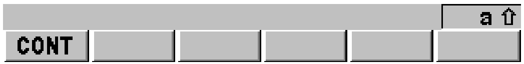
Press **USER** and then **CONF (F2)**.

Description

Config... accesses all configuration parameters related to a survey, the instrument and the interfaces. Any changes made are stored in the configuration set.

Zoom80 Configuration: Configuration Set





CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Config...\Survey Settings...**	Refer to chapter 15
For **Main Menu: Config...\Instrument Settings...**	Refer to chapter 16
For **Main Menu: Config...\General Settings...**	Refer to chapter 17
For **Main Menu: Config...\Interfaces...**	Refer to chapter 19

5.7 Tools...

Access

Select **Main Menu: Tools...**.

Description

Tools... provides functionality which is not directly related to surveying data.

Tools Menu

CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Next step

For **Main Menu: Tools...\Format Memory Device**	Refer to chapter 21
For **Main Menu: Tools...\Transfer Objects...**	Refer to chapter 22
For **Main Menu: Tools...\Upload System Files...**	Refer to chapter 23
For **Main Menu: Tools...\Calculator**	Refer to chapter 24.
For **Main Menu: Tools...\File Viewer**	Refer to chapter 25.
For **Main Menu: Tools...\Licence Keys**	Refer to chapter 26
For **Main Menu: Tools...\Check & Adjust...**	Refer to chapter 27

6 Manage...\Jobs

6.1 Overview

Description

Jobs
- structure surveying projects.
- contain all points, lines, areas and codes that are recorded and stored.
- can be used in GGO.
- may be stored on the CompactFlash card.

Type of jobs

- Data jobs. Explained in this chapter.
- DTM jobs. Refer to "35.8.6 Working with a DTM Job".
- Road jobs.

Default job

A job called **Default** is available on the instrument after formatting the memory device, inserting a previously formatted CompactFlash card or deleting all jobs from **MANAGE Jobs (Device)**.

Active job

The active job is the one data is stored to. One job is always considered the active job. After formatting the memory device, the job **Default** is used until a user defined job is created and selected.

When a job becomes active, then the sort and filter settings of this job are saved in the SystemRAM. If the CompactFlash card is formatted then these last used sort and filter settings are used for the job **Default**.

6.2 Accessing Job Management

Access

Select **Main Menu: Manage...\Jobs**.

OR

Press a hot key configured to access the screen **MANAGE Jobs (Device)**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

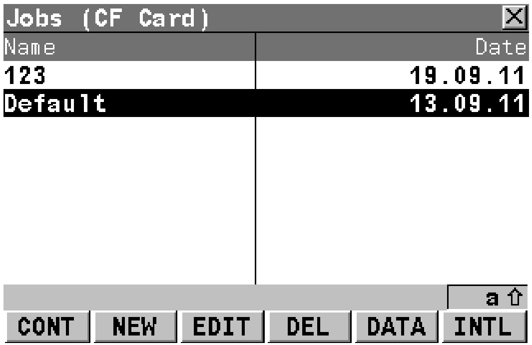
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens, for example the **XX Begin** screen of application programs.

MANAGE Jobs (Device)

Listed are all jobs stored on the CompactFlash card.



CONT (F1)
To select the highlighted job and to return to the screen from where this screen was accessed.

NEW (F2)
To create a job. Refer to "6.3 Creating a New Job".

EDIT (F3)
To edit the highlighted job. Refer to "6.4 Editing a Job".

DEL (F4)
To delete the highlighted job.

DATA (F5)

To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply. Refer to "7.3 Point Management".

Next step

IF a job	THEN
is to be selected	highlight the desired job. **CONT (F1)** closes the screen and returns to the screen from where **MANAGE Jobs (Device)** was accessed.
is to be created	**NEW (F2)**. Refer to "6.3 Creating a New Job".
is to be edited	highlight the job and **EDIT (F3)**. Refer to "6.4 Editing a Job".

6.3 Creating a New Job

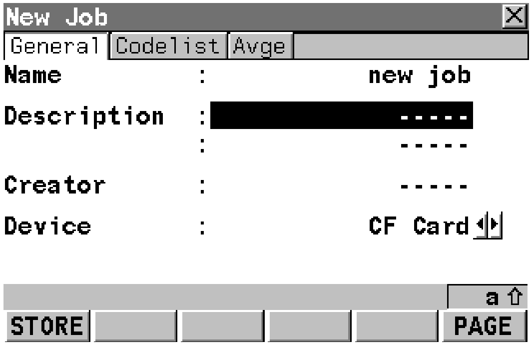
Access

Refer to "6.2 Accessing Job Management" to access **MANAGE Jobs (Device)**.

Create job step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Jobs (Device)** highlight a job. The settings of this job, including sort and filter settings, are applied to the new job.	6.2
2.	**NEW (F2)** to access **MANAGE New Job**.	



STORE (F1)
To store the settings and to return to the screen from where **MANAGE New Job** was accessed.

PAGE (F6)
To change to another page on this screen.

Step	Description	Refer to chapter
3.	**MANAGE New Job, General** page **<Name:>** A unique name for the new job. The name may be up to 16 characters long and may include spaces. Input required. **<Description:>** Two lines for a detailed description of the job. This can be for example, work to be performed or the classes contained in the job. Input optional. **<Creator:>** The person's name who is creating the new job. Input optional. **<Device:>** The device on which the new job will be stored. Depending on the instrument options, this may be an output field.	
4.	**PAGE (F6)** changes to the **Codelist** page.	
5.	**MANAGE New Job, Codelist** page **<Codelist:>** Choosing a codelist copies the codes to the job.	9
6.	**PAGE (F6)** changes to the **Avge** page.	
7.	**MANAGE New Job, Avge** page In order to check measurements, the same point can be measured more than once. If activated, an average or an absolute difference is calculated.	7.3.4

Step	Description	Refer to chapter
	<Averaging Mode:> Defines the averaging principles for multiple measured points. **<Averaging Mode: Average>** computes the average for the position and the height. Points exceeding the defined limits are marked with ! in **MANAGE Edit Point**, **Mean** page. **<Averaging Mode: Absolute Diffs>** computes the absolute differences between two points selected from a list of measured points which are all stored with the same point ID. The selection determines the availability of the subsequent fields for setting the acceptable averaging limits or absolute differences. • For **<Averaging Mode: Average>**: **<Method:>** The method used for computing the average. **<Method: Weighted>** calculates a weighted average while **<Method: No Weighting>** is calculating an arithmetic average. **<Points to Use:>** The type of points which will be taken into account for averaging. **<Avge Limit Pos:>** and **<Avge Limit Ht:>** The acceptable difference for the position and height components. • For **<Averaging Mode: Absolute Diffs>**:	

Step	Description	Refer to chapter
	<Points to Use:> The type of points which will be taken into account for absolute differences. From **<Easting:>** to **<Cartesian Z:>** The acceptable absolute differences for each coordinate component. • For **<Averaging Mode: Off>**: No other fields are available.	
8.	**STORE (F1)** creates the new job and returns to **MANAGE Jobs (Device)**.	

6.4 Editing a Job

Access

Refer to "6.2 Accessing Job Management" to access **MANAGE Jobs (Device)**.

Edit job step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Jobs (Device)** highlight a job to be edited.	
2.	**EDIT (F3)** to access **MANAGE Edit Job: Job Name, General** page.	
3.	**MANAGE Edit Job: Job Name, General** page **<Name:>** Rename the job. **<Device:>** Cannot be edited. The remaining functionality on this page is identical with the creation of a new job.	6.3
	DATA (F5) accesses **MANAGE Data: Job Name**. To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply.	7.2
	SHIFT LOG (F5) accesses **MANAGE Data Log: Job Name**. To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are sorted by time in one list.	7.5
4.	**PAGE (F6)** changes to the **Codelist** page.	

Step	Description	Refer to chapter
5.	Are codes stored in the job? • If **no**, continue with step 6. • If **yes**, continue with step 8.	
6.	No codes are stored in the job. **MANAGE Edit Job: Job Name, Codelist** page **<Codelist: <None>>** This default setting can be changed. Choosing a codelist copies the codes to the job. All codelists from **Main Menu: Manage...\Codelists** can be selected.	9
7.	**PAGE (F6)** changes to the **Avge** page. Continue with step 10.	
8.	Codes are stored in the job. **MANAGE Edit Job: Job Name, Codelist** page **<Codelist:>** If codes had been copied from a System RAM codelist, the name of the codelist is displayed. If codes have been typed in, then the name of the active job is displayed.	
	IMPRT (F2) adds additional codes from a new codelist to the job. The name of this codelist is copied to the job.	8
	SHIFT EXPRT (F2) copies codes from the job to an existing or new codelist.	8
	CODES (F4) views codes currently stored in the job.	6.5
9.	**PAGE (F6)** changes to the **Avge** page.	

Step	Description	Refer to chapter
10.	**MANAGE Edit Job: Job Name, Avge** page The functionality on this page is identical with the creation of a new job.	6.3
☞	**DATA (F5)** accesses **MANAGE Data: Job Name**. To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are shown on separate pages. Selected sort and filter settings apply.	7.2
☞	**SHIFT LOG (F5)** accesses **MANAGE Data Log: Job Name**. To view, edit and delete points, lines and areas stored with the job. Points, lines and areas are sorted by time in one list.	7.5
11.	**STORE (F1)** stores the changes and returns to the screen from where **MANAGE Edit Job: Job Name** was accessed.	

6.5 Managing Job Codes

Description

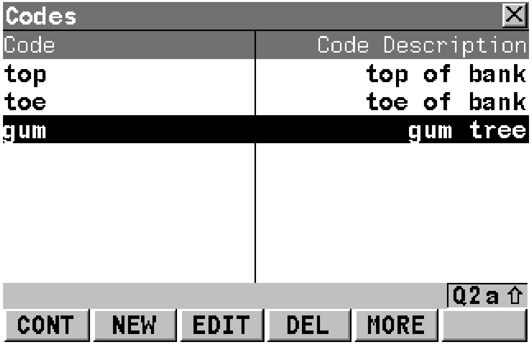
To view, edit, group and sort all codes currently stored in the job. The functionality of this screen is mainly the same as for **MANAGE Codes**. For simplicity, the functionality which is different from **MANAGE Codes** is explained here. Refer to "8.5 Managing Codes" for information on **MANAGE Codes**.

Access step-by-step

Available for jobs which have a codelist attached.

Step	Description
1.	Refer to "6.2 Accessing Job Management" to access **MANAGE Jobs (Device)**.
2.	In **MANAGE Jobs (Device)** highlight a job to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Job: Job Name**.
4.	In **MANAGE Edit Job: Job Name**, **PAGE (F6)** until the **Codelist** page is active.
5.	**CODES (F4)** to access **MANAGE Job Codes**.

MANAGE
Job Codes



CONT (F1)
To return to **MANAGE Edit Job: Job Name**, **Codelist** page.

NEW (F2)
To create a new code. Refer to "8.5.2 Creating a New Code".

EDIT (F3)
To edit the highlighted code. Accesses **MANAGE Edit Code** where new attributes can be added to a code and line styles can be changed. Refer to paragraph "MANAGE Edit Code".

DEL (F4)
To delete an existing code.

MORE (F5)
To display information about the code group, the code type, the code description and the quick codes if available.

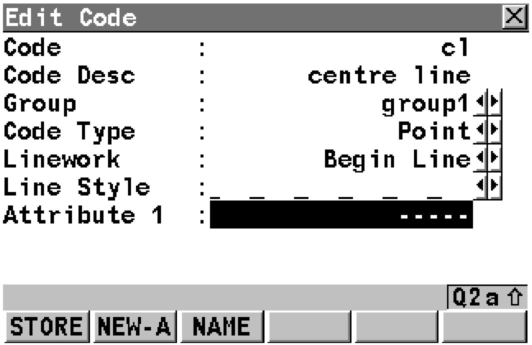
SHIFT GROUP (F4)
To access **MANAGE Code Groups**. To view, create, activate and deactivate code groups. Refer to "8.6 Managing Code Groups".

SHIFT SORT (F5)
To access **MANAGE Sort Codes**. To sort codes by code name, code description, quick code or last used.

Next step

IF	THEN
the job codes do not need to be changed	**CONT (F1)** closes the screen and returns to the screen from where **MANAGE Job Codes** was accessed.
a new job code is to be created	**NEW (F2)**. Refer to "8.5.2 Creating a New Code".
an existing job code is to be edited	highlight the job code and **EDIT (F3)**. Refer to paragraph "MANAGE Edit Code".

MANAGE Edit Code



STORE (F1)
To store the code including any newly created attributes and to return to the screen from where **MANAGE Edit Code** was accessed.

NEW-A (F2)
To add a new attribute to a code.

NAME (F3) or **VALUE (F3)**
Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.

The behaviour of this screen varies with the type of code to be edited. The differences are explained in the table.

Type of code	Description
Point codes and **Free codes**	• New attributes can be added with **NEW-A (F2)**.
Line codes and **Area codes**	• New attributes can be added with **NEW-A (F2)**. • The line style can be changed. This new line style is stored to the code. It can be decided whether or not to update the line style of all previously stored lines/areas with this code in this job.

7 Manage...\Data

7.1 Overview

Description

- Data is a generic term for points, lines and areas.
- Data management is the administration of data stored in the active job. This includes
  - viewing data with their related information.
  - editing data.
  - creating new data.
  - deleting existing data.
  - filtering existing data.

Objects

- Objects
  - are points, lines and areas.
  - have a unique identification ID. This is the point ID, the line ID and the area ID.
  - may or may not have a code attached. This is either a point code, a line code or an area code depending on the type of object. Refer to "9 Coding" for information on coding.

7.2 Accessing Data Management

Access

Select **Main Menu: Manage...\Data**.

OR

Press a hot key configured to access the screen **MANAGE Data: Job Name**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

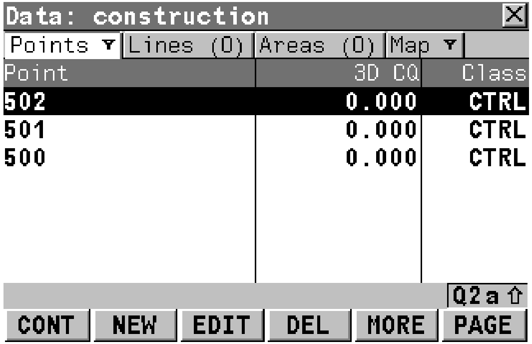
From a choicelist in some screens for example in application programs.

OR

Tap the line/area icon.

☞ The objects listed on the pages belong to the currently active job. The objects listed and their order depend on the active sort and filter settings. An active filter for a page is indicated by Y to the right of the name of the page. Refer to "7.6 Point Sorting and Filters" for information about sort and filter settings.

MANAGE
Data: Job Name, Points page



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

NEW (F2)
To create a point.

EDIT (F3)
To edit the highlighted point.

DEL (F4)
To delete the highlighted point.

MORE (F5)
To display information about the codes if stored with any point, the time and the date of when the point was stored, the 3D coordinate quality, the class and the flag for Linework.

PAGE (F6)
To change to another page on this screen.

SHIFT LOG (F4)
To view points, lines, areas and free codes stored with the job sorted by time. Refer to "7.5 Data Log".

SHIFT FILT (F5)
To define sort and filter settings. Refer to "7.6 Point Sorting and Filters".

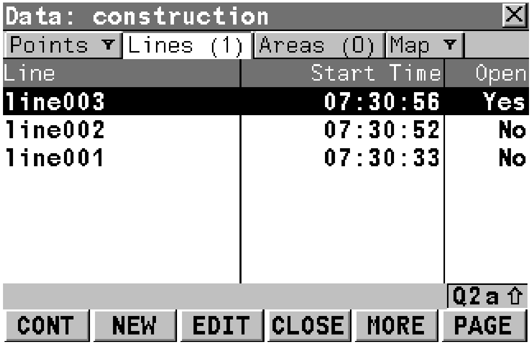
Next step

IF	THEN
a point is to be created	highlight the point and **NEW (F2)**. Refer to "7.3.2 Creating a New Point".
a point is to be edited	highlight the point and **EDIT (F3)**. Refer to "7.3.3 Editing a Point".
a line/area is to be managed	**PAGE (F6)** changes to the **Lines (X)** and **Areas (X)** page. Refer to paragraph "MANAGE Data: Job Name, Lines (X) page; MANAGE Data: Job Name, Areas (X) page".

MANAGE Data: Job Name, Lines (X) page; MANAGE Data: Job Name, Areas (X) page

The explanations for the softkeys given below are valid for both pages.

The number in brackets next to the name of the page indicate the number of open lines/areas. Example: **Lines (2)/Areas (2)** means that two lines/areas are open.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

NEW (F2)
To create a line/area. After storing the new line, all existing lines and areas which are open are closed.

EDIT (F3)
To edit the highlighted line/area.

CLOSE (F4) and **OPEN (F4)**
To change between the options in the **Open** column of the highlighted line/area.

MORE (F5)
To display information about the codes if stored with any line/area, the start time, the end time of when the last point was added to the line/area, the length of the line, the perimeter and the area of the area.

PAGE (F6)
To change to another page on this screen.

SHIFT DEL (F4)
To delete the highlighted line/area.

SHIFT FILT (F5)
To define sort and filter settings. Refer to "7.6 Point Sorting and Filters".

Description of columns

Column	Description
Line or **Area**	The listed lines/areas already stored in the active job.
Open	The status of a line/area. • **Yes** The line/area is open. Measured points are assigned to the line/area.

Column	Description
	• **No** The line/area is closed. Measured points are not assigned to the line/area. **CLOSE (F4)** and **OPEN (F4)** change between the options.

Next step

IF the line/area	THEN
management is completed	**CONT (F1)** closes the screen and returns to the screen from where this screen was accessed.
is to be opened	highlight the line/area and **OPEN (F4)**.
which was last used is to be opened	press a hot key configured to re-open last used line/area. This hot key can be used at any time. Refer to "2.1 Hot Keys" for information on hot keys.
is to be closed	highlight the line/area and **CLOSE (F4)** OR press a hot key configured to close all open lines/areas. This hot key can be used at any time. Refer to "2.1 Hot Keys" for information on hot keys.
is to be created	**NEW (F2)**. Refer to "7.4.2 Creating a New Line/Area".
is to be edited	highlight the line/area and **EDIT (F3)** to access **MANAGE Edit Line: Line ID** or **MANAGE Edit Area: Area ID**. Refer to "7.4.3 Editing a Line/Area".

IF the line/area	THEN
is to be viewed	**PAGE (F6)** until the **Map** page is active. Refer to "30.5 Map Mode" for information about the functionality and softkeys available on the **Map** page.

7.3 Point Management

7.3.1 Terminology

Description

- This chapter describes technical terms related to data management.

Coordinate triplet

- A measured point consists of three coordinate components - two horizontal components and one vertical component. The generic term for the three coordinate components is coordinate triplet.
- Depending on the class, a point ID can contain more than one coordinate triplet of the same and/or of different classes.

Class

The class describes the type of coordinate triplet.

Description of classes

The following table shows the classes in descending hierarchical order.

Class	Characteristic	Description
CTRL	Type	Control points. Automatically assigned to entered points.
	Instrument source	**TPS** or **GGO**
	Number of triplets	One.
ADJ	Type	Adjusted points using the adjustment program.
	Instrument source	**GGO**
	Number of triplets	One.

Class	Characteristic	Description
REF	Type	Station point set by Setup application program.
	Instrument source	**TPS** or **GGO**
	Number of triplets	One.
AVGE	Type	Averaged point calculated when more than one coordinate triplet of class **MEAS** exist for the same point ID unless **<Averaging Mode: Off>**.
	Instrument source	**TPS**
	Number of triplets	One.
MEAS	Type	• Measured points with angles and distances. • Calculated from some application programs.
	Instrument source	**TPS** or **GGO**
	Number of triplets	Multiple. With more than one measured coordinate triplet, the average for the position and the height can be computed.
EST	Type	Estimated points from GGO.
	Instrument source	**GGO**
	Possible number of triplets	One.
NONE	Type	Measured points with angles.

Class	Characteristic	Description
	Instrument source	**TPS**.
	Possible number of triplets	Unlimited.

Sub class

The sub class describes certain classes in detail. It indicates the status of the position when a coordinate triplet was measured and how the coordinates were determined.

Sub class	Description
COGO	Indirect coordinate determination with application program COGO.
NONE	Direction is available but no coordinates. Height is available but no position coordinates.
TPS	Measured with distances and angles.
Fixed (Height)	Manually entered and fixed in height.
Fixed (Position)	Manually entered and fixed in position.
Fixed (Pos & Ht)	Manually entered and fixed in position and height.
Hidden Point	Indirect coordinate determination with hidden point measurements.

Source

The source describes the application program or functionality that generated a coordinate triplet and the method with which it was created.

Source	Originated from application program/functionality
ASCII File	Convert Data, Import ASCII/GSI Data to Job
Arc Base Pt	COGO, Arc Calculation - Base Point
Arc Centre Pt	COGO, Arc Calculation - Centre Point
Arc Offset Pt	COGO, Arc Calculation - Offset Point
Arc Segmt Pt	COGO, Arc Calculation - Segmentation
COGO Area Divsn.	COGO Area Division
COGO Shift/Rtn	COGO, Shift, Rotate & Scale (Manual) COGO, Shift, Rotate & Scale (Match Pts)
COGO Traverse	COGO, Traverse
Cross Section	Survey Cross Section
GSI File	Convert Data, Import ASCII/GSI Data to Job
Hidden Point	Hidden Point, auxiliary points
Intsct (Brg Brg)	COGO, Intersection - Bearing - Bearing
Intsct (Brg Dst)	COGO, Intersection - Bearing - Distance
Intsct (Dst Dst)	COGO, Intersection - Distance - Distance
Intsct (4 Pts)	COGO, Intersection - By points
Line Base Pt	COGO, Line Calculation - Base Point

Source	Originated from application program/functionality
Line Offset Pt	COGO, Line Calculation - Offset Point
Line Segmt Pt	COGO, Line Calculation - Segmentation
None	No information on the source is available
RefLine (Grid)	Reference Line, staked out in a defined grid
RefLine (Meas)	Reference Line, measured
RefLine (Stake)	Reference Line, staked out
Ref Plane (Meas)	Reference Plane, measured
Ref Plane (Scan)	Reference Plane, scan
Road	Road
Sets of Angles	Sets of Angles
Setup (Known BS)	Setup, Known Backsight Point
Setup (Loc Rsct)	Setup, Local Resection
Setup (Ori&Ht)	Setup, Orientation and Height Transfer
Setup (Resect)	Setup, Resection
Setup (Resect H)	Setup, Resection Helmert
Setup (Set Az)	Setup, Set Azimuth
Srvy Auto Offset	Survey Auto Points, automatically recorded with offsets
Stakeout	Stakeout

Source	Originated from application program/functionality
Survey	Survey, measured
Survey (Auto)	Survey Auto Points, automatically recorded
Survey (Rem Pt)	Survey, Remote Point
Unknown	-
User Entered	Manually entered point

Instrument source

The instrument source describes where the coordinate triplet was measured or entered. The options are **TPS**, **GGO** or **Level**.

Coordinate quality

Description

The **C**oordinate **Q**uality is an indicator for the estimated quality of the point coordinates. The coordinate quality of the measurements is used in point averaging.

Column	Description
Est 3D CQ	Estimated 3D coordinate quality of computed position.
Est 2D CQ	Estimated plan coordinate quality of computed position.
Est 1D CQ	Estimated height coordinate quality of computed position.

Vertical angles are always assuming Zenith angles and not elevation angles. Standard deviations of circle readings relate to one face measurements.

$$\rho = \frac{200}{\pi}$$

Standard deviation of circle reading

$$\sigma_{Hz,V}[rad] = \frac{\sigma_{Hz,V}[gon]}{\rho}$$

$\sigma_{Hz,V}$ Standard deviation of circle reading if $\sigma_{Hz} = \sigma_V$.
σ_{Hz}: Standard deviation of horizontal circle reading.
σ_V: Standard deviation of vertical circle reading.

Standard deviation of distance measurement

$$\sigma_D = c_D + ppm * D$$

σ_D	Standard deviation of distance measurement.
c_D	Constant part of EDM accuracy.
ppm	ppm part of EDM accuracy.
D	Slope Distance.

1D estimated coordinate quality

$$1D\ CQ = \sqrt{\sigma^2_D * \cos^2 V + \sigma^2_{Hz,V} * D^2 * \sin^2 V}$$

1D CQ	Estimated coordinate quality of the height.
V	Zenith angle.

2D estimated coordinate quality

$$2D\ CQ = \sqrt{\sigma^2_D * \sin^2 V + \sigma^2_{Hz,V} * D^2}$$

2D CQ	Estimated horizontal coordinate quality.

3D estimated coordinate quality

$$3D\ CQ = \sqrt{\sigma^2_D + \sigma^2_{Hz,V} * D^2 * (1 + \sin^2 V)}$$

3D CQ	Estimated spatial coordinate quality.

Working Example 1

Instrument:	Zoom80 2"
Angular accuracy:	2" = $6.1728*10^{-4}$ gon => σHz,V = 2"*$\sqrt{2}$
EDM accuracy:	2 mm + 2 ppm for an IR measurement
Slope distance:	150 m
Hz:	210 gon
V:	83 gon

1D CQ = 0.00207 m ≅ 2.1 mm
2D CQ = 0.00303 m ≅ 3.0 mm
3D CQ = 0.00367 m ≅ 3.7 mm

Working Example 2

Instrument:	Zoom80 2"
Angular accuracy:	2" = $6.1728*10^{-4}$ gon => σHz,V = 2"*$\sqrt{2}$
EDM accuracy:	2 mm + 2 ppm for an IR measurement
Slope distance:	7000 m
Hz:	210 gon

V:	83 gon

1D CQ = 0.0927 m
2D CQ = 0.0972 m
3D CQ = 0.1343 m

7.3.2 Creating a New Point

Access

Refer to "7.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

Create point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**MANAGE Data: Job Name**, **Points** page	
2.	**NEW (F2)** to access **MANAGE New Point**.	
3.	**MANAGE New Point**, **Coords** page **<Point ID:>** The name of the new point. The configured point ID template is used. The ID can be changed. • To start a new sequence of point ID's overtype the point ID. • For an individual name independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Enter a point ID and the coordinates.	
4.	**PAGE (F6)** changes to the **Code** page.	
5.	**MANAGE New Point**, **Code** page	15.3

Step	Description	Refer to chapter
	The setting for **<Thematc Codes:>** in **CONFIGURE Coding Settings** determines the availability of the subsequent fields and softkeys. • For **<Thematc Codes: With Codelist>**: The codes from the job codelist are used. **<Point Code:>** All point codes of the job codelist can be selected. The description of the code is shown as an output field. The attributes are shown as output, input or choicelist fields depending on their definition. • For **<Thematc Codes: Without Codelist>**: Codes for points can be typed in but not selected from a codelist. **<Point Code:>** The code to be stored with the point. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown. **<Attribute n:>** Up to eight attribute values are available.	
6.	Is **<Thematc Codes: With Codelist>**? • If **yes**, continue with the next row. • If **no**, continue with step 7.	

Step	Description	Refer to chapter
☞	**NEW-A (F2)** allows additional attributes to be created for this point code.	
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.	
☞	**LAST (F4)** recalls the last used attribute values which were stored with this point code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	
7.	**STORE (F1)** stores the new point entered and all associated information and returns to **MANAGE Data: Job Name, Points** page. The properties stored with the point are: Class: **CTRL** Sub class: **Fixed (Pos & Ht)** Source: **User Entered** Instrument source: **TPS**	

Step	Description	Refer to chapter
☞	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	9.6

7.3.3 Editing a Point

Access

Refer to "7.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

Edit point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Data: Job Name**, **Points** page highlight a point to be edited.	
2.	**EDIT (F3)** to access **MANAGE Edit Point: Point ID**. ☞ The visible pages on this screen depend on the properties of the point being edited.	
3.	**MANAGE Edit Point: Point ID**, **Coords** page It is possible to edit the point ID and for points of **<Class: CTRL>**. Other point related data is shown in output fields. ☞ Points of **<Class: REF>** cannot be renamed. ☞ Changing the point ID for a point of any class applies this new point ID to all other points with the same original name, regardless of class.	7.3.1
☞	**MORE (F5)** displays information about class, sub class, estimated 3D coordinate quality, time and date of when point was stored, instrument source and source. Changing the height type does not edit the point.	7.3.1

Step	Description	Refer to chapter
4.	Is **<Class: MEAS>**? • If **yes**, continue with step 5. • If **no**, continue with step 7.	
5.	The edited point is **<Class: MEAS>**. **PAGE (F6)** changes to the **Obs** page.	
6.	**MANAGE Edit Point: Point ID**, **Obs** page It is possible to edit the reflector height. The station from where the point was measured is shown in an output field. ☞ The reflector height is shown and may be edited. Changing the reflector height recalculates the point height. The reflector type is shown in an output field. The distance variables **Δ**Hz, **Δ**V, **Δ**Slop Dist are shown in an output field, whenever a measurement has been taken in both faces.	
☞	**MORE (F5)** displays the horizontal angle or the azimuth from the point to the instrument.	
7.	**PAGE (F6)** changes to the **Code** page.	
8.	**MANAGE Edit Point: Point ID**, **Code** page	9.2 and 9.3

Step	Description	Refer to chapter
	The point code can be edited. All point codes in the job can be selected. The description of the code is shown as an output field. The attributes are shown as output, input or choicelist fields depending on their definition. The attribute values shown depend on **<Attributes:>** in **CONFIGURE Coding & Linework**. **<Attributes: Last Used>** shows the last used attribute values which are stored for this point code in the active codelist. **<Attributes: Default Values>** shows the default attribute values for this point code if existing.	
☞	**NEW-A (F2)** allows additional attributes to be created for this point code.	
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.	
☞	**LAST (F4)** recalls the last used attribute values which were stored with this point code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	

Step	Description	Refer to chapter
9.	Is **<Class: MEAS>** and no offset point? • If **yes**, continue with step 11. • If **no**, continue with step 10.	
10.	Is **<Class: AVGE>**? • If **yes**, continue with step 13. • If **no**, continue with step 15.	
11.	The edited point is **<Class: MEAS>** and no offset point. **PAGE (F6)** changes to the **Annots** page.	
12.	**MANAGE Edit Point: Point ID, Annots** page The comments to be stored with the point can be edited. Continue with step 15.	
13.	The edited point is **<Class: AVGE>**. **PAGE (F6)** changes to the **Mean** page.	
14.	**MANAGE Edit Point: Point ID**, **Mean** page All points of **<Class: MEAS>** of the same point ID are listed sorted by time. The settings in the **Use** column can be edited. All functionality and keys are explained in a separate section.	7.3.4
15.	**STORE (F1)** stores the changes and returns to **MANAGE Data: Job Name**.	

Step	Description	Refer to chapter
	☞ An edited point retains the creation value for **<Time:>**. ☞ Changing coordinates of a point which has been previously used in other application programs, for example COGO, does not update the application results.	
☞	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	9.6

7.3.4 Mean Page

Description

- In order to check measurements, the same point can be measured more than once. These measured points are assigned the class **MEAS**. The various measured coordinate triplets for one point can be recorded using the same point ID. If the averaging mode is activated, an average is calculated when more than one measured coordinate triplet is available for the same point ID.
- The averaged point is given the class **AVGE**. It is checked if the deviations of each single point are within the limits configured in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page.
- After averaging, the **Mean** page becomes available in **MANAGE Edit Point: Point ID** and accessible from the Survey application program **SURVEY Survey: Job Name, Survey** page.
- Available functionality on the **Mean** page depends on the selected averaging mode.

Averaging

Averaging Mode

The averaging mode defines the checks which are performed when more than one set of measured coordinates are recorded for the same point. The selected averaging mode also affects the behaviour of the instrument when editing a point and calculating averages.

Defining the averaging mode and configuring the limits

The averaging mode and the limits are configured in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page. Refer to "6.3 Creating a New Job" and to "6.4 Editing a Job".

Description of averaging modes

Averaging mode	Description
Average	When more than one measured coordinate triplet is recorded for the same point, the average for the position and the height is computed. Depending on the selected averaging method, the average will be computed weighted or arithmetic (no weighting). The class **AVGE** is assigned to the averaged point. The horizontal and height distances from the measured points to the average are computed and displayed on the **Mean** page. A check is performed that the differences for the position and height components between the **averaged point** and the point being stored does not exceed the defined limits.
Absolute Diffs	What is described above for **Average** applies for **Absolute Diffs.** Additionally, the **absolute difference** between two points selected from a list of measured points which are all stored with the same point ID are computed and checked for being within the defined limits.
Off	Averaging functionality is turned off. With more than one measured coordinate triplet recorded for the same point, no average for the position and the height is computed.

Averaging with position only or height only points

Position only points, height only points and points with full coordinate triplets are handled in the averaging.

Access step-by-step

The **Mean** page can be accessed if

<Averaging Mode: Average> or **<Averaging Mode: Absolute Diffs>** is configured in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page.

AND

more than one measured coordinate triplet is recorded for the same point using the same point ID.

Access within data management

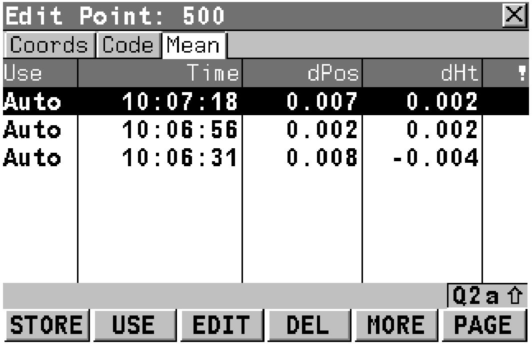
Step	Description
1.	Refer to "7.2 Accessing Data Management" to access **MANAGE Data: Job Name**.
2.	In **MANAGE Data: Job Name**, **Points** page highlight a point to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Point: Point ID, Mean** page.

Access within Survey

Step	Description
1.	**Main Menu: Survey** to access **SURVEY Survey Begin**.
2.	**CONT (F1)** to access **SURVEY Survey: Job Name**, **Survey** page.
3.	**SHIFT AVGE (F2)** or **SHIFT ABS (F2)** to access **SURVEY Edit Point: Point ID**, **Mean** page.

MANAGE
Edit Point: Point ID, Mean page

All measured coordinate triplets recorded using the same point ID are shown.



STORE (F1)
To store the changes and to return to the screen from where this screen was accessed.

USE (F2)
To change between the options in the **Use** column for the highlighted coordinate triplet. To include or exclude this triplet in or from the calculation of the average. Refer to "Description of columns" below.

EDIT (F3)
To view and edit the highlighted measured coordinate triplet. It is possible to edit the point ID and the reflector height without impact on all other classes of the point with the same original name. The coordinates are updated. Codes cannot be changed. The average point has the higher priority. A change in codes must be an overall change for the average point.
Example: One of the measured coordinate triplets has a wrong point ID and should not be included in the average. By editing the point ID, the point is renamed and no longer contributes to the average.

DEL (F4)
To delete the highlighted coordinate triplet. The average is recomputed.

MORE (F5)
To change between time and date of when the point was stored and the 3D coordinate quality.

PAGE (F6)
To change to another page on this screen.

SHIFT DIFFS (F5)
Available for **<Averaging Mode: Absolute Diffs>** and **Yes** is set in the **Use** column for exactly two measurements. To display the absolute coordinate differences. Differences exceeding the defined limit are indicated by !.

Description of columns

Column	Description
Use	The use of a measured coordinate triplet in the averaging. • **Auto** The coordinate triplet is included in the averaging computation if within the averaging limit defined in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page.

Column	Description
	• **Yes** The coordinate triplet is always included in the averaging computation even if it would fall outside the averaging limit defined in **MANAGE New Job, Avge** page or in **MANAGE Edit Job: Job Name, Avge** page. • **No** The coordinate triplet is never included in the averaging computation. • ----- The coordinate triplet cannot be included in the averaging computation. Automatically set by the system. **USE (F2)** changes between the options.
Time	The time the measured coordinate triplet was stored.
Date	The date the measured coordinate triplet was stored. The format is as defined in **CONFIGURE Units & Formats**, **Time** page.
dPos	The horizontal distance from the measured coordinate triplet to the average. **<dPos: ----->** indicates unavailable information, for example for a height only point.
dHt	The height distance from the measured coordinate triplet to the average. **<dHt: ----->** indicates unavailable information, for example for a position only point.

Column	Description
!	Available for measured coordinate triplets with **Auto** or **Yes** in the **Use** column if **<Averaging Mode: Average>**. Indicates an exceeding of the limits.

Next step

IF a measured coordinate triplet	THEN
is not to be viewed	**STORE (F1)** stores the changes and returns to **MANAGE Data: Job Name**.
is to be viewed	highlight a measured coordinate triplet and **EDIT (F3)**.

7.4 Line/Area Management

7.4.1 Overview

Description

A line/area consists of points and can be created/edited in **MANAGE Data: Job Name**. The individual points are measured within any application program. These can be all points. Points can be simultaneously assigned to one or more lines and/or areas.

A line/area can have

- a style for display in MapView.
- a code independent of the point code of the points comprising the line/area.

☞ Points are assigned to a line/area when the line/area is open. Refer to "7.2 Accessing Data Management" for information on how to open a line/area.

7.4.2 Creating a New Line/Area

☞ The functionality of all screens and fields are similar for the creation of both lines and areas. The step-by-step instructions for creating a new line can be applied for areas.

Access

Refer to "7.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

OR

Press a hot key configured to access the screen **MANAGE New Line/MANAGE New Area**. Refer to "2.1 Hot Keys" for information on hot keys.

Create line step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**MANAGE Data: Job Name**	
2.	**PAGE (F6)** until the **Lines (X)** page is active.	
3.	**MANAGE Data: Job Name**, **Lines (X)** page	
4.	**NEW (F2)** to access **MANAGE New Line**.	
5.	**MANAGE New Line, General** page **<Line ID:>** The name of the new line. The configured ID template for lines is used. The ID can be changed.	

Step	Description	Refer to chapter
	• To start a new sequence of line ID's overtype the line ID. • For an individual name independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. **<Pts to Store:>** The type of points which are used to form the line during a survey. Select between all points, measured points, auto points and offset points of type 1 or 2. **<Line Style:>** This is the line style in which lines/areas are represented in MapView and GGO. For **<Line Code: <None>>** on the Code page a line style can be selected from a choicelist. Otherwise the line style as defined for the selected line code is shown. Type in a number for the line, select the points to be stored with the line and select a line style if necessary.	43.1, 43.4
6.	**PAGE (F6)** changes to the **Code** page.	
7.	**MANAGE New Line**, **Code** page The setting for **<Thematc Codes:>** in **CONFIGURE Coding & Linework** determines the availability of the subsequent fields and softkeys.	15.3

Step	Description	Refer to chapter
	• For **<Thematc Codes: With Codelist>**: The codes from the job codelist are used. **<Line Code:>** All line codes of the job codelist can be selected. The description of the code is shown as an output field. The line style is shown as defined for the selected line code. It is the style in which lines/areas are represented in MapView and GGO. For **<Line Code: <None>>**, it can be changed. The attributes are shown as output, input or choicelist fields depending on their definition. • For **<Thematc Codes: Without Codelist>**: Codes for lines can be typed in but not selected from a codelist. **<Line Code:>** The line code to be stored with the point. A check is performed to see if a line code of this name already exists in the job. If so, the according attributes are displayed. **<Attribute n:>** Up to eight attribute values are available. Type in a code.	
8.	Is **<Thematc Codes: With Codelist>**? • If **yes**, continue with the next row.	

Step	Description	Refer to chapter
	• If **no**, continue with step 9.	
☞	**NEW-A (F2)** allows additional attributes to be created for this line code.	
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.	
☞	**LAST (F4)** recalls the last used attribute values which were stored with this line code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	
9.	**STORE (F1)** stores the new line entered and all associated information and returns to **MANAGE Data: Job Name, Lines (X)** page. The value for **<Start Time:>** with which the line is stored is the time when **STORE (F1)** was pressed. The same value is assigned to the value for **<End Time:>** until a point is added to the line.	7.4.3
☞	Any existing lines and areas which are open are closed.	

Creating lines/areas most efficiently

IF the task is to create	THEN
multiple lines/areas with subsequent line/area ID's	use the hot key/user menu function **FUNC Create New Line (Quick)**/**FUNC Create New Area (Quick)**. Pressing the hot key or selecting the function from the user menu creates and immediately stores the new line/area. For the line/area ID, the line/area ID template as defined in **CONFIGURE ID Templates** is used. The code and attributes are taken over from the last created line/area.
lines/areas with certain codes	use quick coding. The job codelist must contain quick codes for lines/areas. By tying the quick code a new line/area is created and immediately stored with that line/area code and attributes. For the line/area ID, the line/area ID template as defined in **CONFIGURE ID Templates** is used.

7.4.3 Editing a Line/Area

☞ The functionality of all screens and fields are similar for the editing of both lines and areas. The step-by-step instructions for editing a new line can be applied for areas.

Access

Refer to "7.2 Accessing Data Management" to access **MANAGE Data: Job Name**.

Edit line step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**MANAGE Data: Job Name**	
2.	**PAGE (F6)** until the **Lines** page is active.	
3.	In **MANAGE Data: Job Name**, **Lines** page highlight a line to be edited.	
4.	**EDIT (F3)** to access **MANAGE Edit Line: Line ID**.	
5.	**MANAGE Edit Line: Line ID**, **General** page The line ID and the type of points which are used to form the line during a survey can be edited. Other line related data is shown in output fields. **<No. of Pts:>** The number of points contained within the line.	

Step	Description	Refer to chapter
	<Length:> The sum of the distances between the points in the sequential order in which they are stored for the line. **<Start Time:>** and **<Start Date:>** The time/date when the line was created. ☞ A line cannot be renamed to an already existing line ID.	
☞	**MORE (F5)** displays **<End Time:>** and **<End Date:>**. This is the time/date when the last point was added to the line. This can be different to the time the point was created. The values do not change after deleting the last added point or after editing unless an additional point is added to the line.	
6.	**PAGE (F6)** changes to the **Points** page.	
7.	**MANAGE Edit Line: Line ID**, **Points** page All points belonging to the line are listed. The point that was added last to the line is at the top of the list.	
☞	**ADD (F2)** Accesses **MANAGE Select Point** with the **Points** and **Map** page. To add an existing point from the active job to the line. A new point is added above the point which was highlighted when **ADD (F2)** was pressed.	7.2.
☞	**EDIT (F3)** edits the highlighted point.	7.3.3.
☞	**REMOV (F4)** removes the highlighted point from the line. The point itself is not deleted.	

Step	Description	Refer to chapter
☞	**MORE (F5)** displays information about the point codes if stored with the line, the time and the date of when the line was stored, the 3D coordinate quality, the class and the flag for Linework.	7.3.1
8.	**PAGE (F6)** changes to the **Code** page.	
9.	**MANAGE Edit Line: Line ID**, **Code** page The line code can be edited. All line codes can be selected. For **<Line Code: <None>>**, the line style can be changed. The description of the code is shown as an output field. The attributes are shown as output, input or choicelist fields depending on their definition.	9
☞	**NEW-A (F2)** allows additional attributes to be created for this line code.	
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.	
☞	**LAST (F4)** recalls the last used attribute values which were stored with this line code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	

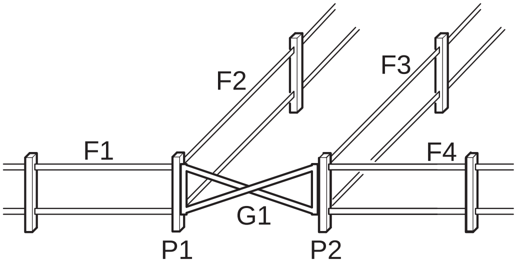
Step	Description	Refer to chapter
10.	**STORE (F1)** stores the changes and returns to **MANAGE Data: Job Name, Lines** page.	
☞	An edited line retains the creation value for **<Start Time:>**. The value for **<End Time:>** changes when a point was added to the line.	

7.4.4 Working Example

Description

Application:	Pick up points along fence lines with a gate. The gate can also be represented as a line. Some points belong to more than one line.
Setting:	**F7** is configured to access the **MANAGE Data: Job Name** screen. Refer to "2.1 Hot Keys" on how to configure hot keys.
Goal:	Each point is to be picked up once.

Diagram



P1 Gate post
P2 Gate post
F1 First fence line
F2 Second fence line
F3 Third fence line
F4 Fourth fence line
G1 Gate

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Create the lines F1, F2 and G1.	7.4.2

Step	Description	Refer to chapter
2.	Start Survey application program.	42.1
3.	Press **F7.**	
4.	**MANAGE Data: Job Name, Lines (X)** page The line F1 must be open, the lines F2 and G1 must be closed. To open/close a line, highlight the line and **CLOSE (F4)** and **OPEN (F4)**.	
5.	**CONT (F1)**	
6.	**SURVEY Survey: Job Name** Measure points along fence line F1 until the last point before P1. These points are automatically added to line F1.	
☞	Points can be coded separately.	
7.	Press **F7.**	
8.	**MANAGE Data: Job Name, Lines (X)** page Highlight the line F2. **OPEN (F4)** to open the line.	
9.	Highlight the line G1. **OPEN (F4)** to open the line.	
☞	Line F1 stays open.	
10.	**CONT (F1)**	

Step	Description	Refer to chapter
11.	**SURVEY Survey: Job Name** Measure P1. This point is automatically added to all three lines open at that time.	42.1
12.	Press **F7.**	
13.	**MANAGE Data: Job Name, Lines (X)** page Highlight the line F1. **CLOSE (F4)** to close the line.	
14.	Highlight the line F2. **CLOSE (F4)** to close the line.	
☞	Line G1 stays open.	
15.	**CONT (F1)**	
16.	**SURVEY Survey: Job Name** Measure points along gate G1. These points are automatically added to line G1.	42.1
17.	After finishing the survey, import the data into a CAD package. If the line codes required by the CAD package were used, the lines are automatically connected and the point symbols are automatically set.	

7.5 Data Log

Description

A list of all objects and free codes in the active job is displayed in order of time.

Access step-by-step

Access within data management

Step	Description
1.	Refer to "7.2 Accessing Data Management" to access **MANAGE Data: Job Name**.
2.	In **MANAGE Data: Job Name** on the **Points** page, **SHIFT LOG (F4)** to access **MANAGE Data Log: Job Name**.

Access within job management

Step	Description
1.	**Main Menu: Manage...\Jobs** to access **MANAGE Jobs (Device)**. Refer to "6.2 Accessing Job Management" for further options to access this screen.
2.	In **MANAGE Jobs (Device)** highlight a job to be edited.
3.	**EDIT (F3)** to access **MANAGE Edit Job: Job Name**.
4.	**SHIFT LOG (F5)** to access **MANAGE Data Log: Job Name**.

Access by hot key

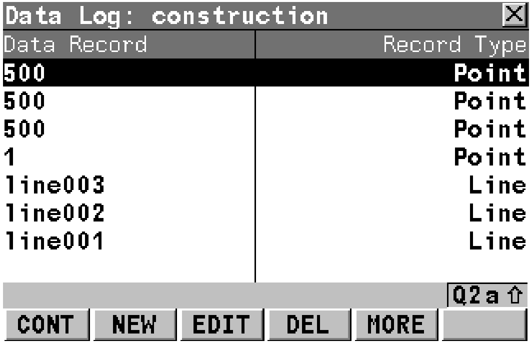
Press a hot key configured to access the screen **MANAGE Data Log: Job Name**. Refer to "2.1 Hot Keys" for information on hot keys.

Access by user defined menu

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

MANAGE
Data Log: Job Name

In the column **Data Record**, all points, lines and areas as well as free codes stored within the active job are displayed. They are always sorted by time with the most recent record at the top. For lines and areas, the value for **<Start Time:>** is relevant.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

NEW (F2)
To insert a free code below, this means timewise before, the currently highlighted object or record. The functionality of inserting a free code is identical to the functionality of entering a free code during a survey. Refer to "9.3 Free Coding".

EDIT (F3)
To edit the highlighted object or free code. Refer to "7.3.3 Editing a Point", "7.4.3 Editing a Line/Area". The functionality of editing a free code is identical to the functionality of entering a free code during a survey. Refer to "9.3 Free Coding" .

DEL (F4)
To delete the highlighted object or free code.

MORE (F5)
To display information about the type of data recorded, the time and the date of when it was stored or for lines and areas when they were created and the codes if stored with any object.

Next step

CONT (F1) returns to the screen from where **MANAGE Data Log: Job Name** was accessed.

7.6 Point Sorting and Filters

7.6.1 Sorting and Filters for Points, Lines and Areas

Description

The sort settings define the order of the objects in the active job. The filter settings define the objects to be viewed.

Three types of filters are available:

Point filter:	An active point filter shows selected points in **MANAGE Data: Job Name**, **Points** page.
Line filter:	An active line filter shows selected lines in **MANAGE Data: Job Name**, **Lines (X)** page.
Area filter:	An active area filter shows selected areas in **MANAGE Data: Job Name**, **Areas (X)** page.

The sort and filter settings are stored in the job. They are remembered after turning off the instrument and are copied to a new job.

When a job becomes active, then the sort and filter settings of this job are saved in the SystemRAM. If the CompactFlash card is formatted then these last used sort and filter settings are used for the job **Default**.

☞ Changing the active job does influence the sort settings for the objects. The filter settings are set to those of the selected job.

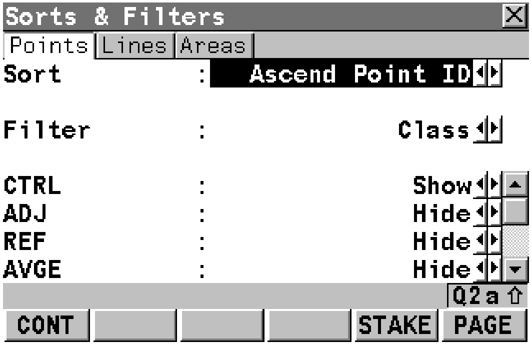
☞ An active filter for an object is indicated in **MANAGE Data: Job Name** by Y located on the right hand side of the page name.

Access step-by-step

Step	Description
1.	Refer to "7.2 Accessing Data Management" to access **MANAGE Data: Job Name**.
2.	In **MANAGE Data: Job Name** on the **Points**, **Lines** or **Areas** page, **SHIFT FILT (F5)** to access **MANAGE Sorts & Filters**.
3.	**MANAGE Sorts & Filters** This screen consists of three pages, one for each type of object. The page for an object is displayed when the equivalent page is displayed in **MANAGE Data: Job Name**.

MANAGE Sorts & Filters, Points page

The available fields on this screen depend on the selected setting for **<Filter:>**.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed. The selected sort and filter settings are applied.

CODES (F4)
Available for **<Filter: Point Code>**. To select the line codes to be used.

STAKE (F5)
To filter points for the Stakeout application program. Refer to "7.6.3 Stakeout Filter".

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Sort:>	**Ascend Point ID**, **Descend Point ID**, **Forward Time** or **Backward Time**	Always available. The method points are sorted by.
<Filter:>		Always available. The method the points are filtered by.
	No Filter	Shows all points.
	Highest Class	Shows points of highest class.
	Range of Pt ID's	Shows points with point ID’s between the entered start and end ID. The points are left aligned and sorted by the first digit.
	Pt ID Wildcard	Shows points with point ID’s matching the wildcard.
	Time	Shows points which were recorded within a defined time window.
	Class	Shows points of the selected class.
	Point Code	Shows points with selected codes attached. Refer to "7.6.2 Point, Line and Area Code Filter".

Field	Option	Description
	Radius From Pt	Shows points within the defined radius from a particular point. The radius is the horizontal distance.
	Individual Line	Shows points forming a selected line. This may for example be useful during stakeout.
	Individual Area	Shows points forming a selected area. This may for example be useful during stakeout.
<Start ID:>	User input	Available for **<Filter: Range of Pt ID's>**. The first point to be displayed.
<End ID:>	User input	Available for **<Filter: Range of Pt ID's>**. The last point to be displayed.
<Wildcard:>	User input	Available for **<Filter: Pt ID Wildcard>**. * and ? are supported. * indicates an undefined number of unknown characters. ? indicates a single unknown character.
<Start Date:>	User input	Available for **<Filter: Time>**. The date of the first point to be displayed.
<Start Time:>	User input	Available for **<Filter: Time>**. The time of the first point to be displayed.
<End Date:>	User input	Available for **<Filter: Time>**. The date of the last point to be displayed.

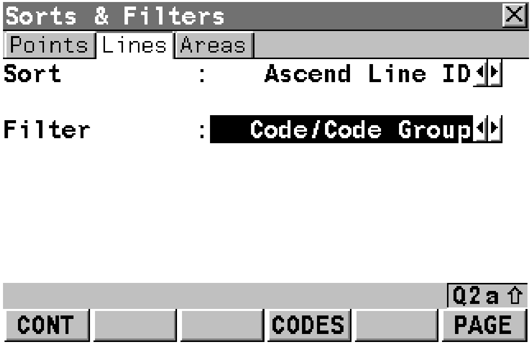
Field	Option	Description
<End Time:>	User input	Available for **<Filter: Time>**. The time of the last point to be displayed.
<CTRL:>, <ADJ:>, <REF:>, <AVGE:>, <MEAS:>, <EST:>, <NONE:>	**Show** or **Hide**	Available for **<Filter: Class>**. Defined classes are shown or hidden.
<View:>		Available for **<Filter: Class>**.
	Highest Triplet	The coordinate triplets of the highest class are shown.
	All Triplets	All classes for one coordinate triplet are shown.
<Point ID:>	Choicelist	Available for **<Filter: Radius From Pt>**. The point to which the radius is applied. Opening the choicelist opens **MANAGE Data: Job Name**. Refer to "7.2 Accessing Data Management".
<Radius:>	User input	Available for **<Filter: Radius From Pt>**. The radius of the circle within which the points are shown.

Field	Option	Description
<Line ID:>	Choicelist	Available for **<Filter: Individual Line>**. Opening the choicelist opens **MANAGE Data: Job Name**. Refer to "7.2 Accessing Data Management".
<Area ID:>	Choicelist	Available for **<Filter: Individual Area>**. Opening the choicelist opens **MANAGE Data: Job Name**. Refer to "7.2 Accessing Data Management".

Next step

PAGE (F6) changes to the **Lines** page. Refer to paragraph "MANAGE Sorts & Filters, Lines page".

MANAGE Sorts & Filters, Lines page



CONT (F1)
To close the screen and return to the screen from where this screen was accessed. The selected sort and filter settings are applied and the lists in **MANAGE DATA: Job Name** are updated.

CODES (F4)
Available for **<Filter: Code/Code Group>**. To select the line codes to be used.

PAGE (F6)
To change to another page on this screen.

Description of fields

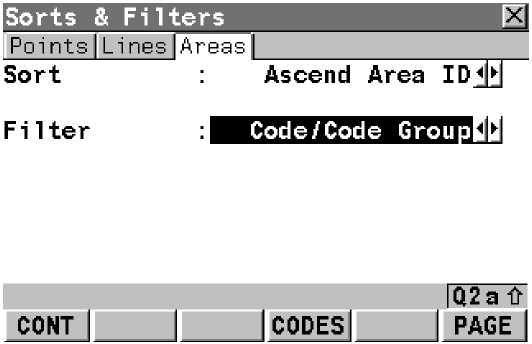
Field	Option	Description
<Sort:>	**Ascend Line ID**, **Descend Line ID**, **Fwrd Start Time**, **Bwrd Start Time**, **Fwrd End Time** or **Bwrd End Time**	Always available. The method the lines are sorted by.
<Filter:>		Always available. The method by which the lines are filtered.
	No Filter	Shows all lines.

Field	Option	Description
	Code/Code Group	Shows lines with selected codes attached. Refer to "7.6.2 Point, Line and Area Code Filter" since the functionality is identical to the point code filter.

Next step

PAGE (F6) changes to the **Areas** page. Refer to paragraph "MANAGE Sorts & Filters, Areas page".

MANAGE Sorts & Filters, Areas page



CONT (F1)
To close the screen and return to the screen from where this screen was accessed. The selected sort and filter settings are applied and the lists in **MANAGE DATA: Job Name** are updated.

CODES (F4)
Available for **<Filter: Code/Code Group>**. To select the area codes to be used.

PAGE (F6)
To change to another page on this screen.

Description of fields

The functionality of setting the filters is identical to those on the **Lines** page. Refer to paragraph "MANAGE Sorts & Filters, Lines page".

Next step

CONT (F1) returns to the screen from where **MANAGE Sorts & Filters** was accessed.

7.6.2 Point, Line and Area Code Filter

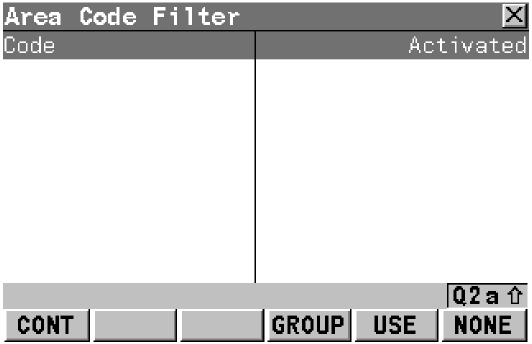
☞ For each object, a code filter exists. The point, line and area code filters are independent from each other. The functionality is identical. For simplicity, the point code filter is explained.

Access step-by-step

Step	Description
1.	Refer to "7.6.1 Sorting and Filters for Points, Lines and Areas" to access **MANAGE Sorts & Filters**.
2.	Select **<Filter: Point Code>**.
3.	**CODES (F4)** to access **MANAGE Point Code Filter**.

MANAGE Point Code Filter

This screen shows the point codes from the active job and codes currently used as filter. Point codes are sorted according to the settings in **MANAGE Sort Codes**.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

GROUP (F4)
To activate and deactivate code groups. Accesses **MANAGE Code Groups**. Any code group that have been previously deactivated are displayed as deactivated here. Codes belonging to a deactivated code group are not displayed in **MANAGE Code Filter**. Refer to "8.6 Managing Code Groups".

USE (F5)
To activate and deactivate the filter for the highlighted code.

NONE (F6) or **ALL (F6)**
To deactivate or activate all point codes.

SHIFT SORT (F5)
To define the order of the codes. Accesses **MANAGE Sort Codes**.

7.6.3 Stakeout Filter

Description

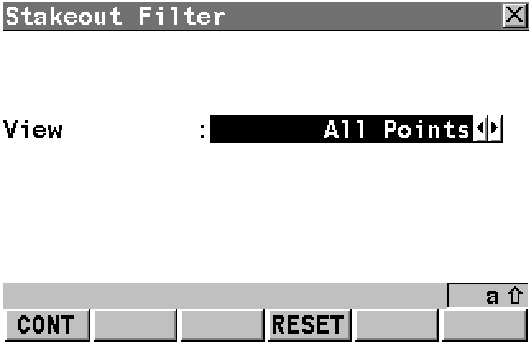
The settings on this screen define a filter for the Stakeout application program, for example to show points which are already staked or points that are still to be staked.

☞ The stakeout filter acts in addition to any other filter set in **MANAGE Sorts & Filters**.
For example, points still to be staked out with a particular code can be filtered.

Access step-by-step

Step	Description
1.	Refer to "7.6.1 Sorting and Filters for Points, Lines and Areas" to access **MANAGE Sorts & Filters**.
2.	In **MANAGE Sorts & Filters**, **PAGE (F6)** until the **Points** page is active.
3.	**STAKE (F5)** to access **MANAGE Stakeout Filter**.

MANAGE
Stakeout Filter



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

RESET (F4)
To reset the staked flag for all points of the currently active job.

Description of fields

Field	Option	Description
<View:>	**All**	Shows all points.
	Pts to Stakeout	Shows points not yet staked out.
	Staked Points	Shows points which are already staked out.

8 Manage...\Codelists

8.1 Terminology

Description

This chapter describes technical terms related to codes and codelists.

☞

The values for code groups, codes and attributes are case sensitive. For example the code group Tree is not the same as the code group TREE.

Object

For coding, points, lines and areas have the same behaviour. In this chapter, object is used as generic term for points, lines and areas.

Code group

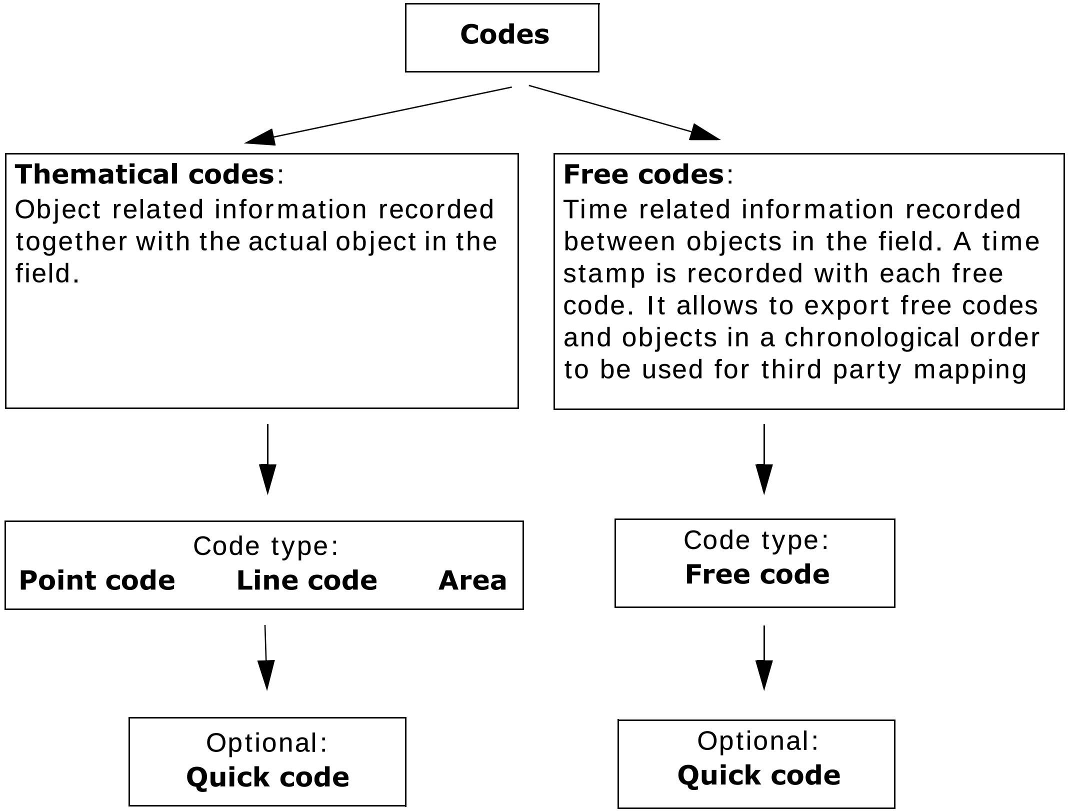
A code group allows codes belonging to the same theme to be grouped together. Individual groups can be activated or deactivated. The codes belonging to a deactivated code group cannot be selected from the choicelist for code selection.

Code

Description

A code is a description which can be stored with an object or alone.

Structure of codes



Code types

The code type defines how and for which objects a code can be used. It is possible to create a code of the same name but of different code types both on the instrument and in GGO. Example: The code Oak can exist with code type point code and with code type line code.

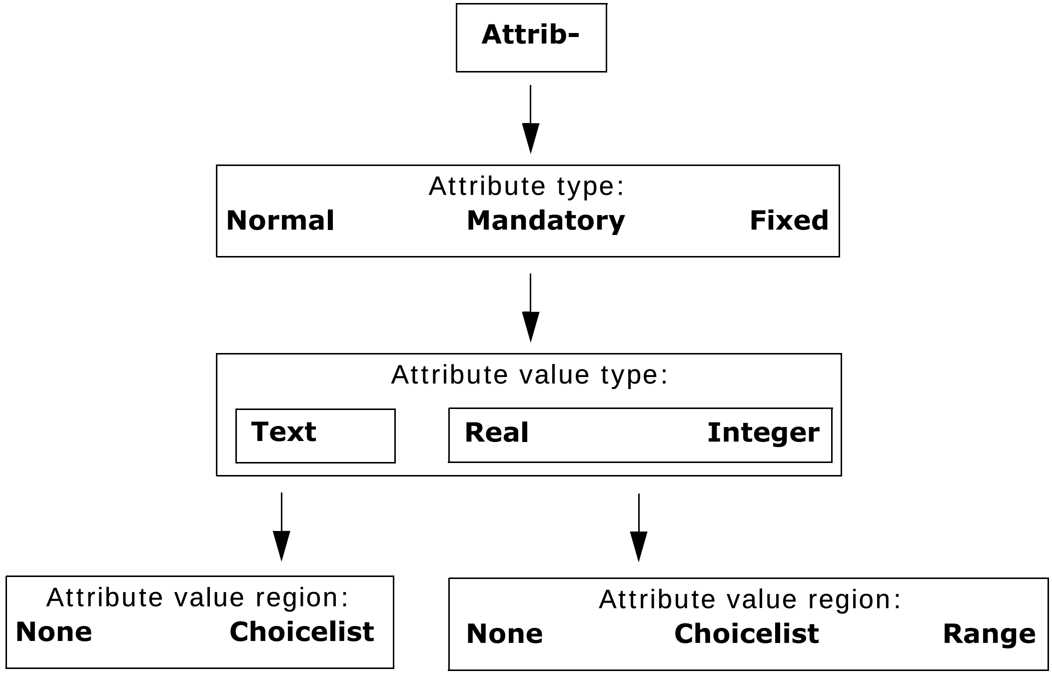
Point code:	To record a code directly with a point. This is thematical point coding.
Line code:	To record a code directly with a line. This is thematical line coding.
Area code:	To record a code directly with an area. This is thematical area coding.
Free code:	To record a code based on time in between objects.
Quick code:	To start a point measurement and store the code by typing in one, two or three predefined digits.

Attribute

Description

The use of attributes allows additional information to be stored with the code. Up to twenty attributes can be related to one code. Attributes are not compulsory.

Structure of attributes



Attribute types

The attribute type defines the input requirements for the attribute.

Normal:	An input for the attribute is optional. The attribute value can be typed in in the field. New attributes with this attribute type can be created in GGO or on the instrument.
Mandatory:	An input for the attribute is compulsory. The attribute value must be typed in the field. New attributes with this attribute type can be created in GGO.
Fixed:	The attribute value is a predefined default which is displayed but cannot be changed in the field. This attribute value is automatically attached to the code. New attributes with this attribute type can be created in GGO.

Attribute value types

The attribute value type defines which values are accepted as input.

Text:	Any input for the attribute is interpreted as text. New attributes with this attribute value type can be created in GGO or on the instrument.
Real:	An input for the attribute must be a real number, for example 1.23. New attributes with this attribute value type can be created in GGO.
Integer:	An input for the attribute must be an integer number, for example 5. New attributes with this attribute value type can be created in GGO.

Attribute value regions

The attribute value region defines if the attribute values must be selected from a predefined list.

None: An input for the attribute must be typed in. New attributes with this attribute value region can be created in GGO or on the instrument.

Range: An input for the attribute must fall within a predefined range. New attributes with this attribute value region can be created in GGO.

Choicelist: An input for the attribute is selected from a predefined list. New attributes with this attribute value region can be created in GGO.

Example

Code	Attributes	Attribute value type	Attribute value region	Example for the attribute value region
Birch	Height	Real	Range	0.5-3.0
	Condition	Text	Choicelist	Good, Dead, Damaged
	Remark	Text	None	-

Codelist

Description

A codelist is a collection of codes that can be used to describe surveyed objects in the field.

Elements of a codelist

- Code group
- Code
- Attributes

Structure of a codelist

Structure	Example
Codelist	Codelist
Code group 1	Trees
Code 1.1	Birch
Attribute 1.1.1	Height
Attribute ...	Condition
Attribute 1.1.20	Remark
Code 1.2	Oak
Attribute 1.2.1	Circumference
Attribute ...	Condition
Attribute 1.2.20	...
Code ...	...
Code group 2	Infrastructure
Code 2.1	Road
Attribute 2.1.1	Material
...	...

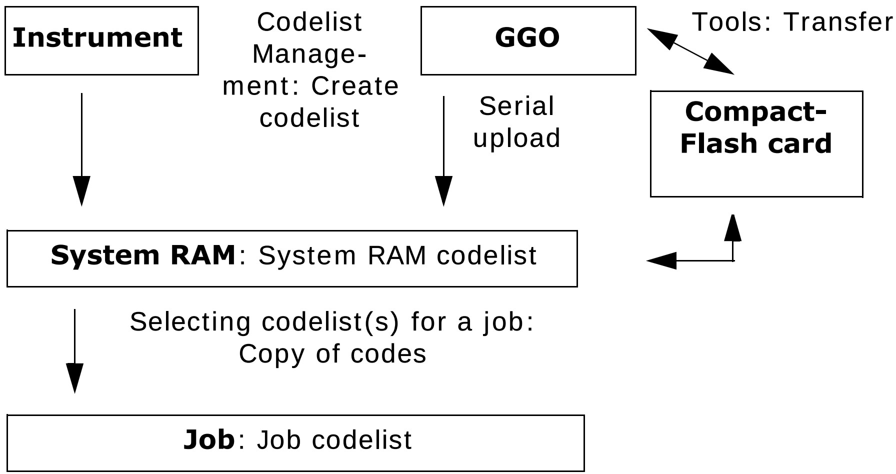
Codelist types

System RAM codelist:	A codelist stored in the System RAM of the instrument.
Job codelist:	The collection of codes contained within the currently active job.

8.2 Overview

It is recommended to create a codelist in GGO. A codelist can be transferred from GGO to the System RAM of the instrument using the CompactFlash card.

Steps from creating to using a codelist



The creating, editing and managing of codelists is explained in this chapter.
In order to use a codelist on the instrument, it must be transferred from the CompactFlash card to the System RAM. Refer to "22 Tools...\Transfer Objects...".

8.3 Accessing Codelist Management

Access

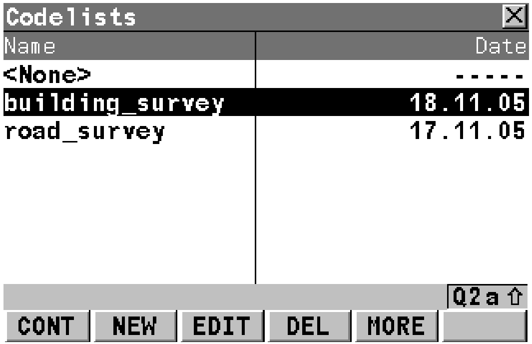
Select **Main Menu: Manage...\Codelists**.

OR

From a choicelist in some screens, for example **MANAGE New Job, Codelist** page.

MANAGE Codelists

Listed are all codelists stored in the System RAM.



CONT (F1)
To return to the screen from where this screen was accessed. If this screen was accessed from a choicelist, the codes from the highlighted codelist are copied to the active job.

NEW (F2)
To create a codelist. Refer to "8.4 Creating/Editing a Codelist".

EDIT (F3)
To edit the highlighted codelist. Refer to "8.4 Creating/Editing a Codelist".

DEL (F4)
To delete the highlighted codelist.

MORE (F5)
To display information about the creator and the date of when the codelist was created.

Next step

IF a codelist	THEN
is to be selected	highlight the desired codelist. **CONT (F1)** copies the codes of the codelist to the active job, closes the screen and returns to the screen from where **MANAGE Codelists** was accessed.
is to be created	**NEW (F2)**. Refer to "8.4 Creating/Editing a Codelist".
is to be edited	highlight the codelist and **EDIT (F3)**. Refer to "8.4 Creating/Editing a Codelist".

8.4 Creating/Editing a Codelist

Access

Refer to "8.3 Accessing Codelist Management" to access **MANAGE Codelists**.

Create/edit a codelist step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**MANAGE Codelists** **NEW (F2)** or **EDIT (F3)** to access **MANAGE XX Codelist**.	8.3
2.	**MANAGE New Codelist** or **MANAGE Edit Codelist** **<Name:>** A unique name for the codelist. The name may be up to 16 characters long and may include spaces. Input required. **<Description:>** A detailed description of the codelist. This can be for example, work to be performed. Input optional. **<Creator:>** The person's name who is creating the new codelist. Input optional.	
☞	**CODES (F4)** accesses **MANAGE Codes** where codes can be created, edited or deleted and code groups can be accessed.	8.5.2, 8.5.3 or 8.6
3.	**STORE (F1)** stores the codelist and returns to **MANAGE Codelists**.	

8.5 Managing Codes

8.5.1 Accessing MANAGE Codes

Description

Managing codes includes

- creating new codes
- viewing codes with their related information
- editing codes.
- deleting existing codes.

Access step-by-step

Step	Description
1.	Refer to "8.3 Accessing Codelist Management" to access **MANAGE Codelists**.
2.	In **MANAGE Codelists** highlight the codelist of which codes are to be managed.
3.	**EDIT (F3)** to access **MANAGE Edit Codelist**.
4.	**CODES (F4)** to access **MANAGE Codes**. This screen is described below.

MANAGE Codes

Codes from currently active code groups are shown.

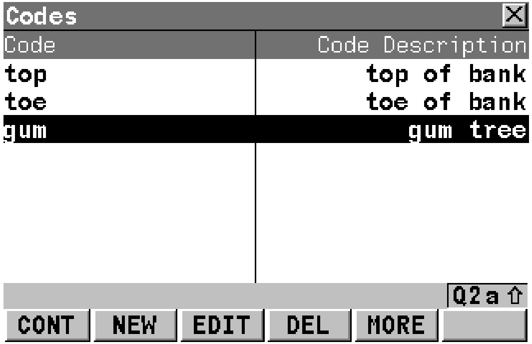
The listed code groups belong to

the selected System RAM codelist when this screen was accessed through **Main Menu: Manage...\Codelists**.

OR

to the job codelist when **MANAGE Codes** was accessed from an application program, **MANAGE New Job** or **MANAGE Edit Job**.

The indicates codes which have attributes attached.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

NEW (F2)
To create a new code. Refer to "8.5.2 Creating a New Code".

EDIT (F3)
To edit the highlighted code. Refer to "8.5.3 Editing a Code".

DEL (F4)
To delete the highlighted code.

MORE (F5)
To display information about the code description, the quick codes if available, the code groups and the code type.

SHIFT GROUP (F4)
To view, create, delete, activate and deactivate code groups. Refer to "8.6 Managing Code Groups".

SHIFT SORT (F5)
To sort codes by code name, code description, quick code or the last use.

Next step

IF	THEN
a code is to be created	**NEW (F2)**. Refer to "8.5.2 Creating a New Code".
a code is to be edited	highlight the code and **EDIT (F3)**. Refer to "8.5.3 Editing a Code".
code groups are to be accessed	**SHIFT GROUP (F4)**. Refer to "8.6 Managing Code Groups".

8.5.2 Creating a New Code

Create a new code step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "8.5.1 Accessing MANAGE Codes" to access **MANAGE Codes**.	
2.	**NEW (F2)** to access **MANAGE New Code**.	
3.	**MANAGE New Code** **<Code:>** A unique name for the new code. The name may be up to 16 characters long and may include spaces. Input required. **<Code Desc:>** A detailed description of the code. Input optional. **<Group:>** The code group to which the code is to be assigned. All code groups from **MANAGE Code Groups** can be selected. **<Code Type:>** This field contains a choicelist, where the code type (Thematical code - Point, Line, Area or Free code - Free) can be selected. The selected option will define how the code will be used. Selecting a code type allows a code to remain unique. **<Code:>** can have the same value but with a different **<Code Type:>** within the same codelist.	

Step	Description	Refer to chapter
	<Linework:> Available for **<Code Type: Point>** only. This field contains a choicelist, to allow a new line or new area to be opened whenever the point code is newly selected. This functionality is also available when creating codelists with GGO Codelist Management. • None: Select this option to disable the functionality. All other code settings on the instrument are not affected when this option is set. • Begin Line: When a point code is newly selected, a new line is opened and the point being stored is added to the line. When the same point code remains selected, a new line is not opened. The point being stored is simply added to the current line. • Begin Area: The behaviour for opening a new area is the same as the behaviour for opening a new line, as mentioned above.	
	<Line Style:> Not available for **<Code Type: Free>**. The style in which lines and areas are represented in MapView and GGO.	8.1
4.	**NEW-A (F2)** adds **<Attribute 1:>** as new input field for an attribute of attribute type normal and of value type text.	

Step	Description	Refer to chapter
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute 1:>** or the field for the attribute value. The name of **<Attribute 1:>** can be edited and the attribute value to be used as the default attribute value can be typed in.	
☞	Attributes of attribute type mandatory or fixed and of value type real or integer must be created in GGO.	
☞	Up to twenty attributes can be created.	
5.	Is another attribute to be created? • If **yes**, repeat step 4. • If **no**, continue with step 6.	
6.	**STORE (F1)** adds the new code and any associated attributes to the System RAM codelist and returns to the screen from where this screen was accessed.	
☞	A new code can also be created within an application program. In this case, the new code is added to the job codelist.	

8.5.3 Editing a Code

Access step-by-step

Step	Description
1.	Refer to "8.5.1 Accessing MANAGE Codes" to access **MANAGE Codes**.
2.	**EDIT (F3)** to access **MANAGE Edit Code**.
3.	All following steps are identical with the creation of a new code. Refer to "8.5.2 Creating a New Code". Follow the instructions in paragraph "Create a new code step-by-step" from step 3. onwards.
☞	Attribute names that have already been typed in cannot be edited in a job codelist.

8.6 Managing Code Groups

Access step-by-step

Step	Description
1.	Refer to "8.5.1 Accessing MANAGE Codes" to access **MANAGE Codes**.
2.	**SHIFT GROUP (F4)** to access **MANAGE Code Groups**.

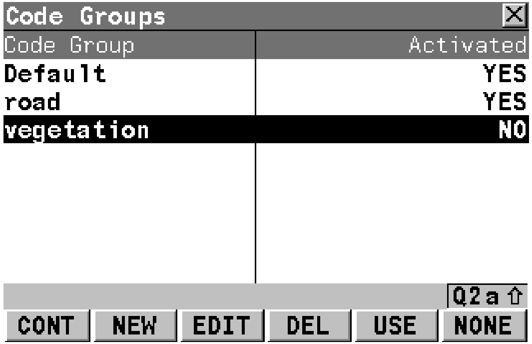
MANAGE Code Groups

The listed code groups belong to

the selected System RAM codelist when this screen was accessed through **Main Menu: Manage...\Codelists**.

OR

to the job codelist when **MANAGE Codes** was accessed from an application program, **MANAGE New Job** or **MANAGE Edit Job**.



CONT (F1)
To close the screen and return to the screen from where this screen was accessed.

NEW (F2)
To create a new code group.

EDIT (F3)
Available for System RAM codelists. To edit the highlighted code group.

DEL (F4)
Available for System RAM codelists. To delete the highlighted code group.

USE (F5)
To activate and deactivate the highlighted code group. Codes belonging to a deactivated code group are not displayed in **MANAGE Codes**.

NONE (F6) or **ALL (F6)**
To deactivate or activate all code groups.

Description of columns

Column	Description
Code Group	The name of the code group.
Activated	Use code group or not. The options are **Yes** and **No**. The codes belonging to a deactivated code group cannot be selected from the choicelist for code selection. **USE (F5)** changes between the options.

Next step

IF a code group	THEN
is to be created	**NEW (F2)**. In **MANAGE New Code Group** type in a unique name for **<Group:>**. **STORE (F1)** stores the new code group typed in and returns to **MANAGE Code Groups**.
is to be edited	highlight the code group and **EDIT (F3)**. In **MANAGE Edit Code Group** type in the changes for **<Group:>**. **STORE (F1)** stores the changes and returns to **MANAGE Code Groups**.

9 Coding

9.1 Overview

Description

A code is a description which can be stored with a point, line, area or alone.
Coding on Zoom80 is very flexible with thematical, free and quick coding being available. Thematical and free coding is possible by selecting codes from a codelist or by directly typing in codes. SmartCodes are a quick way for a code to be stored with a point to be selected and to be measured.

☞ For coding, points, lines and areas have the same behaviour. In this chapter, the word object is used as a generic term for points, lines and areas.

Coding methods

Coding method	Characteristic	Description
Themat-ical	Use	To store a description together with an object inside an application program or in **Main Menu: Manage...\Data**.
	Selection of the codes	• For thematical coding with codelist: On a configured display mask, codes are selected from the job codelist in a choicelist. The job codelist must contain thematical codes. • For thematical coding without codelist: On a configured display mask, codes are typed in.

Coding method	Characteristic	Description
	Recording of the codes	Together with the objects.
Free	Use	To store a description independent of an object at any time. A free code can be used to store a description related to an object or to store additional descriptions such as the job name or the temperature.
	Selection of the codes	• For free coding using a codelist: Pressing the configured hot key opens a choicelist with the free codes of the job codelist. • For free coding with direct input: Pressing the configured hot key opens a screen for alphanumeric input.
	Recording of the codes	Stored as time related information. A time stamp is stored with each free code. According to the requirements of the CAD package used, free codes can be configured to be stored before or after the object.
Quick	Use	Quick coding is the storing of an object plus a thematical or free code using a minimum number of keystrokes.

Coding method	Characteristic	Description
	Selection of the codes	Shortcuts must be assigned to codes in the job codelist. **<Quick Code: On>** must be set in **CONFIGURE Coding & Linework**. Typing the shortcut searches for the assigned code and initiates a measurement.
	Recording of the codes	• For thematical codes: Together with the objects. • For free codes: Stored as time related information before or after the points. A time stamp is stored with each free code.
	☞	Quick codes must be created in GGO.
	☞	Characters that can be assigned to quick codes are: • 0 to 9 • A to Z, not case sensitive • a to z, not case sensitive

Configure Coding

Refer to "15.3 Coding & Linework Settings" for information on configuring coding.

9.2 Thematical Coding

9.2.1 Thematical Coding with Codelist

☞ Thematical coding of points with a codelist is explained in this chapter. Refer to "7.4 Line/Area Management" for information on coding lines/areas.

Requirements

- The job codelist contains thematical codes.
- **<Thematc Codes: With Codelist>** in **CONFIGURE Coding & Linework**.
- A display mask with an input field for point codes must be configured.

Access

Open the choicelist for **<Code:>** in a display mask of an application program.

OR

Open the choicelist for **<Code:>**/**<Point Code:>** in **MANAGE New Point**, **Code** page in data management.

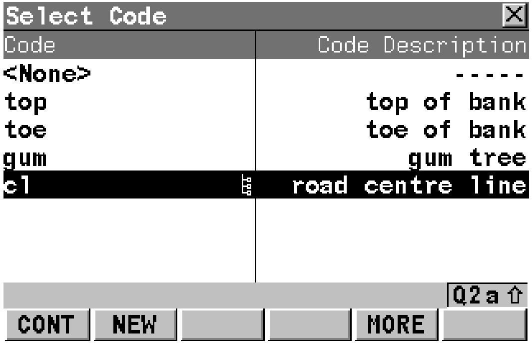
OR

Open the choicelist for **<Point Code:>** in **MANAGE Edit Point: Point ID**, **Code** page in data management.

OR

Open the choicelist for **<Auto Pt Code:>** in **SURVEY Survey: Job Name**, **Auto** page, if configured.

MANAGE
Select Code



CONT (F1)
To return to the screen from where this screen was accessed.

NEW (F2)
To create a new code. Refer to "8.5.2 Creating a New Code".

ATRIB (F3)
Available unless accessed from **MANAGE New Point/Line/Area** or **MANAGE Edit Point/Line/Area**. To type in attribute values for the selected code and/or add new attributes for the selected code.

LAST (F4)
Available if a code has been previously used in the active job. To select from a list of last used codes. The codes are sorted by time with the most recently used code at the top of the list.

MORE (F5)
To display information about the code description, the code group, the code type and the quick code if codes with quick codes exist in the job.

SHIFT GROUP (F4)
To view, create, delete, activate and deactivate code groups. Refer to "8.6 Managing Code Groups".

SHIFT SORT (F5)
To sort codes by code name, code description, quick code or the last used.

Thematical coding with codelist step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Access" to access **XX Select Point Code**.	
2.	**MANAGE Select Point Code** All point codes from the job codelist which belong to the active code groups are available for selection. Point codes marked with have attributes attached.	8.6
3.	Highlight the desired code.	
4.	**ATRIB (F3)** to access **XX Enter Attributes**.	
5.	**XX Enter Attributes** **<Point Code:>** The name of the selected code for which attribute values are to be typed in. **<Code Desc:>** The detailed description of the selected code. If configured for the selected code, input fields for attribute values are available. Type in the attribute values. Attribute values for attributes of type • normal can be typed in. • fixed cannot be edited.	

Step	Description	Refer to chapter
☞	**NEW-A (F2)** to add a new attribute of type normal and of value type text.	
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value.	
☞	Attributes of type mandatory or fixed and of value type real or integer must be created in GGO.	online help in GGO.
☞	Up to twenty attributes can be added.	
☞	**LAST (F4)** recalls the last used attribute values for the selected code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	
6.	**CONT (F1)** returns to the screen from where **XX Select Point Code** was accessed.	
☞	The point code and any associated attribute values are stored when the point is stored.	

Step	Description	Refer to chapter
	If a point with the same point ID exists in the job, the codes, the attribute names and the attribute values of the new and the existing point must be identical. Should they not be identical, a screen opens where the code or attribute mismatch can be corrected.	9.6

9.2.2 Thematical Coding without Codelist

☞ Thematical coding without codelist for points is explained in this chapter. Refer to "7.4 Line/Area Management" for information on coding lines/areas.

Requirements

- **<Thematc Codes: Without Codelist>** in **CONFIGURE Coding & Linework**.
- A display mask with an input field for point codes must be configured.

Access

A thematical code is typed in the field

<Code:> in a display mask of an application program.

OR

<Code:>/**<Point Code:>** in **MANAGE New Point**, **Code** page in data management. The procedure is similar for lines and areas.

OR

<Point Code:> in **MANAGE Edit Point: Point ID**, **Code** page in data management. The procedure is similar for lines and areas.

OR

in the field **<Auto Pt Code:>** in **SURVEY Survey: Job Name**, **Auto** page, if configured.

Thematical coding without codelist step-by-step

Step	Description
☞	Thematical coding in the Survey application program is explained in this step-by-step instruction. A typical configuration set with a display mask for coding called **Code** is used.

Step	Description
1.	**SURVEY Survey: Job Name**, **Code** page **<Point ID:>** The identifier for the point for which codes and attribute values are to be typed in. **<Point Code:>** The name for the code. **<Attribute n:>** The attribute values for the code. Type in a code and attribute values.
	Up to eight attributes can be added. This is configured in the display mask.
2.	**ALL (F1)** to measure angles and distance. OR **PAGE (F6)** to change to another page on this screen.

9.3 Free Coding

9.3.1 Free Coding Using a Codelist

☞ In this chapter, free coding using a codelist is explained for points. Refer to "7.4 Line/Area Management" for information on coding lines/areas.

Requirements

- The job codelist contains free codes.
- A hot key is configured to access the screen **FREECODE Select Free Code** or the user defined menu is configured to display the option **Select Free Code**.

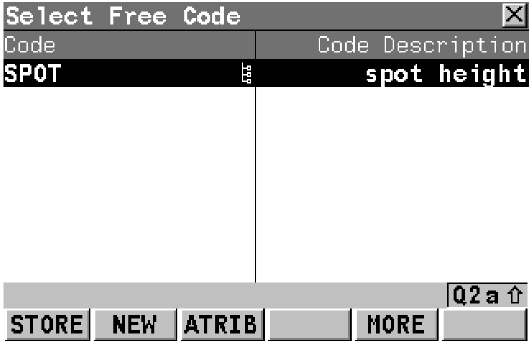
Access

Press a hot key configured to access the screen **FREECODE Select Free Code**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER** and select **Select Free Code** to access the screen **FREECODE Select Free Code**. Refer to "2.2 USER Key" for information on the **USER** key.

FREECODE
Select Free Code



STORE (F1)
: To store the free code and any associated attribute values and to return to the screen from where this screen was accessed.

NEW (F2)
: To create a new code. Refer to "8.5.2 Creating a New Code".

ATRIB (F3)
: To type in attribute values and/or add new attributes for the selected free code.

LAST (F4)
: Available if a free code has been previously used in the active job. To select from a list of last used free codes. The free codes are sorted by time with the most recently used code at the top of the list.

MORE (F5)
: To display information about the code description, the code group and the quick code if codes with quick codes exist in the job.

SHIFT GROUP (F4)
: To view, create, delete, activate and deactivate code groups. Refer to "8.6 Managing Code Groups".

SHIFT SORT (F5)
: To sort codes by code name, code description, quick code or the last used.

Free coding using a codelist step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Access" to access **FREECODE Select Free Code**.	9.3
2.	**FREECODE Select Free Code** All free codes from the job codelist which belong to the active code groups are available for selection. Free codes marked with have attributes attached.	8.6
3.	Highlight the desired code.	
4.	**ATRIB (F3)** to access **FREECODE Enter Attributes**.	
5.	**FREECODE Enter Attributes** **<Free Code:>** The name of the selected code for which attribute values are to be typed in. **<Code Desc:>** The detailed description of the selected code. If configured for the selected code, input fields for attribute values are available. Type in the attribute values. Attribute values for attributes of type • normal can be typed in. • fixed cannot be edited.	

Step	Description	Refer to chapter
☞	**NEW-A (F2)** to add a new attribute of type normal and of value type text.	
☞	**NAME (F3)** or **VALUE (F3)** Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value.	
☞	Attributes of type mandatory or fixed and of value type real or integer must be created in GGO.	online help in GGO.
☞	Up to twenty attributes can be added.	
☞	**LAST (F4)** recalls the last used attribute values for the selected code.	
☞	**DEFLT (F5)** recalls the default attribute values for the selected code.	
6.	**FREECODE Enter Attributes** **STORE (F1)** returns to the screen from where **FREECODE Select Free Code** was accessed and stores the free code, any associated attribute values and time related information.	

9.3.2 Free Coding with Direct Input

☞ In this chapter, free coding with direct input is explained for points. Refer to "7.4 Line/Area Management" for information on coding lines/areas.

Requirements

A hot key is configured to access the screen **FREECODE Enter Free Code & Attributes** or the user defined menu is configured to display the option **Enter Free Code**.

Access

Press a hot key configured to access the screen **FREECODE Enter Free Code & Attributes**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER** and select **Enter Free Code** to access the screen **FREECODE Enter Free Code & Attributes**. Refer to "2.2 USER Key" for information on the **USER** key.

Free coding with direct input step-by-step

Step	Description
1.	Refer to paragraph "Access" to access **FREECODE Enter Free Code & Attributes**.
2.	**FREECODE Enter Free Code & Attributes** **<Free Code:>** The name for the free code. **<Attribute n:>** The attribute values for the free code. Type in a code and attribute values.
☞	As soon as a free code is typed in, a codelist is created within the job.
☞	Up to eight attributes can be added.

Step	Description
☞	**LAST (F4)** Available if a free code has been previously used in the active job. Accesses **FREECODE Last Used Free Codes**. To select from a list of last used free codes. The free codes are sorted by time with the most recently used code at the top of the list. In **FREECODE Last Used Free Codes** press **ATRIB (F3)** to type in attribute values.
3.	**STORE (F1)** stores the free code, any associated attribute values and time related information.

9.4 Quick Coding

Requirements

- The job codelist contains quick codes for points, lines and/or areas.
- According to the requirements of the used CAD package, set **<Rec Free Code: Before Point>** or **<Rec Free Code: After Point>** in **CONFIGURE Coding & Linework**.

Activate quick coding

The current setting for **<Quick Code:>** in **CONFIGURE Coding & Linework** determines how quick coding is activated. Quick coding can be activated at any time.

- For **<Quick Code: On>** in **CONFIGURE Coding & Linework**
  Quick coding is active and can be used.
- For **<Quick Code: Off>** in **CONFIGURE Coding & Linework**
  Press a hot key configured to switch between **<Quick Code: Off>** and **<Quick Code: On>** in **CONFIGURE Coding & Linework**. Refer to "2.1 Hot Keys" for information on hot keys.
  OR
  Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.
  OR
  Tap the quick coding icon visible during Survey and other application programs where it is possible to measure a point with quick codes.
  OR
  Access **CONFIGURE Coding & Linework** and change the setting. Refer to "15.3 Coding & Linework Settings".
- For **<Quick Code: Never>** in **CONFIGURE Coding & Linework**

Access **CONFIGURE Coding Settings** and change the setting. Refer to "15.3 Coding & Linework Settings".

Quick coding for points step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Activate quick coding" to activate quick coding.	
☞	A screen must be active where points can be measured. **ALL (F1)** must be visible. For example **SURVEY Survey: Job Name.**	
2.	Type in the one, two or three digits of the quick code. The current setting for **<Digits:>** in **CONFIGURE Coding & Linework** determines by how many keystrokes quick coding is executed.	15.3
☞	**ENTER** to execute quick coding already after one or two keystrokes. Available for **<Digits: 2>** and **<Digits: 3>** in **CONFIGURE Coding & Linework**.	
☞	**ESC** clears digits from the entry.	
3.	What is the code type of the quick codes? • For point codes continue with the next row. • For free codes continue with step 5.	
☞	The point code assigned to the quick code is searched for in the job codelist and initiates measurements.	

Step	Description	Refer to chapter
☞	Attribute values for attributes of type • normal cannot be typed in. Depending on the setting for **<Attributes:>** in **CONFIGURE Coding & Linework**, the default or the last used attribute values are stored. • fixed cannot be edited.	
☞	The point code and any associated attribute values are stored with the point.	
☞	If a point with the same point ID exists in the job, the codes, the attribute names and the attribute values of the new and the existing point must be identical. Should they not be identical, a screen opens where the code or attribute mismatch can be corrected.	9.6
4.	Quick coding for a point code is finished.	
5.	Quick coding for free codes continues from here.	
☞	The free code assigned to the quick code is searched for in the job codelist and initiates measurements.	
☞	Attribute values for attributes of type • normal cannot be typed in. Depending on the setting for **<Attributes:>** in **CONFIGURE Coding Settings**, the default or the last used attribute values are stored. • fixed cannot be edited.	

Step	Description	Refer to chapter
☞	The free code, associated attribute values and time related information are stored. The setting for **<Rec Free Code:>** in **CONFIGURE Coding & Linework** determines if the free code is stored before or after the point.	
6.	Quick coding for a free code is finished.	

Quick coding for lines/areas step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Activate quick coding" to activate quick coding.	
2.	Type in the one, two or three digits of the quick code. The current setting for **<Digits:>** in **CONFIGURE Coding & Linework** determines by how many keystrokes quick coding is executed.	15.3
☞	**ENTER** to execute quick coding already after one or two keystrokes. Available for **<Digits: 2>** and **<Digits: 3>** in **CONFIGURE Coding & Linework**.	
☞	**ESC** clears digits from the entry.	
☞	The line/area code assigned to the quick code is searched for in the job codelist.	

Step	Description	Refer to chapter
☞	A new line/area is created and immediately stored with that line/area code and attributes. For the line/area ID, the line/area ID template as defined in **CONFIGURE ID Templates** is used.	
☞	The system asks for mandatory attribute values.	
3.	Quick coding for a line/area is finished.	

9.5 SmartCodes

9.5.1 Overview

Description

SmartCodes is basically a quick way for code to be selected and point to be measured. All existing coding, linework, and point measurement functionality is retained.

9.5.2 Configuring SmartCodes

Access

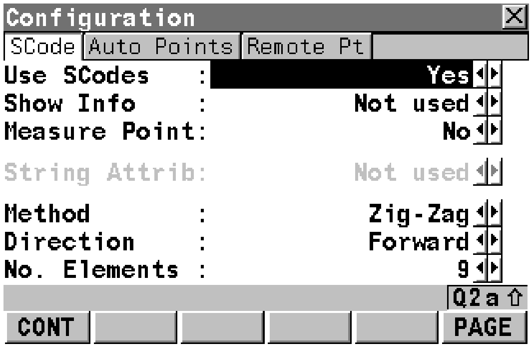
Select **Main Menu: Survey**. In **SURVEY Survey Begin** press **CONF (F2)** to access **SURVEY Configuration**.

OR

In **SURVEY Survey**: **Job Name** press **SHIFT CONF (F2)** to access **SURVEY Configuration**.

SURVEY Configuration, SCode page

The settings on this page activate the using of SmartCodes and define the method. All settings in this screen are stored within the currently active configuration set.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Use SCodes:>	**Yes**	Activates using of SmartCodes. ☞ All other fields on the screen are active and can be edited.
	No	Deactivates using of SmartCodes and all fields on this screen.
<Show Info:>		Information shown in line 8 of **SURVEY Survey: Job name, SCode** page.
	Not used	No display mask element is shown.
	Point ID	The identifier for the measured points. The configured point ID template is used. ☞ Refer to "42.2 Surveying Points".
	3D CQ	The current 3D coordinate quality of the measured point.
	2D CQ	The current 2D coordinate quality of the measured point.
	1D CQ	The current height coordinate quality of the measured point.
	Reflector Ht	The height of the reflector that is being used. Changing the reflector height here does not update the default reflector height as defined in the active configuration set.

Field	Option	Description
	Hz	The current horizontal angle of the measured point.
	V	The current vertical angle of the measured point.
	Horiz Dist	The current horizontal distance of the measured point.
	Slope Dist	The current slope distance of the measured point.
	Ht Diff	The current height difference between the station and the measured point.
	Linework	The linework flag to be stored with the point. The options available depend on whether a line/area is currently open. Refer to "10.2 Performing Linework" for an explanation of the options that become available in **SURVEY Survey: Job name, SCode** page.
<Measure Point:>	**Yes** or **No**	If one of the code boxes is tapped in **SURVEY Survey**: **Job name**, **SCode** page then that code is selected and the point is measured for **<Measure Point:Yes>**.

Field	Option	Description
<String Attrib:>	Choicelist	Available for **<Show Codes: All Codes>**. When this field is active, surveyed points that have the same code attached are strung to one line. Refer to "15.3 Coding & Linework Settings".
<Method:>		Method by which subsequent code box is selected after a point is stored.
	Not used	**<Direction:>** and **<No. Elements:>** are invisible and the number of codes boxes shown in **SURVEY Survey: Job name, SCode** page is nine.
	Zig-Zag	Each new code block is started at the same end as where the previous code block finished.
	Same direction	Each new code block is started at the same end as where the previous code block started.
<Direction:>		The way of using the code boxes. This influences in which order the code boxes will be applied.
	Forward	The code boxes are used in the same way as defined in **SURVEY Survey: Job name, SCode** page.

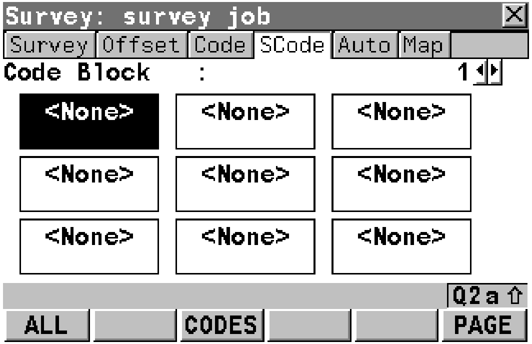
Field	Option	Description
	Backward	The code boxes are used in the reverse way as defined in **SURVEY Survey: Job name, SCode** page.
<No. Elements:>	**1, 2, 3, 4, 5, 6, 7, 8 or 9**	Number of code boxes shown in **SURVEY Survey: Job name, SCode** page.

9.5.3 Code Block

Requirements

- **<Use SCodes: Yes>** in **SURVEY Configuration**, **SCode** page.

SURVEY Survey: Job Name, SCode page



ALL (F1)
To measure and store distances and angles.

CODES (F3)
To select a code from **MANAGE Select Code** screen.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To activate/deactivate/configure Smart-Codes.

SHIFT 2FACE (F4)
To take a measurement in Face I and Face II. The point stored is an average of the two measurements.

Creating a Code Block step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Accessing Survey" to access **SURVEY Survey Begin**.	42.1
2.	**CONT (F1)** to access **SURVEY Survey: Job Name**.	

Step	Description	Refer to chapter
3.	**PAGE (F6)** until the **SCode** page is visible.	
4.	With the focus on **<Code Block: 1>** press enter to access **SURVEY Manage Code Blocks** screen.	
5.	**NEW (F2)** to create a new code block.	
	Code blocks can only be created or deleted in **SURVEY Manage Code Blocks** screen.	
6.	**CONT (F1)** to return to **SURVEY Survey: Job Name, SCode** page.	

Assigning codes to a Code Block step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Creating a Code Block step-by-step" to access **SURVEY Survey: Job Name, SCode** page.	
2.	Move the focus on a code box.	
3.	**CODES (F4)** to select a code to be assigned to the highlighted code block.	
	To create a new code to be assigned refer to "Creating a New Code".	8.5.2

Copying a Code Block to a new job step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
☞	Code blocks are stored in the job.	
1.	Refer to paragraph "Accessing Job Management" to access **MANAGE Edit Job: Job Name, Codelist** page.	6.2
☞	**<Codelist:>** If codes had been copied from a System RAM codelist, the name of the codelist is displayed. If codes have been typed in, then the name of the active job is displayed.	
2.	**SHIFT EXPRT (F2)** copies codes and code blocks from the job to an existing or new codelist.	
☞	To create a new codelist refer to "Creating/Editing a Codelist".	8.4
☞	Copying code blocks to an existing codelist overwrites the code blocks of the existing codelist.	
3.	**STORE (F1)** to save the currently active job and return to **MANAGE Job (Device)**.	
4.	Create a new job and assign the related codelist to the job.	
☞	SmartCodes from the codelist are now available within the new job.	
☞	To create a new job refer to "Creating a New Job".	6.3

9.5.4 Using SmartCodes

Measuring points using Code Blocks step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to paragraph "Creating a Code Block step-by-step" to access **SURVEY Survey: Job Name, SCode** page.	9.5.4
2.	Move the focus on a code box.	
☞	When **<String Attrib:>** is active, you can type in an attribute value below the code name of the highlighted code box.	
☞	**+ (F4)** or **- (F5)** to increase or decrease the value. Applies only if the value is numeric.	
3.	**ALL (F1)** to measure and store the point with the highlighted code.	
☞	When **<Measure Point: Yes>** is set in the configuration settings, tapping the code box with the supplied stylus automatically measures and stores the point with the highlighted code. Selecting the code box by using the arrow keys will not measure and store the point.	

Measuring lines/ares using Code Blocks step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Activate **<Show Info: Linework>** in **SURVEY Configuration**, **SCode** page.	9.5.2
2.	Refer to paragraph "Creating a Code Block step-by-step" to access **SURVEY Survey: Job Name, SCode** page.	9.5.4
3.	Create a line/area SmartCode and return to **SURVEY Survey: Job Name, SCode** page.	9.5.3
☞	The line/area is opened and closed using the SmartCode.	
4.	To start an arc/spline move the focus on **<Linework:>**, the last line of the page, and select the linework flag to be stored with the point.	
5.	Move the focus on the line/area code box.	
6.	**ALL (F1)** to measure and store the point with the highlighted line/area code.	

9.6 Code and Attribute Mismatch

9.6.1 Code Mismatch

Description

When storing a point with a code, it may happen that a point with the same point ID already exists in the job. If the codes of the new and the existing point do not match, a screen opens where the code can be corrected. One point cannot have different codes.

XX Point Code Mismatch

STORE (F1)
To store the highlighted code and any associated attributes with the point being stored and to continue with the application program or data management.

MORE (F5)
To display information about the code description, the code group and any attributes associated with the highlighted code.

Description of fields

Field	Option	Description
<New Code:>	Output	The code for the point.
<Stored Code:>	Output	The code as stored for the existing point in the job.

Match codes step-by-step

Step	Description
☞	**XX Point Code Mismatch** opens automatically if the codes of the new and the existing point do not match.
1.	Highlight the code to be stored with the new point.
2.	**STORE (F1)** stores the highlighted code and any associated attributes with the point being stored and continues with the application program or data management.

9.6.2 Attribute Mismatch

Description

If a point with the same point ID exists in the job, the codes, the attribute names and the attribute values of the new and the existing point must be identical. Should they not be identical, a screen opens where the attribute mismatch can be corrected. One point cannot have different attributes.

The name of the screen changes with pressing **CURNT (F5)** or **STORD (F5)**:

Pressing **CURNT (F5)**:**XX Attributes Being Stored**
Pressing **STORD (F5)**:**XX Attributes Already Stored**

For simplicity, the screen shown is **XX Attributes Already Stored**.

XX Attributes Already Stored

STORE (F1)
To store the selected attributes with the new/created point and to continue with the application program or data manage-ment.

CURNT (F5) or **STORD (F5)**
To change between viewing the attribute names and values of the new/created point and those stored for the existing point in the job.

Description of fields

Field	Option	Description
<Point Code:>	Output	• For **XX Attributes Already Stored**: The code of the existing point in the job. • For **XX Attributes Being Stored**: The code of the new point.
Attributes	Output	• For **XX Attributes Already Stored**: The attributes as stored for the existing point in the job. • For **XX Attributes Being Stored**: The attributes of the new point.

Match attributes step-by-step

Step	Description
☞	**XX Attributes Already Stored** opens automatically if the attribute names and/or values of the new and the existing point do not match.
1.	**CURNT (F5)** and **STORD (F5)** to display the attribute names and values to be stored with the point.
2.	**STORE (F1)** stores the displayed attribute names and values with the point being stored and continues with the application program or data management.

10 Linework

10.1 Overview

Description

Two methods are available for the surveying of lines and areas. These two methods can be combined and are described in the following table.

Linework by	Description

Linework	• In all application programs, a display mask can be configured to show the field **<Linework:>.** This field contains a choicelist, where the Linework flags can be selected.
	• The selection of a linework flag determines:
	  • the action taken for a line/area, for example beginning a line.
	  • the linework flag to be stored with the point.
	• The Linework flags:
	  • are configured in **CONFIGURE Coding & Linework**, **Line-work**.
	  • can be exported with a format file.

Coding	• Line/area codes can be selected in many application programs. • Refer to "8.5.2 Creating a New Code" and "9 Coding" for more information.

☞

- The Linework flag and coding are not linked.
- Additionally to Linework, thematical point, line and area codes can be used.

- Quick coding can be used as per normal.

10.2 Performing Linework

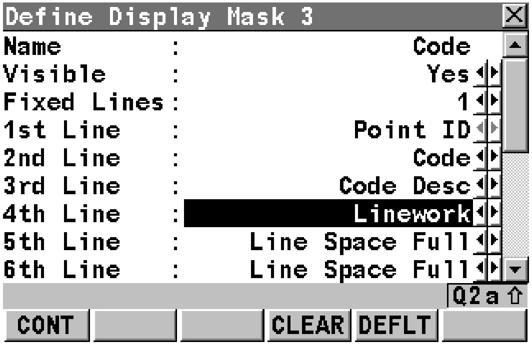
☞ The Survey application program is used here to explain Linework.

Requirements

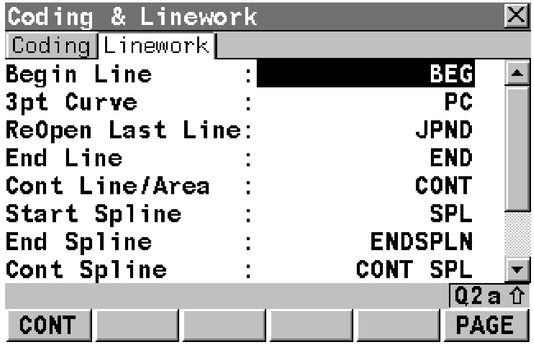
- A display mask with a choicelist for Linework must be configured.
- The Linework flags are defined in **CONFIGURE Coding & Linework Settings**, **Linework**

Preparing Linework

Step1: Placing Linework in a display mask



Step2: Defining the Linework flags



Performing Linework

The most important keys are explained.

ALL (F1)
To measure and store distances and angles.

STOP (F1)
Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data. If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways: • To start a new sequence of point ID's type over the point ID.

Field	Option	Description
		• For an individual point ID independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "15.1 ID Templates".
<Line-work:>		The linework flag to be stored with the point. The options available depend on whether a line/area is currently open.
	- - - - -	No linework flag is stored.
	Begin Line	Opens a new line when the next point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the **End Line**/**Close Area** linework flag. The point may or may not be stored with a point code.
	3pt Curve	Stores the linework flag for a curve through the next three measured points and continues a line/area.

Field	Option	Description
	ReOpen Any Line	Opens a line from a list of all lines which are currently stored in the job when the next point is stored. The last code used with the reopened line is automatically selected when the point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the **End Line**/**Close Area** linework flag.
	ReOpen Last Line	Opens the last used line again. The last code used with the reopened line is automatically selected when the point is stored.
	End Line	Closes all open lines.
	Cont Line/Area	Indicates a line/area is open.
	Start Spline	Stores the linework flag for beginning a spline and continues any open line/area.
	End Spline	Closes a spline and continues any open line/area.
	Cont Spline	Indicates a line/area is open with spline line type.

Field	Option	Description
	Begin Area	Opens a new area when the next point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the **End Line**/**Close Area** linework flag. The point may or may not be stored with a point code.
	ReOpen Any Area	Opens an area from a list of all lines which are currently stored in the job when the next point is stored. The last code used with the reopened area is automatically selected when the point is stored. Any line/area which is currently open is closed and the last point belonging to that line/area is given the **End Line**/**Close Area** linework flag.
	ReOpen Last Area	Opens the last used area again. The last code used with the reopened area is automatically selected when the point is stored.
	Close Area	Closes all open areas.

Next step

Step	Description
1.	Go to the point to be measured.
2.	Select the appropriate Linework flag to be stored with the next point.

Step	Description
3.	**ALL (F1)**
4.	Repeat steps 1. to 3. until all points are measured and stored.
5.	**SHIFT QUIT (F6)** to exit the Survey application program.
6.	Use a format file to export the points including the linework flags.

Selecting a line with MapView

- Selecting a line in MapView is possible with either the softkeys or the touch screen.
- Refer to "30 MapView Interactive Display Feature" for further information.

10.3 Combining Linework and Coding

Description

- Linework and coding can be combined.
- This combination can be useful, because coding, assigning linework flags and opening/closing lines/areas can all be done with one point observation.
- Combining Linework and coding can only be configured if thematical point codes or if thematical point, line and area codes are available for selection. Thematical coding can be done with or without codelists.

☞ Linework and coding can also be combined using SmartCodes. Refer to "9.5.4 Using SmartCodes".

Configuration options

- The configuration for the types of codes available and the configuration for coding with/without a codelist both have an influence on the following:
  - The required configuration of a display mask.
  - The behaviour of the fields configured for the display mask.
  - The behaviour of the software.
- The possible configurations and their influence are shown in this table:

Configuration in **CONFIGURE Coding & Linework**				
Show Codes	Only Pt Codes		All Codes	
Thematc Codes	With Codelist	Without Codelist	With Codelist	Without Codelist
Required fields and their appearance in display mask				
Code				
Required	✓	✓	✓	✓

Optional	-	-	-	-
Appearance	Choicelist	User input	Choicelist	User input
Code Type				
Required	-	-	-	✓
Optional	✓	✓	✓	-
Appearance	Output	Output	Output	Choicelist
Linework				
Required	✓	✓	✓	✓
Optional	-	-	-	-
Appearance	Choicelist	Choicelist	Choicelist	Choicelist

Requirements

- A display mask must be configured with:
  - a field for codes.
  - a choicelist for Linework.

- The configuration of a field for code types in a display mask is required for working with point, line and area codes without choicelist. Else the configuration of a field for code types is optional.

- Configure in **CONFIGURE Coding & Linework**, **Coding**:
  - **<Show Codes: Only Pt Codes>** or **<Show Codes: All Codes>**.
  - **<Thematc Codes: With Codelist>** or **<Thematc Codes: Without Codelist>**.

- In **CONFIGURE Coding & Linework Settings**, **Linework** defines the flags for Linework.

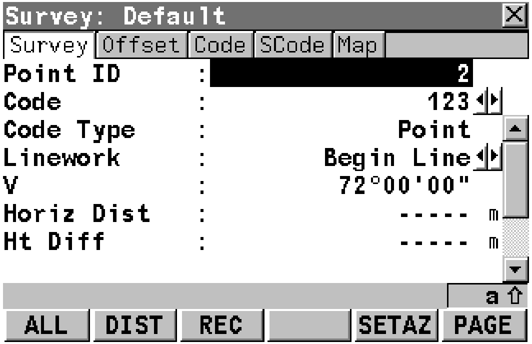
☞ The Survey application program is used here to explain the combination of Linework/Coding.

Access step-by-step

Step	Description
1.	Select **Main Menu: Survey** to access **SURVEY Survey Begin**.
2.	In **SURVEY Survey Begin** select a job.
3.	Select a configuration set.
4.	Select a reflector.
5.	**CONT (F1)** to access **SURVEY Survey: Job Name**.

Using Linework/Coding

This is what a display mask configured for Linework and coding looks like. The most important keys are explained. For the explanation of the other keys refer to "42.2 Surveying Points".



ALL (F1)
To measure and store distances and angles.

STOP (F1)
Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data. If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

Using Linework/Coding for point codes step-by-step

For <Show Codes: Only Pt Codes>

Step	Field	Description for thematical coding	
		With codelist	**Without codelist**
1.	**<Code:>**	Select a code from the choicelist. Only point codes are available for selection.	Type in a code.
		<None> to store a point without code or to perform Linework without coding.	**-----** to store a point without code or to perform Linework without coding.

Step	Field	Description for thematical coding	
		With codelist	Without codelist
2.	**<Code Type:>**	• **Point** is displayed. This field is an output field only.	
3.	**<Line-work:>**	• Select a Linework flag to be stored with the point. • Select **-----** to store a point without a Linework flag or to perform coding without Linework.	
4.	-	• **ALL (F1)**	
	- - -	• The point is stored with the selected code. • The point is stored with the selected Linework flag. • The choice of flags available for **<Linework:>** is updated.	

Using Line-work/Coding for all codes step-by-step

For <Show Codes: All Codes>

Step	Field	Description for thematical coding	
		With codelist	Without codelist
1.	**<Code:>**	Select a code from the choicelist. Point, line and area codes are available for selection. **<None>** to store a point without code or to perform Linework without coding.	Type in a code. **-----** to store a point without code or to perform Linework without coding.

Step	Field	Description for thematical coding	
		With codelist	Without codelist
2.	**<Code Type:>**	The type of the selected code. This field is an output field only.	Select the type of the entered code.
3.	**<Line-work:>**	• Select a Linework flag to be stored with the point. • Select **-----** to store a point without a Linework flag or to perform coding without Linework.	
4.	-	• **ALL (F1)**	
	- - -	• For a point code being selected: • The point is stored with the selected code. • The point is stored with the selected Linework flag. • The choice of flags available for **<Linework:>** is updated.	

11 Manage...\Configuration Sets

11.1 Overview

Description	The instrument has numerous user configurable parameters and functions. This allows a variety of preferences to be addressed. The configuration of the parameters and functions for an individual measuring technique are combined in a configuration set.
Default configuration sets	Default configuration sets exist on the instrument. They use standard settings for the majority of application programs. Default configuration sets can be edited and deleted. It is always possible to restore the default configuration sets.
User defined configuration sets	New configuration sets can be created. The configuration set wizard assists in editing configuration sets.
Edit outside the configuration set wizard	Parameters and functions can be edited without going through the configuration set wizard. Refer to "11.4 Editing a Configuration Set" for more information.
☞	Each application program can be configured separately. Application program settings are configured in the application program but are stored as part of the configuration set. Refer to "31 Application Programs - General".

11.2 Accessing Configuration Set Management

Access

Select **Main Menu: Manage...\Configuration Sets**.

OR

Press a hot key configured to access the screen **MANAGE Configuration Sets**. Refer to "2.1 Hot Keys" for information on hot keys.

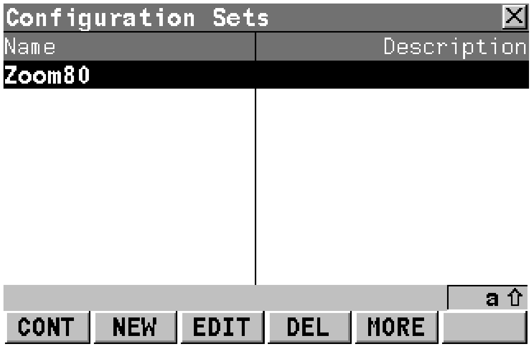
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens for example the begin screen of application programs.

MANAGE Configuration Sets



CONT (F1)
To select the highlighted configuration set and to return to **Zoom80 Main Menu**.

NEW (F2)
To create a new configuration set. Refer to "11.3 Creating a New Configuration Set".

EDIT (F3)
To edit a configuration set. Accesses the first screen of the sequential configuration set wizard for the highlighted configuration set. Default configuration sets can be edited. Refer to "11.4 Editing a Configuration Set".

DEL (F4)
To delete the highlighted configuration set.

MORE (F5)
To display information about the description, the creator and the creation date of the configuration set.

SHIFT SET-D (F4)
Available unless a default configuration set is highlighted. To turn the highlighted configuration sets into a user defined default configuration set stored in the instrument.

SHIFT DEFLT (F5)
To recall previously deleted default configuration sets and to reset default configuration sets to the default settings. User defined configuration sets are not affected.

Next step

IF a configuration set	THEN
is to be selected	select the desired configuration set. **CONT (F1)** to close the screen and to return to the screen from where **MANAGE Configuration Sets** was accessed.
is to be created	highlight any configuration set and **NEW (F2)**. Refer to "11.3 Creating a New Configuration Set".

IF a configuration set	THEN
is to be edited	highlight the configuration set and **EDIT (F3)**. Refer to "11.4 Editing a Configuration Set".

11.3 Creating a New Configuration Set

Access

Refer to "11.2 Accessing Configuration Set Management" to access **MANAGE Configuration Sets**.

Configuration step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Configuration Sets** highlight a configuration set. A copy of this configuration set is taken for further configurations. Example: Select **DEFAULT** for the creation of a new configuration set.	11.2
2.	**NEW (F2)** to access **MANAGE New Configuration Set**. A copy of the highlighted configuration set is created.	
3.	**MANAGE New Configuration Set** **<Name:>** A unique name for the new configuration set. **<Description:>** A detailed description of the configuration set, since the name of a configuration set is usually an abbreviation. Input optional. **<Creator:>** The person's name who creates the new configuration set. Input optional. Enter a name.	

Step	Description	Refer to chapter
4.	**STORE (F1)** stores the new configuration set with the entered name. Starts the sequential configuration set wizard.	
5.	**CONFIGURE Wizard Mode** **<Wizard Mode: Reduced>**	17.2
☞	**LIST (F6)** accesses **CONFIGURE Quick Access**. Lists all screens within the configuration set. Allows to access these individual screens and to change settings.	
6.	**CONT (F1)** to access **CONFIGURE Coding & Linework**.	
7.	**CONFIGURE Coding & Linework**	15.3
8.	**CONT (F1)** to access **CONFIGURE TPS Correction**.	
9.	**CONFIGURE TPS Corrections** Configure atmospheric ppm, geometric ppm and refraction.	16.4
10.	**CONT (F1)** to access **CONFIGURE EDM & Aim360 Settings**.	
11.	**CONFIGURE EDM & Aim360 Settings**	16.1
12.	**CONT (F1)** to access **CONFIGURE Offsets**.	
13.	**CONFIGURE Offsets**	15.4
14.	**CONT (F1)** to access **MANAGE Configuration Sets**.	
15.	**MANAGE Configuration Sets** The adapted configuration set is highlighted.	

Step	Description	Refer to chapter
16.	**CONT (F1)** closes the screen and returns to **Zoom80 Main Menu**. The highlighted configuration set is then the active configuration set.	

11.4 Editing a Configuration Set

Description

There are two possibilities to edit a configuration set.

Using the **configuration set wizard** to be lead through the steps.

OR

Outside of the **configuration set wizard**. Each screen can be accessed separately without being guided through the steps.

Access step-by-step with using configuration set wizard

Step	Description
1.	Refer to "11.2 Accessing Configuration Set Management" to access **MANAGE Configuration Sets**.
2.	In **MANAGE Configuration Sets** highlight a configuration set to be edited.
3.	**EDIT (F3)** to access **CONFIGURE Wizard Mode**. This starts the sequential configuration set wizard.
4.	All following steps are identical with the creation of a new configuration set. Refer to "11.3 Creating a New Configuration Set". Follow the instructions in paragraph "Configuration step-by-step" from step 5. onwards.

Access without using the configuration set wizard

The currently active configuration set can be edited. Choose one of the following options and access the required screens to edit the configuration set.

Select **Main Menu: Config...**. Refer to "5 Main Menu".

OR

From inside an application program press **USER** and then **CONF (F2)**.

OR

In **CONFIGURE Wizard Mode**, press **LIST (F6)**. Refer to "11.3 Creating a New Configuration Set".

12 Manage...\Reflectors

12.1 Overview

Description

- Each reflector type has an additive constant.
- Some reflectors are predefined as default and can be selected.
- Additional reflectors can be defined.

Default reflectors

Following default reflectors are always available on the instrument:

Product Name	Name in list	Type	Additive Constant
GRZ4	360° Prism	Prism	+23.1 mm
ZPR100	Circ Prism	Prism	0.0 mm
ZPM100	Mini Prism	Prism	+17.5 mm
ZTM100	ReflTape	Tape	+34.4 mm
ZTP100	Target plate	Plate	+34.4 mm
-	Reflectorless	RL	+34.4 mm

Active reflector

One reflector is always the active reflector.

12.2 Accessing Reflector Management

Access

Select **Main Menu: Manage...\Reflectors**.

OR

Press a hot key configured to access the screen **MANAGE Reflectors**. Refer to "2.1 Hot Keys" for information on hot keys.

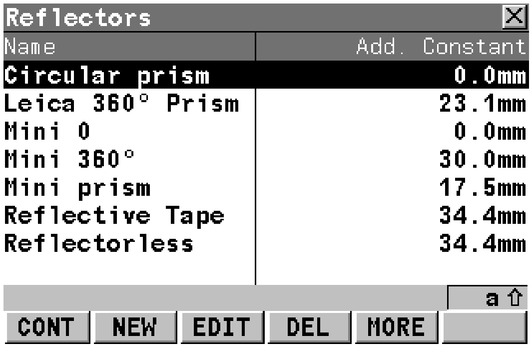
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

From a choicelist in some screens for example the **SURVEY Survey Begin** screen.

MANAGE Reflectors



CONT (F1)
To select the highlighted reflector and to return to the previous screen.

NEW (F2)
To define a new reflector. Refer to "12.3 Creating a New Reflector".

EDIT (F3)
To edit the highlighted reflector, except for default reflectors. Refer to "12.4 Editing a Reflector".

DEL (F4)
To delete the highlighted reflector, except for default reflectors.

MORE (F5)
To display information about the additive constant, the reflector type and the creator of the reflector.

Next step

IF a reflector	THEN
is to be selected	highlight the desired reflector. **CONT (F1)** closes the screen and returns to the screen from where **MANAGE Reflectors** was accessed.
is to be created	highlight any reflector and **NEW (F2)** creates a new reflector. Refer to "12.3 Creating a New Reflector".
is to be edited	highlight the desired reflector. **EDIT (F3)** Refer to "12.4 Editing a Reflector".

12.3 Creating a New Reflector

Access

Refer to "12.2 Accessing Reflector Management" to access **MANAGE Reflectors**.

Create new reflector step-by-step

Step	Description
1.	In **MANAGE Reflectors** press
2.	**NEW (F2)** The **<Type:>** of the new reflector is taken from the previously highlighted reflector except for RL reflectors.
3.	**MANAGE New Reflector** **<Name:>** A significant name for the new reflector. **<Type:>** The type of reflector to be defined can be **<Type: Prism>, <Type: Tape>** or **<Type: Undefined>**. **<Add. Constant:>** The additive constant is always in [mm]. An additive constant of 0.0 mm has been defined for the GeoMax standard reflector ZPR100. All entered or selected additive constant values are differences to this 0.0 mm based GeoMax TPS prism system. The additive constants of non GeoMax prisms are often given in the true zero prism system. Use the following formula to convert the additive constant to the GeoMax TPS prism system. This GeoMax constant needs to be entered into the GeoMax instrument.

Step	Description
	Formula: True zero constant - 34.4 mm = GeoMax constant. It is highly recommended to check the additive constant for non GeoMax prisms on a baseline by means of an appropriate procedure. **<Creator:>** A name of the creator or other comments can be entered.
4.	**STORE (F1)** stores the new reflector and returns to **MANAGE Reflectors**.

12.4 Editing a Reflector

Access

Refer to "12.2 Accessing Reflector Management" to access **MANAGE Reflectors**.

Edit reflector step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	In **MANAGE Reflectors** highlight a reflector to be edited.	
2.	**EDIT (F3)** to access **MANAGE Edit Reflector**.	
3.	**MANAGE Edit Reflector** The fields are identical with those for the creation of a new reflector. All fields can be edited except fields of GeoMax default reflectors. Make the required changes.	12.3
4.	**STORE (F1)** stores the changes and returns to **MANAGE Reflectors**.	

13 Convert...\Export Data from Job

13.1 Overview

Description

This screen lists all the exporters loaded.

Data can be exported

- to a file on the CompactFlash card.
- via RS232 to an external device. Refer to "19 Config...\Interfaces... - Editing The Interface" for information on how to configure the interface.

Export format

Format	Characteristic	Description
Custom ASCII	Export variables	Refer to the online help of GGO.
	Format definition	Composed individually as format file using GGO. Refer to the online help of GGO for information on creating format files.
	Units	Defined within the format file.
	Height	All height types are supported. If the desired height cannot be computed, the default value for the missing variable is output.
DXF	Export variables	All points are exported in local grid.

Format	Characteristic	Description
	Height	Orthometric height

13.2 Accessing the Data Export Functionality

Access

Select **Main Menu: Convert...\Export Data from Job**.

OR

Press a hot key configured to access the screen **EXPORT Export Data from Job**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

Next step

IF exporting to	THEN
custom ASCII format	Refer to "13.3 Exporting Data from a Job to a Custom ASCII Format".
another device	Refer to "13.4 Exporting Data from a Job to another Device".
DXF format	Refer to "13.5 Exporting Data in DXF Format".

13.3 Exporting Data from a Job to a Custom ASCII Format

Description

The settings on this screen define the data that is converted and exported and what format is used.

Data is exported from the selected job. Currently active view, filter and sort settings are applied. The points that are exported are those that are visible in **MANAGE Data**: **Job Name**.

Requirement

At least one format file was created using GGO and has been transferred to the System RAM.

Access

Refer to "13.2 Accessing the Data Export Functionality" to access **EXPORT Export ASCII from Job**.

Export data step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**EXPORT Export ASCII from Job** **<Export To: CF Card>** **<Directory:>** Available for **<Export To: CF Card>**. The data can be exported to the \Data, the \GSI or the root directory. **<Job:>** All jobs from **Main Menu: Manage...\Jobs** can be selected.	6

Step	Description	Refer to chapter
	<Format File:> The format files currently available in the System RAM. **<File Name:>** The name of the file to which the data should be exported. The name is automatically suggested based on the job name to be exported and an extension. The default extension to be used can be configured in the **EXPORT Define ASCII Export** screen using **CONF (F2)**. Select the job to be exported and enter an individual file name or accept the suggested name.	
2.	Highlight **<Format File:>** and **ENTER**.	
3.	**EXPORT Format Files** All format files available in the System RAM are listed. Select the format file to be used.	
☞	**DEL (F4)** deletes the highlighted format file from the System RAM.	
4.	**CONT (F1)** selects the highlighted format file and leads back to **EXPORT Export ASCII from Job**.	
5.	**FILT (F4)** to set the sort and filter settings for export. Accesses **EXPORT Sorts & Filters**.	
6.	**EXPORT Sorts & Filters, Points** page **<Sort:>** The order in which points, lines and areas are exported.	7.6

Step	Description	Refer to chapter
	<Filter:> Defines which points are exported.	
7.	**CONT (F1)** accepts the changes and returns to **EXPORT Export ASCII from Job**.	
8.	**CONT (F1)** exports the data.	
9.	Information message: Are more data to be exported? • If **yes**, continue with step 10. • If **no**, continue with step 11.	
10.	**YES (F4)**. Repeat steps 1. to 9.	
11.	**NO (F6)** returns to the **Zoom80 Main Menu**.	

13.4 Exporting Data from a Job to another Device

General

Data can be transferred to an external device via RS232.

Access

Refer to "13.2 Accessing the Data Export Functionality" to access **EXPORT Export ASCII from Job**.

Export data step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**EXPORT Export ASCII from Job** **<Export To: RS232>**	13.1
☞	**IFACE (F5)** accesses **CONFIGURE Export Job Interface.** Choose the port and device to which the data should be exported.	
2.	**FILT (F4)** to set the sort and filter settings for the export. Accesses **EXPORT Sorts & Filters**.	
3.	**EXPORT Sorts & Filters, Points** page **<Sort:>** The order in which points, lines and areas are exported. **<Filter:>** Defines which points are exported.	7.6
4.	**CONT (F1)** accepts the changes and returns to **EXPORT Export ASCII from Job**.	
5.	**CONT (F1)** exports the data.	

Step	Description	Refer to chapter
6.	Information message: Are more data to be exported? • If **yes**, continue with step 7. • If **no**, continue with step 8.	
7.	**YES (F4)**. Repeat the steps 1. to 6.	
8.	**NO (F6)** returns to the **Zoom80 Main Menu**.	

13.5 Exporting Data in DXF Format

General

Data can be exported to a DXF file in the \DATA directory of the CompactFlash card.

Access

Refer to "13.2 Accessing the Data Export Functionality" to access **EXPORT Export DXF from Job**.

Export data step-by-step

Step	Description
1.	**EXPORT Export DXF from Job** **<Job:>** All jobs from **Main Menu: Manage...\Jobs** can be selected. **<File name:>** The name of the file to which the data should be exported. The name is automatically suggested based on the job name to be exported and the extension dxf. Select the job to be exported and enter an individual file name or accept the suggested name.
	CONF (F2) accesses **EXPORT Configuration**, **Export** page. **<Points:>** Defines if points are exported. **<Lines:>** Defines if lines are exported. **<Areas:>** Defines if areas are exported. **<Filter:>** Defines which points are exported. **PAGE (F6)** changes to the **DXF** page. **<Lines & Areas:>** Defines if lines and areas are exported as Line or Polyline entities.

Step	Description
	<Dimensions:> Defines the dimension of the DXF file. **<DXF Layer:>** Defines the DXF Layer as **<Default>**, **<Code Group>**, **<Code>**, **<Code+Attri>** or **<Code+Descr+Attri>**.
☞	**PAGE (F6)** changes to the **Labels** page. The settings on this page define which labels with information (Point ID, Coords, Height and Pt Code) for each point are exported. Each label can be exported as separate layer or in the same layer as the point is exported. For each label the color can be defined and for user defined labels the DXF layer name can also be defined. Additionally the decimals can be defined for the Coords and Height label.
2.	**CONT (F1)** accepts the changes and returns to **EXPORT Export DXF from Job**.
3.	**CONT (F1)** exports the data.
☞	Message: **Do not remove CF Card!**
4.	Information message: Are more data to be exported? If **yes**, continue with step 5. If **no**, continue with step 6.
5.	**YES (F6)**. Repeat steps 1. to 4.
6.	**NO (F4)** returns to the **Zoom80 Main Menu**.

14 Convert...\Import Data to Job

14.1 Overview

Description

This screen lists all the importers loaded. The data to import are stored on the CompactFlash card.

Data can be imported to a job on the CompactFlash card.

Import formats

Format	Characteristic	Description
ASCII	Import variables	Point ID, grid coordinates, thematical codes. No free codes, no attributes.
	Format definition	Free format. Use and order of variables and delimiter can be defined during import.
	Units	As currently configured on the instrument.
	Height	Orthometric
	Specialities	
	Local heights but no coordinates in file	Points are imported without coordinates but with local height and code if available.
	Coordinates but no heights in file	Points are imported without height but with coordinates and code if available.

Format	Characteristic	Description
	Neither coordinates nor heights in file	No import.
	No point ID's in file	No import.
GSI8 **GSI16**	Import variables	Point ID WI 11, local coordinates WI 81, WI 82, WI 83, thematical codes WI 71. No free codes, no attributes. Refer to "19.1 GSI Output" for information on GSI Format.
	Format definition	Fixed format. Easting and Northing can be switched during import.
	Units	As defined in the GSI file.
	Heights	Orthometric
	Specialities	
	Local heights but no coordinates in file	Points are imported without coordinates but with local height and code if available.
	Coordinates but no heights in file	Points are imported without height but with coordinates and code if available.
	Neither coordinates nor heights in file	No import.
	No point ID's in file	No import.

Format	Characteristic	Description
DXF	Import variables	Block, point, line, arc, polyline. Local coordinates. No free codes, no attributes.
	Format definition	Fixed format (X/Y/Z).
	Units	Not predefined.
	Heights	Z value imported as orthometric.
	Specialities	
	Neither coordinates nor heights in file	No import

Checks

Points are always imported with the class **CTRL** and a coordinate quality of **-----**.
Refer to "7.3.1 Terminology".

While importing points to a job, checks are performed against point ID, class and coding of points already existing in the job.

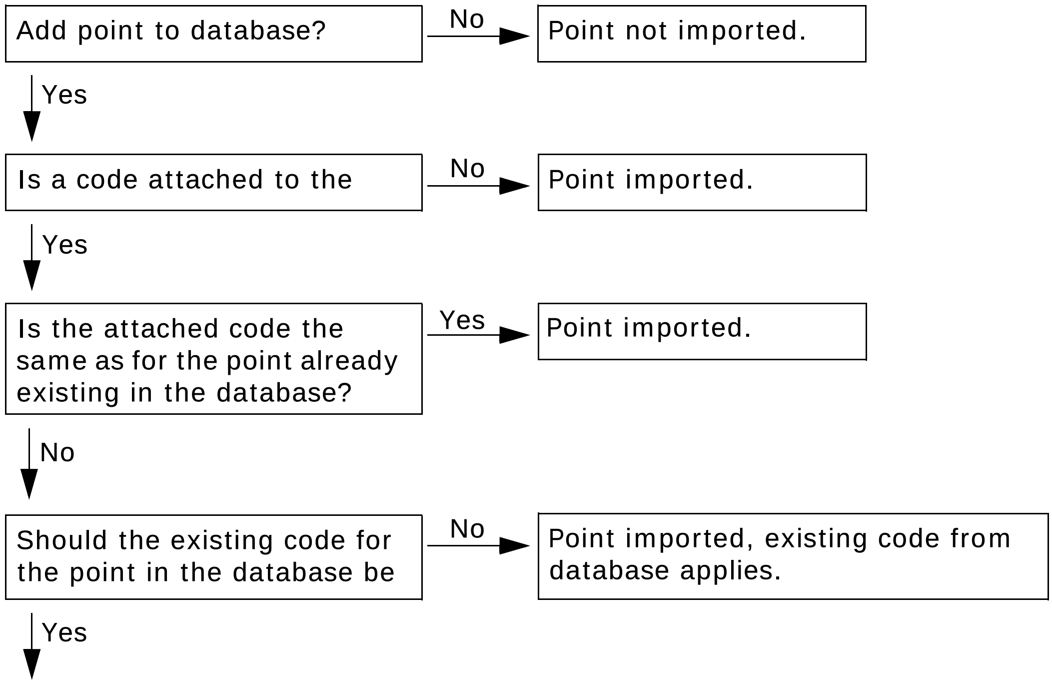
Case 1: Point already exists in database with class CTRL

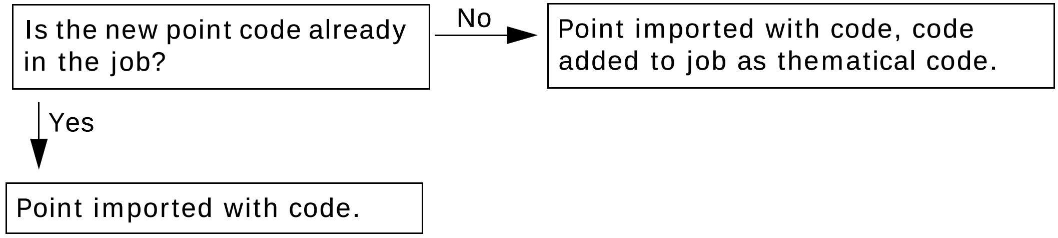
Overwrite existing $\xrightarrow{\text{No}}$ Point not imported.

↓ Yes

Point imported; coordinates and code information over-

Case 2: Point already exists in database with a class other than CTRL




Is the new point code already in the job?
No
Point imported with code, code added to job as thematical code.
Yes
Point imported with code.

14.2 Accessing the Data Import Functionality

Access

Select **Main Menu: Convert...\Import Data to Job**.

OR

Press a hot key configured to access the screen **IMPORT Import Data to Job**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

Next step

IF importing data in	THEN
ASCII format	Refer to "14.3 Importing Data in ASCII Format".
GSI format	Refer to "14.4 Importing Data in GSI Format".
DXF format	Refer to "14.5 Importing Data in DXF Format".

14.3 Importing Data in ASCII Format

Requirements

At least one ASCII file with any file extension is stored in the \DATA directory of the CompactFlash card.

Access

Refer to "14.2 Accessing the Data Import Functionality" to access **IMPORT Import ASCII/GSI Data to Job**.

Import data step-by-step

Step	Description
1.	**IMPORT Import ASCII/GSI Data to Job** **<Import: ASCII Data>** **<From File**:> All files in the \DATA directory on the CompactFlash card can be selected. **<To Job:>** Choosing a job as destination for import makes this job the active job. All jobs from **Main Menu: Manage...\Jobs** can be selected. **<Header:>** This option allows up to ten header lines which may exist in an ASCII file to be skipped. Select the number of header lines.
2.	**CONF (F2)** defines the format of the data to be imported.
3.	**IMPORT Define ASCII Import** **<Delimiter:>** The separator between the import variables. **<Multi Spaces:>** Available for **<Delimiter: Space>**. **<Multi Spaces: No>** for space delimited data having one space between the variables. **<Multi Spaces: Yes>** for space delimited data having multi spaces between the variables.

Step	Description
	<No. Lines/Pt:> Available for **<Delimiter: Line Feed>**. The number of lines used to describe each point. Select the delimiter and the positions of the particular variables.
	DEFLT (F5) recalls the default ASCII import settings.
4.	**CONT (F1)** leads back to **IMPORT Import ASCII/GSI Data to Job**
5.	**CONT (F1)** imports the data.
	Points with a height > 20000 m are not imported.
6.	Information message: Are more data to be imported? • If **yes**, continue with step 7. • If **no**, continue with step 8.
7.	**YES (F6)**. Repeat steps 1. to 6.
8.	**NO (F4)** returns to the **Zoom80 Main Menu**.

14.4 Importing Data in GSI Format

Requirements

At least one ASCII file in GSI format with the file extension *.gsi is stored in the GSI directory of the CompactFlash card.

Access

Refer to "14.2 Accessing the Data Import Functionality" to access **IMPORT Import ASCII/GSI Data to Job**.

Import data step-by-step

Step	Description
1.	**IMPORT Import ASCII/GSI Data to Job** **<Import: GSI Data>** **<From File:>** All files with extension *.gsi in the \GSI directory on the CompactFlash card can be selected. **<To Job:>** Choosing a job as destination for import makes this job the active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
☞	**CONF (F2)** accesses **IMPORT Define GSI Import**. For **<Switch WI81/WI82: Yes>** all WI 81 data, normally Easting, is imported as Northing and all WI 82 data, normally Northing, is imported as Easting. This coordinate switch is necessary for “left handed” coordinate systems.
2.	**CONT (F1)** imports the data.
☞	Points with a height > 20000 m are not imported.
3.	Information message: Are more data to be imported? • If **yes**, continue with step 4.

Step	Description
	• If **no**, continue with step 5.
4.	**YES (F6)**. Repeat steps 1. to 3.
5.	**NO (F4)** returns to the **Zoom80 Main Menu**.

14.5 Importing Data in DXF Format

Requirements

At least one file in DXF format with the file extension *.dxf has to be stored in the \DATA directory of the CompactFlash card.

Access

Refer to "14.2 Accessing the Data Import Functionality" to access **IMPORT Import DXF Data to Job**.

Import data step-by-step

Step	Description
1.	**IMPORT Import DXF Data to Job** **<From File:>** All files with extension *.dxf in the \DATA directory on the CompactFlash card can be selected. **<To Job:>** Choosing a job as destination for import makes this job the active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
☞	**CONF (F2)** accesses **IMPORT Configuration**. **<Block Prefix:>** Optional prefix to imported blocks. **<Point Prefix:>** Optional prefix to imported points. **<Line Prefix:>** Optional prefix to imported lines. **<File Units:>** Choosing the unit for the DXF data to be imported. **<Create Vertex Points:>** Option if points will be created at vertices of the imported line/arc/polyline elements. **<Convrt White Elements:>** Option if white colored elements will be converted to black colored elements.

Step	Description
	<Exclude Height:> Height value inside the DXF file are considered invalid and will not be converted.
2.	**CONT (F1)** leads back to **IMPORT Import DXF Data to Job**
3.	**CONT (F1)** imports the data.
☞	Message: **Do not remove CF Card!**
4.	Information message: Are more data to be imported? If **yes**, continue with step 5. If **no**, continue with step 6.
5.	**YES (F6)**. Repeat steps 1. to 4.
6.	**NO (F4)** returns to the **Zoom80 Main Menu**.

15 Config...\Survey Settings...

15.1 ID Templates

15.1.1 Overview of Templates

Description

- ID templates are predefined templates for point, line or area numbers. ID templates save having to type in the ID for each object. They are useful when many points are collected.
- ID templates that are selected to be used suggest ID's for **Point ID**, **Line ID** and **Area ID** whenever points, lines and areas are to be surveyed.

Description of the default ID templates

Default ID Template	Description
0001	• Suggested as ID for measured points in default configuration sets. • This ID is automatically incremented.
Area0001	• Suggested as ID for areas in default configuration sets. • This ID is automatically incremented.
Auto0001	• Suggested as ID for auto points in default configuration sets. These points are automatically recorded at a specific rate. • This ID is automatically incremented.

Default ID Template	Description
Aux0001	• Suggested as ID for auxiliary points in default configuration sets. These points are used when measuring a hidden point. • This ID is automatically incremented.
Line0001	• Suggested as ID for lines in default configuration sets. • This ID is automatically incremented.
No Template Used	• The last point ID during a survey will be displayed. This ID is automatically incremented if it contains numerical characters. If this ID is overwritten, the auto increment starts from the new ID. The automatic incrementation can be turned off when editing this ID template. Refer to "15.1.4 Editing an ID Template".
Time & Date	• The current local time and date is the ID.

Use Code&String	• Allows the line/area ID assigned to a line/area object to be based on the code related to the line/area.
	  • If line/area codes are being used then the line/area code is used as part of the line/area ID.
	  • If point codes are being used then the point code is used as part of the line/area ID.
	  • If attributes/strings are not being used then the numerical part of the line/area ID is automatically incremented.

Availability of the default ID templates

Default ID Template	Availability:			
	Survey Points	Auto Points	Lines	Areas
0001	✓	✓	✓	✓
Area0001	✓	✓	✓	✓
Auto0001	✓	✓	✓	✓
Aux0001	✓	✓	✓	✓
Line0001	✓	✓	✓	✓
No Template Used	✓		✓	✓
Time & Date	✓	✓	✓	✓
Use Code&String			✓	✓

Selecting the default ID templates

- A default ID template can be selected:
  - manually, by selecting it in the ID Template Library under **Config \Survey Settings \ID Templates**. The ID template becomes active as soon as it is highlighted on the screen and when **CONT (F1)** is pressed. The currently active configuration set is automatically updated, to include the selected ID template. To ensure that all default ID templates appear in the ID Template Library, press **SHIFT DEFLT (F5)**.
  - indirectly, by selecting a configuration set which includes the ID template.

15.1.2 Accessing ID Template Configuration

Access

Select **Main Menu: Config...\Survey Settings...\ID Templates**.

OR

Press a hot key configured to access the screen **CONFIGURE ID Templates**. Refer to "2.1 Hot Keys" for information on hot keys.

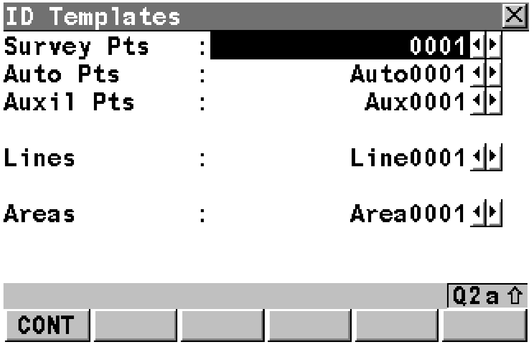
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE ID Templates



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Survey Pts:>	Choicelist	Sets the ID templates for measured points.
<Auto Pts:>	Choicelist	Sets the ID templates for auto points. These points are automatically recorded at a specific rate.
<Auxil Pts:>	Choicelist	Sets the ID templates for auxiliary points. These points are used when trying to find a stake-out point.
<Lines:>	Choicelist	Sets the ID templates for lines.
<Areas:>	Choicelist	Sets the ID templates for areas.

Next step

IF an ID template	THEN
is to be selected	select the desired ID template. **CONT (F1)** to close the screen and to return to the screen from where **CONFIGURE ID Templates** was accessed.
is to be created	Refer to "15.1.3 Creating a New ID Template".
is to be edited	Refer to "15.1.4 Editing an ID Template".
is to be deleted	Refer to "15.1.5 Deleting an ID Template".

15.1.3 Creating a New ID Template

Create ID template step-by-step

Step	Description
1.	Refer to "15.1.2 Accessing ID Template Configuration" to access **CONFIGURE ID Templates**.
2.	In **CONFIGURE ID Templates** highlight any field.
3.	**ENTER** to access **CONFIGURE ID Template Library**.
4.	Highlight an ID template. A copy of this ID template is taken for further configurations.
5.	**NEW (F2)** to access **CONFIGURE New ID Template**.
6.	**CONFIGURE New ID Template** **<ID:>** The name of the ID template and the format of the ID object. Any characters including spaces are allowed. Leading spaces are not accepted. **<Increment:>** ID's are incremented numerical or alphanumerical. **<Increment By:>** The amount by which the point ID is incremented. **<Cursor Posn:>** The character position at which the cursor is placed when **ENTER** is pressed in **<Point ID:>** when surveying points. **<Cursor Posn: Last Character>** means that the cursor is placed immediately to the right of the last character. Adapt the settings according to the requirements.
7.	**CONT (F1)** stores the new ID template into the ID template library and returns to **CONFIGURE ID Template Library**.

Step	Description
8.	**CONT (F1)** returns to **CONFIGURE ID Templates**.
9.	**CONT (F1)** returns to the screen from where **CONFIGURE ID Templates** was accessed.

Examples for incrementation

For <Increment: Numeric only>

The rightmost numeric part is incremented within the point ID.

<ID:>	<Increment By:>	Next point ID	Notes
Point994	5	Point999 Point1004 ...	-
994point	5	999point 1004point ...	-
123point123	-10	123point113	Right hand side numbers are incremented. Negative increments allowed.
Point11	-6	Point5 Point-1 Point-7 Point-13 ...	-

<ID:>	<Increment By:>	Next point ID	Notes
Abcdefghijklmn94	5	Abcdefghijklmno99 Point ID increment fail	Incrementation fails if next increment will result in more than 16 characters.
Abcdefghijklmno9	-5	Abcdefghijklmnop4 Point ID increment fail	Negative incrementing fails if next increment requires negative sign and will result in more than 16 characters.

For <Increment: Alphanumeric>

The rightmost character within the point ID is incremented regardless of whether that character is numeric or alphanumeric.

Template	Increment value	Next point ID's	Notes
Point994	5	Point999 Point99E Point99J ...	-
994point	5	994poiny Point ID increment fail	Lower case alpha characters increment until z is reached. Then a new point ID must be entered.

Template	Increment value	Next point ID's	Notes
Abcdef	-5	Abcdea AbcdeV ... AbcdeB Point ID increment fail	Lower case alpha characters decrement from lower to upper case until A is reached. Then a new point ID must be entered.
ABCDEB	5	ABCDEB ABCDEG ... Abcdez Point ID increment fail	Upper case alpha characters increment from upper to lower case until z is reached. Then a new point ID must be entered.

15.1.4 Editing an ID Template

Edit ID template step-by-step

Step	Description
1.	Refer to "15.1.2 Accessing ID Template Configuration" to access **CONFIGURE ID Templates**.
2.	In **CONFIGURE ID Templates** highlight any field.
3.	**ENTER** to access **CONFIGURE ID Template Library**.
4.	**CONFIGURE ID Template Library** Highlight the ID template to be edited. The ID template **Time & Date** cannot be edited. **EDIT (F3)**.
5.	**CONFIGURE Edit ID Template** The type of ID template selected for editing determines the availability of the fields on this screen. • Available for the default ID template **No Template Used**: **<ID:>** The name of the ID template cannot be changed since it is a default ID template. The other fields on this screen are the same as in **CONFIGURE New ID Template**. Refer to "15.1.3 Creating a New ID Template". • Available for a user defined ID template: All fields on this screen are the same as in **CONFIGURE New ID Template**. Refer to "15.1.3 Creating a New ID Template". Adapt the settings according to the requirements.

Step	Description
6.	**CONT (F1)** stores the changes and returns to **CONFIGURE ID Template Library**.
7.	**CONT (F1)** returns to **CONFIGURE ID Templates**.
8.	**CONT (F1)** returns to the screen from where **CONFIGURE ID Templates** was accessed.

15.1.5 Deleting an ID Template

Delete ID template step-by-step

Step	Description
1.	Refer to "15.1.2 Accessing ID Template Configuration" to access **CONFIGURE ID Templates**.
2.	In **CONFIGURE ID Templates** highlight any field.
3.	**ENTER** to access **CONFIGURE ID Template Library**.
4.	**CONFIGURE ID Template Library** Highlight the ID template to be deleted. **DEL (F4)**.
☞	It does not matter if the ID template is being used in a configuration set. The ID template will be rebuilt when that configuration set becomes active.
5.	**YES (F4)** returns to the **CONFIGURE ID Template Library**.
6.	**CONT (F1)** returns to **CONFIGURE ID Templates**.
7.	**CONT (F1)** returns to the screen from where **CONFIGURE ID Templates** was accessed.

15.1.6 Working Example

Description

Application:
- Pick up points with many different point ID’s.
- Most point ID’s require an incrementing number behind a text.

Working technique: Application program Survey.

Goal:
- The first point ID’s for survey points are Bolt 001, Bolt 002, ...
- A different point ID can be entered during the survey.
- The following point ID’s will be based on the entered point ID.
- An individual point ID can be typed in for one point.

Requirement

Application program Survey is selected. Refer to "42 Survey - General" for more information on Survey.

Configuration of ID template step-by-step

Step	Description
1.	Refer to "15.1.3 Creating a New ID Template". Follow step 1. to 4.
2.	**CONFIGURE New ID Template** **<ID: Bolt 001>** **<Increment: Numeric only>** **<Increment By: 1>** **<Cursor Posn: 1>**

Step	Description
3.	**CONT (F1)** closes the screen and returns to **CONFIGURE ID Template Library**.
4.	**CONT (F1)** returns to **CONFIGURE ID Templates**.
5.	**CONFIGURE ID Templates** **<Survey Pts: Bolt 001>**
6.	**CONT (F1)** returns to the screen from where **CONFIGURE ID Templates** was accessed.

Field procedure step-by-step

Step	Description
1.	Refer to "42.2 Surveying Points" to access **SURVEY Survey: Job Name**.
2.	**SURVEY Survey: Job Name** **<Point ID: Bolt 001>** is shown automatically.
3.	**ALL (F1)**. **<Point ID: Bolt 002>** is shown automatically.
4.	Repeat step 3. until all points with the ID Bolt XXX are surveyed.
5.	**SURVEY Survey: Job Name** The next point ID's are RoadXXXX, starting with Road0723. Type Road0723 **<Point ID: Road0723>**.
6.	**ALL (F1) <Point ID: Road0724>** is shown automatically.
7.	Repeat step 6. until all points with the ID RoadXXXX are surveyed.
8.	**SURVEY Survey: Job Name**

Step	Description
	The next required point ID is BM98. It is valid for one point. **SHIFT INDIV (F5)**
9.	**SURVEY Survey: Job Name** Type BM98 **<Indiv Pt ID: BM98>**.
10.	**ALL (F1)**. The system changes back to the point ID's RoadXXXX.

15.2 Display Settings

Description

Display settings define the parameters shown on a page on the **SURVEY** screen.

Four display masks are definable.

Mask 1:	Always shown on the **SURVEY** screen.
Mask 2:	Can be shown or hidden on the **SURVEY** screen.
Mask 3:	Can be shown or hidden on the **SURVEY** screen.
Mask 4:	Never shown on the **SURVEY** screen. Reserved for application programs.

The settings on this screen define the layout of the four display masks.

Access

Select **Main Menu: Config...\Survey Settings...\Display Settings.**

OR

Press a hot key configured to access the screen **CONFIGURE Display Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

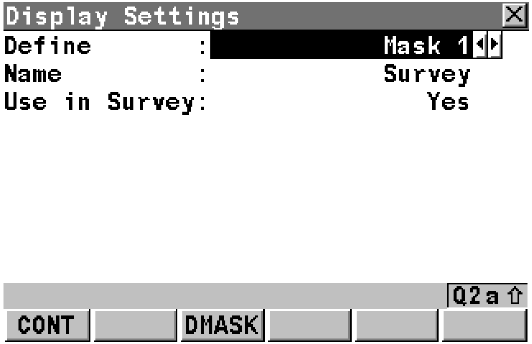
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Display Settings



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
To configure the selected display mask. Refer to paragraph "CONFIGURE Define Display Mask n".

Description of fields

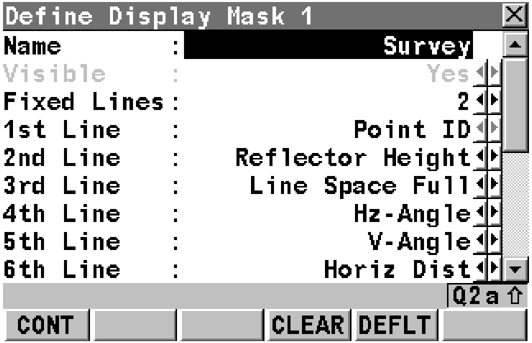
Field	Option	Description
<Define:>	**Mask 1, 2, 3** or **4**	Selected display mask.
<Use in Survey:>	Output	Indicates if the display mask is shown or hidden as a page in **SURVEY**.

Next step

IF a display mask	THEN
is not to be edited	**CONT (F1)** closes the screen and returns to the screen from where **CONFIGURE Display Settings** was accessed.

IF a display mask	THEN
is to be edited	highlight the display mask and **DMASK (F3)**. Refer to paragraph "CONFIGURE Define Display Mask n".

CONFIGURE Define Display Mask n



CONT (F1)
To accept changes and to return to **CONFIGURE Display Settings**.

CLEAR (F4)
To set all fields to **<XX. Line: Line Space Full>**.

DEFLT (F5)
To recall the default settings.

Description of fields

Field	Option	Description
<Visible:>	**Yes** or **No**	Shows or hides the display mask as a page in **SURVEY**.
<Fixed Lines:>	From **0** to **5**	Defines how many lines do not scroll in the survey screen when that display mask is used.
<1st Line:>	Output	Fixed to **<1st Line: Point ID>**.

Field	Option	Description
<2nd Line:> to **<16th Line:>**		For each line one of the following options can be selected.
	Add. Constant	Output field for additive constant of currently selected reflector.
	Angle Right	Displays the horizontal angle difference between the backsight point and the current telescope position.
	Annotation 1-4	Input field for comments to be stored with the point.
	Attrib (free) 01-20	Output field for attributes for free codes.
	Attrib 01-20	Input field for attributes for point codes.
	Automation	Select automation type.
	Avg Max #Dist	Input field for maximum number of distance measurements in the averaging EDM mode.
	Azimuth	Output field for the azimuth.
	Backsight Pt ID	Output field for point ID of backsight point if Quickset method was used in Setup application program.
	Code	Output field for free codes.
	Code (free)	Input field for free codes.

Field	Option	Description
	Code Desc	Output field for the description of codes.
	Code Desc (free)	Output field for the description of free codes.
	Code Type	Output field for the type of code, for example point code, line code or area code.
	EDM Mode	Select EDM measurement mode.
	EDM Type	Select EDM type.
	Easting	Output field for Easting coordinate of measured point.
	Height	Output field for the height coordinate of the measured point.
	Height Diff	Output field for the height difference between station and reflector.
	Horiz Dist	Output field for horizontal distance.
	Hz-Angle	Output field for the horizontal angle.
	Instrument Ht	Output field for the instrument height.
	Line Space Full	Insert full line space.
	Line Space Half	Insert half line space.
	Linework	Choicelist with option for flagging a line/area. Refer to "15.3 Coding & Linework Settings".

Field	Option	Description
	Longitudinal Tilt	Output field for the longitudinal tilt of the vertical axis.
	No. of Dists	Output field for number of averaged distances measured with EDM mode averaging.
	Northing	Output field for Northing coordinate of measured point.
	Offset Cross	Input field for horizontal distance offset for measured point, perpendicular to the line of sight.
	Offset Height	Input field for height offset for measured point.
	Offset Length	Input field for horizontal distance offset, in the direction of line of sight.
	Offset Mode	Select offset mode.
	PPM Atmos	Output field for atmospheric ppm value.
	PPM Geom	Output field for geometric ppm value.
	PPM Total	Output field for the total ppm value.
	Point ID	Input field for the point number.
	Reflector	Select a reflector.
	Reflector Height	Input field for reflector height.

Field	Option	Description
	SD-Last Rec	Output field for the last recorded distance.
	Slope Dist	Output field for measured slope distance.
	Station East	Output field for current station Easting coordinates.
	Station Height	Output field for current station height coordinates.
	Station ID	Output field for current station ID.
	Station North	Output field for current station Northing coordinates.
	Std Dev	Output field of standard deviation in millimeters of averaged distances.
	Transversal Tilt	Output field for the transversal tilt of the vertical axis.
	V-Angle	Output field for vertical angle.
	V-Display	Select vertical angle display.

Next step

Step	Description
1.	**CONT (F1)** returns to **CONFIGURE Display Settings**.
2.	**CONT (F1)** returns to the screen from where **CONFIGURE Display Settings** was accessed.

15.3 Coding & Linework Settings

Description

The settings on this screen define the method of coding, for both points and lines. Refer to "9 Coding" for a complete description of coding.

Access

Select **Main Menu: Config...\Survey Settings...\Coding & Linework Settings**.

OR

Press a hot key configured to access the screen **CONFIGURE Coding & Linework**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

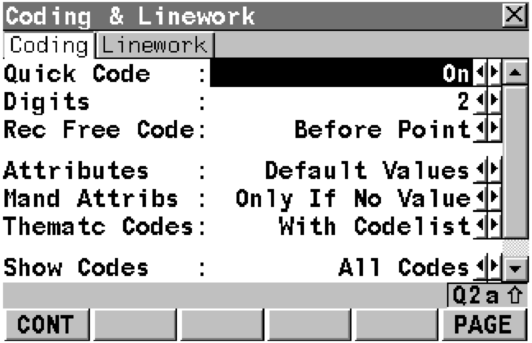
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Coding & Linework,
Coding page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Quick Code:>	**Never**	Prevents the use of quick coding completely.
	On	Allows the use of quick coding and activates it.
	Off	Allows the use of quick coding, but keeps it deactivated.
<Digits:>	**1, 2** or **3**	Available unless **<Quick Code: Never>**. Sets the mostly used number of digits for the quick code. Quick codes with less digits can still be used. While typing a quick code during a survey, using **ENTER** after typing one or two digits of the quick code indicates the end of the input.

Field	Option	Description
<Rec Free Code:>	**After Point** or **Before Point**	Determines if a free code measured with a quick code is stored before or after the point. This field is disabled when **<Quick Code: Never>**.
<Attributes:>		Determines the attribute values displayed under certain circumstances. This is applicable to both the storing and displaying of attribute values.
	Default Values	When available, the default attribute values, as stored in the job, are displayed and stored.
	Last Used	When available, the last used attribute values as stored in the job are displayed and stored.
<Mand Attribs:>	**Always Prompt**	The screen **XX Enter Mandatory Attribute** will always appear when codes, having one or more attributes of attribute type mandatory, are being stored. Attributes of attribute type mandatory or fixed can only be created in GGO.
	Only If No Value	The screen **XX Enter Mandatory Attribute** will only appear when codes, having one or more attributes of attribute type mandatory, are being stored without an attribute value. Attributes of attribute type mandatory can only be created in GGO.

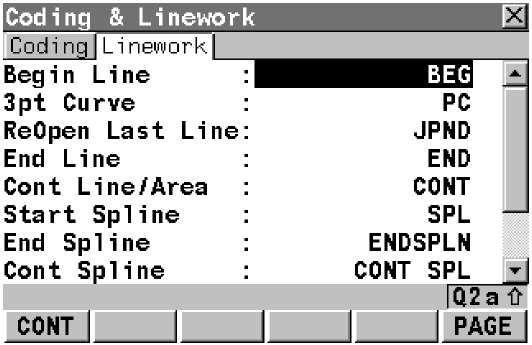
Field	Option	Description
	Code Change Only	The screen **XX Enter Mandatory Attribute** will only appear when a new code with a mandatory attribute was selected.
<Thematc Codes:>		Sets the coding method.
	With Codelist	Codes stored within the job codelist can be selected to code points, lines and areas.
	Without Codelist	Codes stored within the job codelist cannot be selected to code points, lines and areas. Each code must be entered.
<Show Codes:>	**Only Pt Codes**	Only point codes will be available in the choicelist for **<Code:>**/**<Point Code:>** in a display mask of an application program.
	All Codes	All codes of the job codelist will be available in the choicelist for **<Code:>**/**<Point Code:>** in a display mask of an application program. Selecting a line/area code opens a new line/area.
<String Attrib:>	Choicelist	Available for **<Show Codes: All Codes>**. When this field is active, surveyed points that have the same code attached are strung to one line.

Next step
PAGE (F1) changes to the **Linework** page.

CONFIGURE Coding & Linework, Linework page

The flags for Linework are defined on this screen. A flag
- is stored as a property of a point.
- can be exported with a format file.
- is different to a code.

The flags defined on this screen are linked to the options available for **<Linework:>** in a display mask of an application program. The selection for **<Linework:>** in a display mask determines the flag stored with a point. The availability of **<Linework:>** in a display mask is configured in **CONFIGURE Define Display Mask n**. Refer to "10 Linework" for information on Linework.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Begin Line:>	User input	Opens a new line when the next point is stored. Any lines which are currently open are closed. The point may or may not be stored with a point code.
<3pt Curve:>	User input	Stores the linework flag for a curve through the next three measured points and continues a line/area.
<ReOpen Last Line:>	User input	Opens the last used line again.
<End Line:>	User input	Closes all open lines.
<Cont Line/Area:>	User input	Indicates a line/area is open.
<Start Spline:>	User input	Stores the linework flag for beginning a spline and continues any open line/area.
<End Spline:>	User input	Stores the linework flag to stop a spline.
<Cont Spline:>	User input	Indicates a line/area is open with spline line type.
<Begin Area:>	User input	Opens a new area when the next point is stored. Any areas which are currently open are closed. The point may or may not be stored with a point code.

Field	Option	Description
<ReOpen Last Area:>	User input	Opens the last used area again.
<Close Area:>	User input	Closes all open areas.

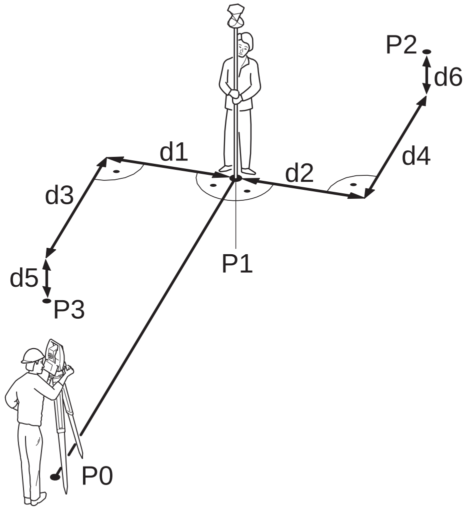
Next step

PAGE (F6) changes to the first page on this screen.

15.4 Offsets

Description

Offsets can be configured and entered. The offset values are applied to measured points. The Offset function allows offset points to be determined, for instance when the reflector cannot be set up directly on a point. Transverse, longitudinal and/or elevation offsets can be defined from the reflector position to the offset point. All of the displayed and recorded measurement data is in relation to the offset point. The values for target eccentricity is retained after storage with **<Offset Mode: Permanent>**. The values are set to zero with **<Offset Mode: Reset after REC>**.



P0	Station
P1	Current position
P2	Offset point
P3	Offset point
d1	Offset cross -
d2	Offset cross +
d3	Offset length -
d4	Offset length +
d5	Offset height -
d6	Offset height +

If configured in a display mask, the offset values appear also in the display mask in Survey.

Access

Select **Main Menu: Config...\Survey Settings...\Offsets**.

OR

Press a hot key configured to access the screen **CONFIGURE Offsets**. Refer to "2.1 Hot Keys" for information on hot keys.

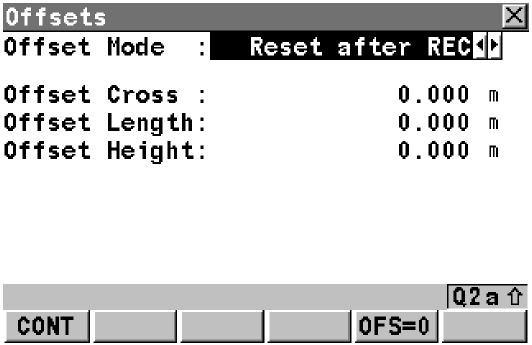
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Offsets



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

OFS=0 (F5)

To set all offsets to 0.000.

Description of fields

Field	Option	Description
<Offset Mode:>	**Reset after REC**	The offset values are reset to 0.000 after a point is measured with **REC (F3)** or **ALL (F1)**.
	Permanent	The offset values are applied to every measured point until reset or changed.
<Offset Cross:>	User input	Sets cross offset of target point, perpendicular to the line of sight.
<Offset Length:>	User input	Sets length offset of target point, in the direction of the line of sight.
<Offset Height:>	User input	Sets height offset of target point.

Next step

CONT (F1) returns to the screen from where **CONFIGURE Offsets** was accessed.

15.5 Target Check

Description

- It is possible to configure the instrument to monitor sequentially stored measurements and to notify the user if the coordinates lie within a defined range from each other.
- If configured, when a point is being stored the X,Y coordinates of the point being stored are compared to those of the last previously stored point. If the difference is less than the defined position tolerance then a warning is shown. It can now be decided whether to store the point or not.
- If configured, then backsight target points and resection target points which were measured during the setup procedure are also checked in this manner.

Access

Select **Main Menu: Config...\Survey Settings...\Target Check**.

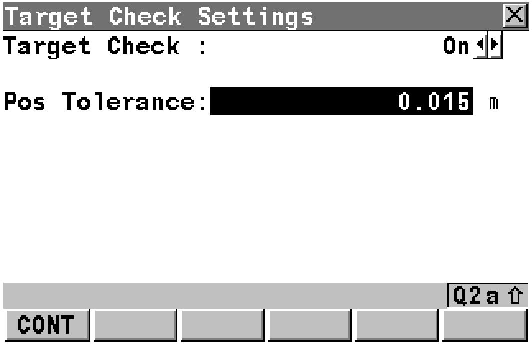
OR

Press a hot key configured to access the screen **CONFIGURE Target Check Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

Configuring the target check



CONT (F1)
To accept the screen entries and continue.

Description of fields

Field	Option	Description
<Target Check:>	**On**	Target checking is activated.
	Off	Target checking is not activated.
<Pos Toler-ance:>	User input	The position tolerance. The units are defined by **Config \General Settings \Units & Formats**.

16 Config...\Instrument Settings...

16.1 EDM & Aim360 Settings

Description

- The settings on this screen define the active EDM **E**lectronic **D**istance **M**easurement and Aim360 settings.
- Refer to "29 Functions" for detailed information on EDM and Aim360.

☞

- Descriptions apply in general to Zoom80 instruments.
- Available options depend on the purchased model, for example with or without Aim360.

Access

Select **Main Menu: Config...\Instrument Settings...\EDM & Aim360 Settings**.

OR

Press a hot key configured to access the screen **CONFIGURE EDM & Aim360 Settings**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **SHIFT USER**.

Refer to "3 Quick Settings - SHIFT USER" for information on the **SHIFT USER** key.

OR

Within the configuration set wizard.

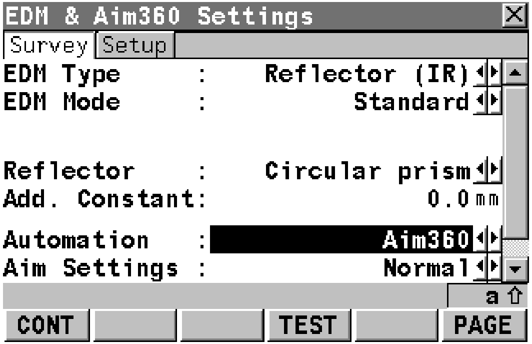
Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE EDM & Aim360 Settings, Survey page Setup page

Description

- This screen has two pages - the Survey page and the Setup page.
- The Survey page and Setup page contain identical fields.
- The settings made in the Survey page are used by all applications and all measurements taken outside of the Setup application program.
- The settings made in the Setup page are only used inside the Setup application program.
- Any changes made to the EDM & Aim360 Settings (for example via Icons, Quick Set, Hotkeys) while the Setup application program is active, only affect the Setup EDM & Aim360 settings.
- Any changes made to the EDM & Aim360 Settings (for example via Icons, Quick Set, Hotkeys) while the Setup application program is not active, only affect the Survey EDM & Aim360 settings.
- When entering the Setup application program, the Setup EDM & Aim360 Settings are active.
- When leaving the Setup application program, the Survey EDM & Aim360 Settings are active.
- Both Survey and Setup EDM & Aim360 Settings are part of the configuration sets.

Diagram



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

TEST (F4)
To access the **CONFIGURE EDM Test Signal/Frequency** screen.

PAGE (F6)
To change to other page on screen.

Description of fields

Field	Option	Description
<EDM Type:>	**Reflector (IR)**	All fields are set to the last used options. The IR EDM exists for all instrument types and allows to measure the distance to a prism or a tape. IR is the EDM that can be used with Aim360 and Track360. For **<Automation: Aim360>** or **<Automation: Track360>** **<EDM Type: Reflector (IR)>** is automatically set. Whenever **<EDM Type: Reflector (IR)>** is selected, the last setting for **<Automation:>** which was used with reflector is set.

Field	Option	Description
		When activated, **IR** is displayed as an icon.
	Reflctrless (RL)	**<Automation: None>** and **<Reflector: Reflectorless>** are selected. The other fields are set to the last used options.
		When activated, **RL** is displayed as an icon.
	Long Range (LO)	**<Automation: None>** is selected. Last used options are reset for the other fields.
		When activated, **LO** is displayed as an icon.
<EDM Mode:>	**Standard**	Available for all **<EDM Type:>** options. Standard single distance measurement.
		When activated, **STD** is displayed as an icon.
	Fast	Available only for **<EDM Type: Reflector (IR)>**. Fast single distance measurement.
		When activated, **FAST** is displayed as an icon.
	Tracking	Available unless **<EDM Type: Long Range (LO)>**. Continuous distance measurement.
		When activated, **TRK** is displayed as an icon.

Field	Option	Description
	Synchro-Track	Available only for **<EDM Type: Reflector (IR)>**. This is the measurement mode for the interpolation of angle measurements in IR Track360 tracking mode. In difference to normal IR Track360 tracking mode, where angle measurements are only assigned to certain distance measurements, SynchroTrack will perform a linear interpolation between the previous and following angle measurement, based upon the timestamp of the EDM measurement. Using this interpolation procedure, a higher accuracy for all dynamic applications (for example machine guidance) is possible. When activated, **SYNC** is displayed as an icon.
	Average	Available for all **<EDM Type:>** options. Repeats measurements in standard measuring mode. The average distance of **<AVG Max #Dist:>** and the standard deviation for the averaged distance are calculated. When activated, **AVG** is displayed as an icon.
<AVG Max #Dist:>	User input	Available if **<EDM Mode: Average>**. Input field for the maximum number of distances to be averaged from 2 to 999 distances.

Field	Option	Description
<Reflector:>	Choicelist	Reflector names as configured in **Main Menu: Manage...\Reflectors**.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.
<Automation:>	**None**	Measurements are done without Aim360.
	Aim360	Positioning to static prisms.
	Track360	The instrument locks onto and follows the moving prism.
<Aim Settings:>		Aim360 Settings.
	Normal	Normal Mode is turned on.
	Low Vis On	Low Visability Mode is turned on. To increase the instrument measuring ability during suboptimal weather conditions. Available only when Aim360 or Track360 mode is activated. This mode is automatically deactivated when the instrument is turned off.
	Low Vis Always On	Low Visability Mode is permanently turned on.
	S-Range On	Short Range Mode is turned on.

Field	Option	Description
		This mode is designed for survey work at close range from the instrument (up to 60-80 m). Under these conditions the instrument Track360 Mode is significantly stabilised.
		This mode has a considerable influence on the range (restriction to 100-150 m) for **<Automation: Aim360>**.
		This mode is automatically deactivated when the instrument is turned off.
	S-Range Always On	Short Range Mode is permanently turned on.
<Target View:>	Choicelist	Available only for **<Automation: Aim360>**. Reduces the Aim field of view to the central area of interest.
	Off	The Aim field of view is not reduced.
	On	The Aim field of view is reduced.
		This mode is automatically deactivated when the instrument is turned off.
	Always On	The Aim field of view is permanently reduced.

Next step

IF EDM	THEN
is not to be tested	**CONT (F1)** closes the screen and returns to **Zoom80 Main Menu**.
is to be tested	**TEST (F4)** to test the EDM signal strength and frequency.

16.2 Search Windows

Description

- The settings on this screen define the size of search windows for prisms to be searched in. The prisms can be searched with Aim360 in the Aim window or with Scout360 in the Scout window.
- Refer to "29.2 Prism Search Methods" for additional information.

Access

Select **Main Menu: Config...\Instrument Settings...\Search Windows**.

OR

Press a hot key configured to access the screen **CONFIGURE Search Windows**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

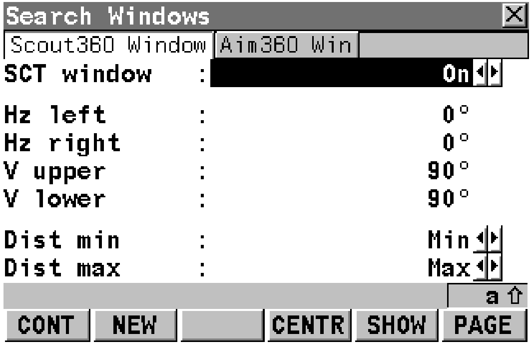
Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Search Windows, Scout Window page



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

NEW (F2)
To define new Scout window.

CENTR (F4)
To centre the Scout window to the current position of the telescope.

SHOW (F5)
To position the telescope to corners of Scout window.

PAGE (F6)
To change to other page on screen.

Description of fields

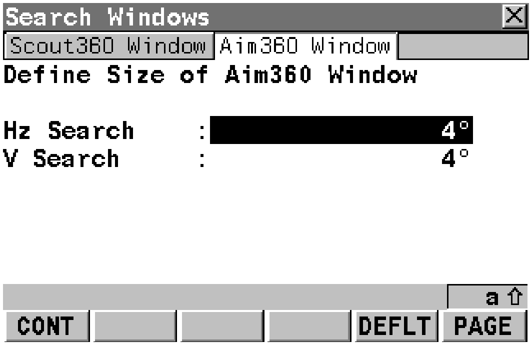
Field	Option	Description
<SCT Window:>		Available on Zoom80 R.
	On	Scout360 searches in the defined window.
	Off	Scout360 searches from 0° to 360° within ±20 gon from horizon.
<Hz left:> **<Hz right:>** **<V upper:>** **<V lower:>**	Output	The left, right, upper and lower boundaries of the Scout window.

Field	Option	Description
<Dist min:>	**Min** and from **25 m** to **175 m**	Minimum distance of the search range for the Scout window to be defined.
<Dist max:>	From **25 m** to **175 m** and **Max**	Maximum distance of the search range for the Scout window to be defined.

Next step

PAGE (F6) changes to the **Aim Window** page.

CONFIGURE Search Windows, Aim Window page



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

DEFLT (F5)
To recall the default Aim window settings.

PAGE (F6)
To change to other page on screen.

Description of fields

Field	Option	Description
<Hz Search:>	User input	Horizontal extent of window. This field is disabled when **<Target View: On>** or **<Target View: Always On>**. **<Target view active>** is displayed at the bottom on this page when the field is disabled.
<V Search:>	User input	Vertical extent of window. This field is disabled when **<Target View: On>** or **<Target View: Always On>**. **<Target view active>** is displayed at the bottom on this page when the field is disabled.

Next step
CONT (F1) returns to **Zoom80 Main Menu**.

16.3 Automatic Prism Search

Description

- The settings on this screen define the behaviour of automatic prism search after the target is lost in lock mode.
- Refer to "29 Functions" for information on Aim360, Scout360, lock and automation behaviour.

Access

Select **Main Menu: Config...\Instrument Settings...\Automatic Prism Search**.

OR

Press a hot key configured to access the screen **CONFIGURE Automatic Prism Search**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

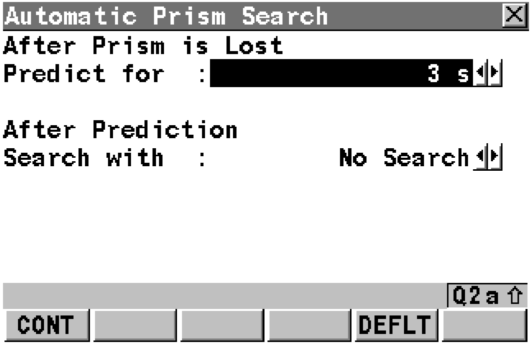
Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Automatic Prism Search



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

DEFLT (F5)
To recall the default settings.

Description of fields

Field	Option	Description
<Predict for:>	From **1 s** to **5 s**	If the target is lost when **<Automation: Track360>** the path of the reflector is predicted for the selected amount of seconds.
<Search with:>	**No Search**	Perform no search after prediction.
	Aim360	Perform search after prediction with Aim360 in a dynamic Aim window.
	Scout360	Available on Zoom80 R. Perform search after prediction with Scout360. For **<Scout Window: On>** search in Scout window and for **<Scout Window: Off>** search in dynamic Scout window.

Field	Option	Description
	Last Point	If the target is lost when **<Automation: Track360>**, then the instrument turns back to the last stored point. The field of view is disabled while the instrument is repositioning.

Next step

CONT (F1) closes the screen and returns to **Zoom80 Main Menu**.

16.4 TPS Corrections

Description

- The settings on this screen define the atmospheric ppm, the geometric ppm and the refraction. The geometric ppm can also be determined by a resection calculation.
- For standard application programs the distance is corrected on account of atmospheric influences. The geometrical correction and the projection distortions are set to 0.00. Heights are reduced with the standard refraction coefficient.
- Refer to Zoom80 User Manual for information on calculations.

Access

Select **Main Menu: Config...\Instrument Settings...\TPS Corrections**.

OR

Press a hot key configured to access the screen **CONFIGURE TPS Corrections**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.

Refer to "2.2 USER Key" for information on the **USER** key.

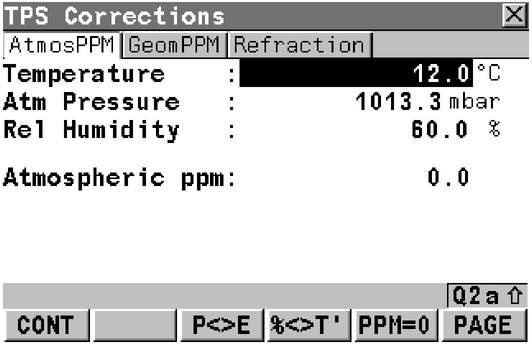
OR

Within the configuration set wizard.

Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE TPS Corrections, AtmosPPM page

The atmospheric distance corrections are derived from the dry air temperature, air pressure or elevation above mean sea level MSL and relative air humidity or wet bulb temperature.



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

P<>E (F3)
To change **<Atm Pressure:>** to **<Elev above MSL:>** and back.

%<>T ' (F4)
To change **<Rel Humidity:>** to **<Temp Wet-bulb:>** and back.

PPM=0 (F5)
To set **<Atmospheric ppm: 0.0>**.

PAGE (F6)
To change to other page on screen.

Description of fields

Field	Option	Description
<Tempera-ture:>	User input	Sets the temperature.
<Atm Pres-sure:> or **<Elev above MSL:>**	User input	Sets the atmospheric pressure or the elevation above mean sea level dependent on selection.

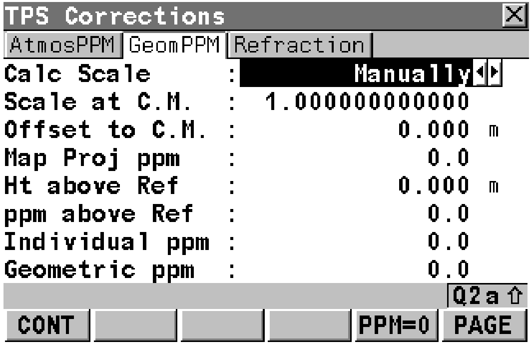
Field	Option	Description
<Rel Humidity:> or **<Temp Wet-bulb:>**	User input	Sets the relative air humidity or the wet bulb temperature dependent on selection.
<Atmospheric ppm:>	User input or Output	The atmospheric ppm is either set or calculated from the above values.

Next step

PAGE (F6) changes to the **GeomPPM** page.

CONFIGURE TPS Corrections, GeomPPM page

- The geometric distance correction (geometric ppm) is derived from the map projection distortion (map projection ppm), the height above reference datum correction (height ppm) and an individual correction (individual ppm).
- The calculation of the map projection ppm follows the formula for the Transversal Mercator Projection. The individual factors are: the scale factor of the line of projection central meridian, Gauss-Krüger = 1.0, UTM = 0.9996, etc. and the offset from the line of projection.
- The calculation of the height ppm is derived from the height of the instrument station above the reference datum. Normally this is the height above mean sea level MSL.



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

PPM=0 (F5)
To set **<Geometric ppm: 0.0>**. Only available when **<Calc Scale: Manually>**.

PAGE (F6)
To change to other page on screen.

Description of fields

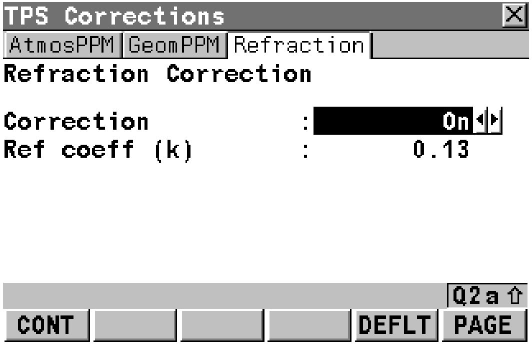
Field	Option	Description
<Calc Scale:>	**Manually**	The geometric ppm value is manually calculated.
<Scale at C.M.:>	User input	The scale at the central meridian.
<Offset to C.M.:>	User input	The offset to the central meridian.
<Map Proj ppm:>	Output	The map projection ppm value. If this value cannot be calculated, then **-----** is displayed and is also ignored in the calculation of the geometric ppm value.
<Ht above Ref:>	User input	The height of the instrument station above the reference datum.

Field	Option	Description
<ppm above Ref:>	Output	The height ppm value calculated from **<Ht above Ref:>**.
<Individual ppm:>	User input	The individual ppm value.
<Geometric ppm:>	Output	**Geometric ppm** = **Map Proj ppm** + **ppm above Ref** + **Individual ppm**.

Next step
PAGE (F6) changes to the **Refraction** page.

CONFIGURE TPS Corrections, Refraction page

The refraction correction is taken into account during the calculation of the height difference. Refer to Zoom80 User Manual for information on refraction calculation.



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

DEFLT (F5)
Sets **<Correction: On>** and **<Ref coeff (k): 0.13>**.

PAGE (F6)
To change to other page on screen.

Description of fields

Field	Option	Description
<Correction:>	**On** or **Off**	Refraction correction is applied to measurements.
<Ref coeff (k):>	User input	Available if **<Correction: On>**. Refraction coefficient to be used for calculation.

Next step
CONT (F1) returns to the screen from where **CONFIGURE TPS Corrections** was accessed.

16.5 Compensator

Description

The compensator and the Hz correction can be deactivated if raw data is to be displayed and recorded.

Access

Select **Main Menu: Config...\Instrument Settings...\Compensator.**

OR

Press a hot key configured to access the screen **CONFIGURE Compensator**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**.
Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard.
Refer to "11.2 Accessing Configuration Set Management".

OR

ICONS.

CONFIGURE Compensator

CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

Description of fields

Field	Option	Description
<Compen-sator:>	**On**	Vertical angles are relative to plumb line. The horizontal angle is corrected for the transversal tilt errors if **<Hz-Correction: On>**.
	Off	Vertical angles are relative to vertical/standing axis.
<Hz-Correc-tion:>	**On**	The horizontal angles are corrected for the line of sight, tilting axis and if **<Compensator: On>** transversal tilt errors.
	Off	Horizontal angles are not corrected.

Next step
CONT (F1) returns to **Zoom80 Main Menu**.

16.6 Instrument ID

Description

- The settings on this screen define the instrument identification number. This number is used for the generation of the file names.
- Using format files, the instrument ID can be output together with data from the instrument. By doing so, it can be identified which instrument was used for certain measurements.

Access

Select **Main Menu: Config...\Instrument Settings...\Instrument ID**.

CONFIGURE Instrument ID

CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

DEFLT (F5)
To recall the default instrument ID.

Description of fields

Field	Option	Description
<Instrument ID:>	User input	Sets a four digit number as instrument identification number. By default the last four numbers of the serial number are used.

Next step

CONT (F1) returns to **Zoom80 Main Menu**.

16.7 Telescope Accessories

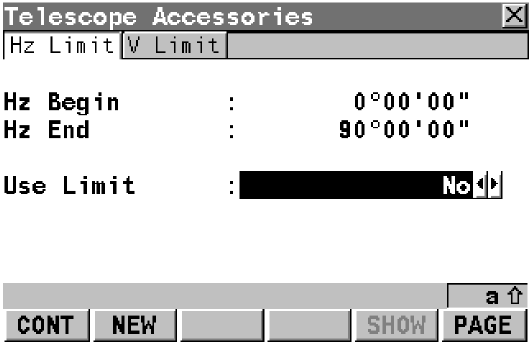
Description

The settings on this screen offer the possibility to limit the motorization to a certain part of the horizontal and/or vertical circle as used telescope and lens accessories may obstruct a full rotation of the telescope. General positioning functions are then restricted to these boundaries.

Access

Select **Main Menu: Config...\Instrument Settings...\Telescope Accessories**.

CONFIGURE Telescope Accessories, Hz Limit page



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

NEW (F2)
To define new horizontal limits for instrument rotation.

SHOW (F5)
To define new horizontal limits for instrument rotation.

Description of fields

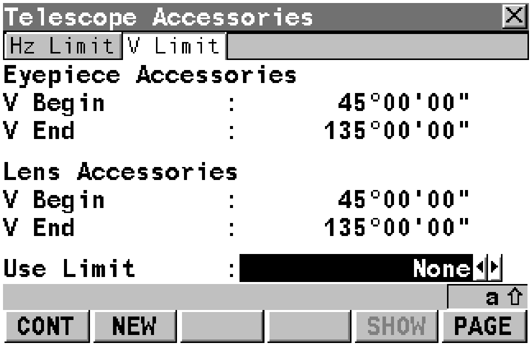
Field	Option	Description
<Hz Begin:> **<Hz End:>**	Output/User input	The boundaries of the window within the instrument is allowed to turn.

Field	Option	Description
<Use Limit:>	**Yes**	Instrument turning is restricted to the defined window.
	No	Instrument rotates without any limitation, from 0 to 400 gon.

Next step

PAGE (F6) returns to the **V Limit** page.

CONFIGURE Telescope Accessories, V Limit page



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

NEW (F2)
To define new vertical limits for telescope rotation.

SHOW (F5)
To position the telescope to its rotation limits.

Description of fields

Field	Option	Description
<V Begin:> **<V End:>**	Output/User input	Vertical extent of the window in which the instrument is allowed to turn the telescope. The value of the current limit refers to the vertical reading of the present line of sight direction.
<Use Limit:>	**None**	Telescope turns without any limitation from 0 to 400 gon.
	Eyepiece	The movement of the telescope is limited by the stored Eyepiece Accessories Limits.
	Lens	The movement of the telescope is limited by the stored Lens Accessories Limits.
	Eyepce & Lens	The movement of the telescope is limited by the combination of both areas with the least vertical extend.

Next step
CONT (F1) returns to **Zoom80 Main Menu**.

17 Config...\General Settings...

17.1 Units & Formats

Description

The settings on this screen define

- the units for all types of measurement data displayed.
- information related to some types of measurement data.
- the order in which coordinates are displayed.

Access

Select **Main Menu: Config...\General Settings...\Units & Formats**.

OR

Press a hot key configured to access the screen **CONFIGURE Units & Formats**. Refer to "2.1 Hot Keys" for information on hot keys.

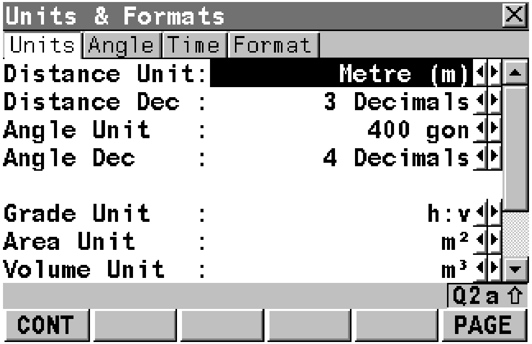
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE
Units & Formats,
Units page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Distance Unit:>		The units shown for all distance and coordinate related fields.
	Metre (m)	Metres [m]
	Int Ft (fi)	International feet [fi], storage in US feet
	Int Ft/Inch (fi)	International feet [fi], inches and 1/8 inches (0' 00 0/8 fi), storage in US feet
	US Ft (ft)	US feet [ft]
	US Ft/Inch (ft)	US feet, inches and 1/8 inches (0' 00 0/8 fi) [ft]

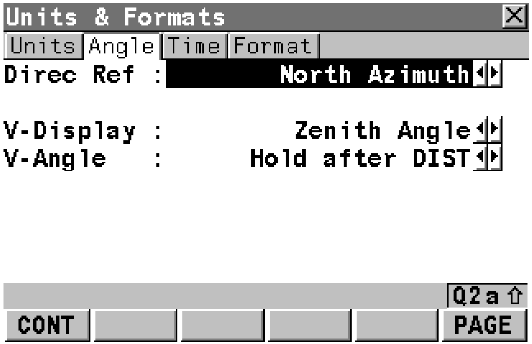
Field	Option	Description
<Distance Dec:>	From **0 Decimal** to **4 Decimals**	The number of decimal places shown for all distance and coordinate related fields. This is for data display and does not apply to data export or storage. The available options depend on the selected **<Distance Unit:>**.
<Angle Unit:>	**400 gon**, **360 ° ' "**, **360° dec** or **6400 mil**	The units shown for all angular and coordinate related fields. More angle settings can be defined on the **Angle** page.
<Angle Dec:>		The number of decimal places shown for all angular and coordinate related fields. This is for data display and does not apply to data export or storage.
	From **2 Decimals** to **4 Decimals**	Available for **<Angle Unit: 400 gon>** or **<Angle Unit: 360° dec>**.
	From **1 Decimal** to **3 Decimals**	Available for **<Angle Unit: 6400 mil>**.
	0.1″, 1″, 5″, 10″, 60″	Available for **<Angle Unit: 360 ° ′ ″>**.

Field	Option	Description
<Grade Unit:>		The input and output format for grades.
	h:v	Horizontal by vertical distance.
	v:h	Vertical by horizontal distance.
	% (v/h * 100)	Percentage of vertical by horizontal distance.
	Elev Angle	Elevation angle.
<Area Unit:>	**m^2**, **Int Acres (Ai)**, **US Acres (A)**, **Hectares (ha)**, **fi^2** or **ft^2**	The units shown for all area related fields.
<Volume Unit:>	**m^3**, **fi^3**, **ft^3** or **yd^3**	The units shown for all volume related fields.
<Temp Unit:>	**Celsius (°C)** or **Fahrenheit (°F)**	The units shown for all temperature related fields.
<Press Unit:>	**mbar**, **mmHg**, **Inch Hg (inHg)**, **hPa** or **psi**	The units shown for all pressure related fields. psi = pounds per square inch.

Next step

PAGE (F6) changes to the **Angle** page. Refer to paragraph "CONFIGURE Units & Formats, Angle page".

CONFIGURE Units & Formats, Angle page

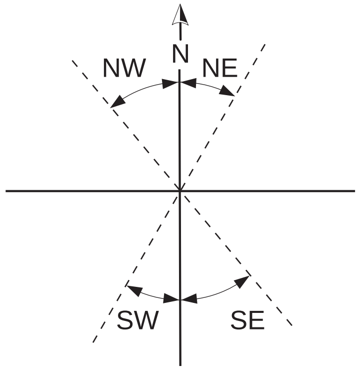


CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Direc Ref:>	**North Azimuth**, **South Azimuth**, **North Anti-clock**, or **Bearing**	Sets the reference direction as well as the direction from where and how azimuths are computed. For **<Direc Ref: Bearing>**, the azimuth/bearing fields in other screens are called **<Bearing:>**. NE, SW, SE and NW indicate the quadrant of the bearing.

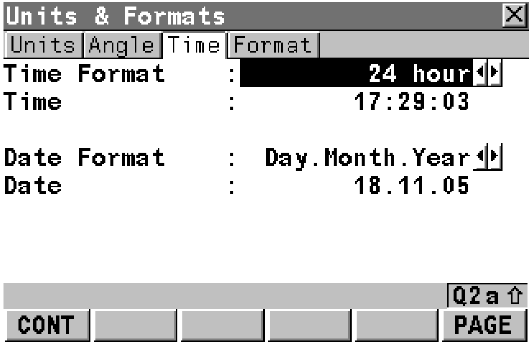
Field	Option	Description
		 For all other options, the azimuth/bearing fields in other screens are called **<Azimuth:>**.
<V-Display:>	**Zenith Angle**	V = 0 in zenith.
	Elev Angle	V = 0 horizontal elevation angle. V-angles are positive above the horizon and negative below it.
	Elev Angle %	V = 0 horizontal. V-angles are expressed in % and are positive above the horizon and negative below it.

Field	Option	Description
<V-Angle:>	**Hold after DIST**	The vertical angle is fixed after a distance measurement with **DIST (F2)**, whereas the horizontal angle is continuously updated with the telescope movement.
	Running	The vertical angle is continuously updated with the telescope movement. ☞ The active reflector height is applied in the calculation of remote point elevations. The reflector height must be set to zero to display and record the elevation of the targeted remote point.

Next step

PAGE (F6) changes to the **Time** page. Refer to paragraph "CONFIGURE Units & Formats, Time page".

CONFIGURE Units & Formats, Time page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

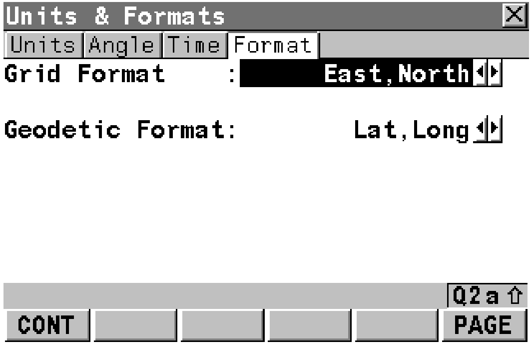
Description of fields

Field	Option	Description
<Time Format:>	**24 hour** or **12 hour (am/pm)**	How the time is shown in all time related fields.
<Date Format:>	**Day.Month.Year**, **Month/Day/Year** or **Year/Month/Day**	How the date is shown in all date related fields.

Next step

PAGE (F6) changes to the **Format** page. Refer to paragraph "CONFIGURE Units & Formats, Format page".

CONFIGURE Units & Formats, Format page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Grid Format:>	**East,North** or **North,East**	The order in which grid coordinates are shown in all screens. The order in display masks depends on the user settings.
<Geodetic Format:>	**Lat,Long** or **Long,Lat**	The order in which geodetic coordinates are shown in all screens. The order in display masks depends on the user settings.

Next step

PAGE (F6) changes to the first page on this screen.

17.2 Wizard Mode

Description

The settings on this screen define the behaviour of the configuration set wizard.

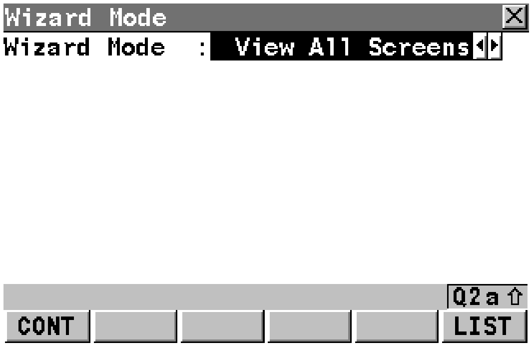
Access

Select **Main Menu: Config...\General Settings...\Wizard Mode**.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Wizard Mode



CONT (F1)

To accept changes and to return to **Zoom80 Main Menu** or to continue with the subsequent screen within the configuration set wizard.

LIST (F6)

To access **CONFIGURE Quick Access**. Lists all screens within a configuration set. Allows to access these individual screens and change settings.

Description of fields

Field	Option	Description
<Wizard Mode:>	**View All Screens**	All configuration screens are shown in the configuration set wizard. Application program configuration screens are not included. They can be configured within each application program.
	Reduced	A reduced set of screens are shown in the configuration set wizard.

Next step

CONT (F1) returns to **Zoom80 Main Menu** or continues with the subsequent screen within the configuration set wizard.

17.3 Hot Keys & User Menu

Description

The settings on this screen assign a particular function, screen or application program to each of the first and second level of hot keys and to the **USER** key. Refer to "2 Configurable Keys" for more information on hot keys and the **USER** key.

Access

Select **Main Menu: Config...\General Settings...\Hot Keys & User Menu**.

OR

Press a hot key configured to access the screen **CONFIGURE Hot Keys & User Menu**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

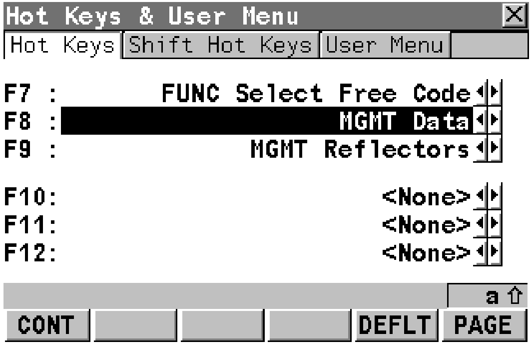
Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

OR

Hold a hot key down for two seconds. This is also possible after pressing **SHIFT**. This is only valid for Zoom80 instruments.

CONFIGURE Hot Keys & User Menu, Hot Keys page

To configure the first level of hot keys.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<F7:> to **<F12:>**	Choicelist	All functions, screens or application programs which can be assigned to the particular key.

Next step

PAGE (F6) changes to the **Shift Hot Keys** page.

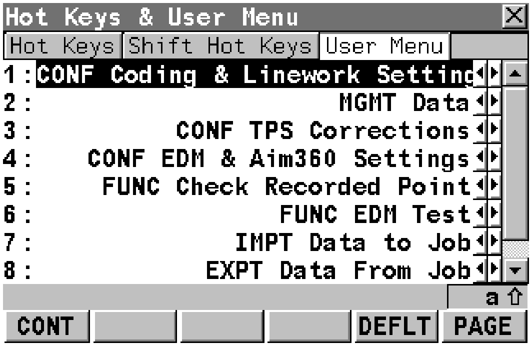
CONFIGURE Hot Keys & User Menu, Shift Hot Keys page

To configure the second level of hot keys.
The functionality on this page is identical to the one on the **Hot Keys** page.

Field	Option	Description
<F7:> to **<F10:>**	Choicelist	All functions, screens or application programs which can be assigned to the particular key.
<F11:>	Output	The lights, display, beeps and text settings can be edited. Refer to "17.5 Lights, Display, Beeps, Text".
<F12:>	Output	The electronic level is shown. Refer to "28.7 STATUS: Level & Laser Plummet".

Next step
PAGE (F6) changes to the **User Menu** page.

CONFIGURE Hot Keys & User Menu, User Menu page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<1:> to **<9:>**	Choicelist	All functions, screens or application programs which can be assigned to the individual lines in the user defined menu.

Next step

PAGE (F6) changes to the first page on this screen.

17.4 Language

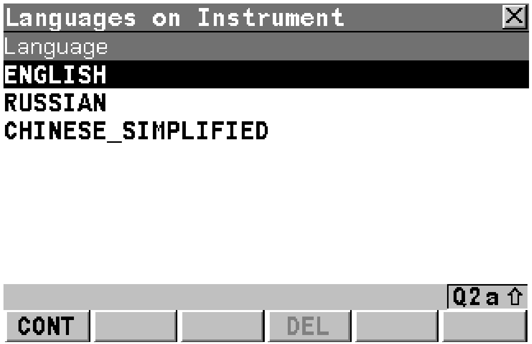
Description

The setting on this screen defines the language used on the instrument. Three languages can be stored on the instrument at one time - English and two others. English cannot be deleted. Refer to "23.2 System Languages".

Access

Select **Main Menu: Config...\General Settings...\Language**.

CONFIGURE Languages on Instrument



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

DEL (F4)
To delete the highlighted language.

Description of fields

Column	Option	Description
<Language:>	Choicelist	Sets the language.

Column	Option	Description
		The selected language is used for the system software. If a language is not available for the system software, the English language is used instead. Application programs run in the language they were loaded.

Next step
CONT (F1) returns to **Zoom80 Main Menu**.

17.5 Lights, Display, Beeps, Text

Description

The settings on this screen allow the lights and screen appearance to be configured, turn the notification beeps on and off and define the behaviour of the keys.

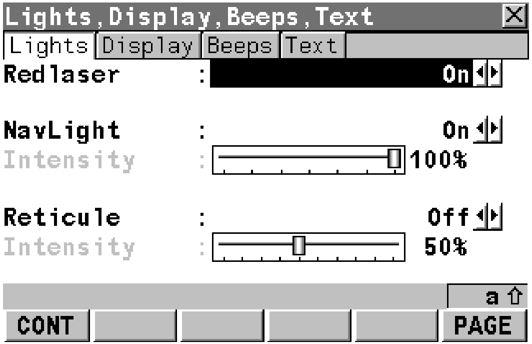
Access

Select **Main Menu: Config...\General Settings...\Lights, Display, Beeps, Text**.

OR

Press **SHIFT F11**.

CONFIGURE Lights, Display, Beeps, Text, Lights page



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Redlaser:>	**On** or **Off**	To turn the redlaser of RL EDM on and off.

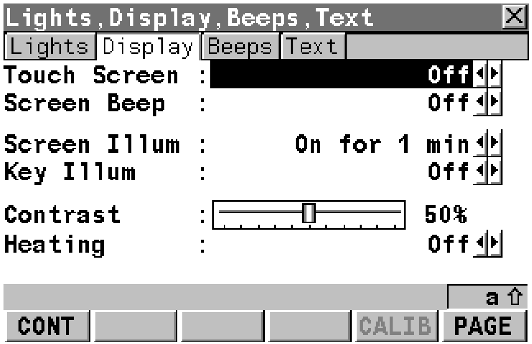
Field	Option	Description
<NavLight:>	**On** or **Off**	To turn the Laser Guide (GUS74) on and off. This field is only available if GUS74 is fitted
<Intensity:>	From **0 %** to **100 %**	To adjust the NavLight/Laser Guide intensity using the left and right arrow keys.
<Reticule:>	**On** or **Off**	To turn the reticule illumination on and off.
<Intensity:>	From **0 %** to **100 %**	To adjust the reticule illumination intensity using the left and right arrow keys.

Next step

PAGE (F6) changes to the **Display** page.

CONFIGURE Lights, Display, Beeps, Text, Display page

This page contains the screen display settings for the Zoom80 instrument.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

CALIB (F5)
To calibrate the touch screen.

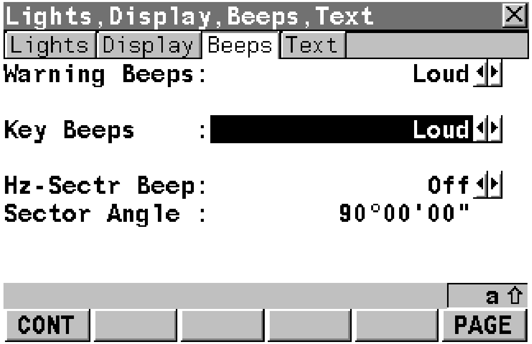
PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Touch Screen:>	**On** or **Off**	Turns touch screen on and off.
<Screen Beep:>	**Off**, **Soft** or **Loud**	Controls the beep upon touching the touch screen.
<Screen Illum:>	**Always On**, **On for 1 min**, **On for 2 min**, **On for 5 min**	Controls the screen illumination to be on, or on for the specified time after the last key was pressed.
<Key Illum:>	**Off**, **Same as Screen** or **Always On**	Controls the keyboard illumination.
<Contrast:>	From **0 %** to **100 %**	To adjust the screen brightness.
<Heating:>	**Off** or **Automatic**	Turns screen heating on and off.

Next step
PAGE (F6) changes to the **Beeps** page.

CONFIGURE Lights, Display, Beeps, Text, Beeps page



CONT (F1)
: To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
: To change to another page on this screen.

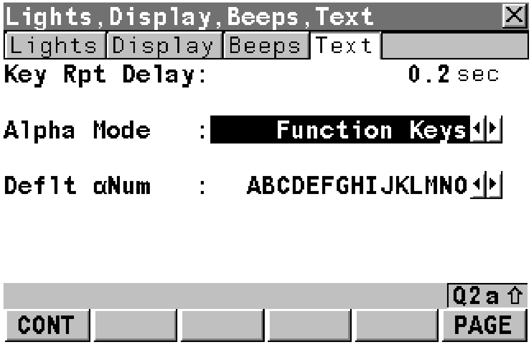
Description of fields

Field	Option	Description
<Warning Beeps:>	**Off**, **Soft** or **Loud**	Controls the beep for acoustic warning signals for the Zoom80 instrument.
<Key Beeps:>	**Off**, **Soft** or **Loud**	Controls the beep upon key presses for the Zoom80 instrument.
<Hz-Sectr Beep:>	**On** or **Off**	Turns the Hz-sector beep on and off. The instrument beeps when within 5 gon/4°30’ of the defined sector, there is a long and consistent beep within 0.5 gon/27’ and no beep within 0.005 gon/16’’.
<Sector Angle:>	User input	Input field for sector angle for which a beep should sound.

Next step

PAGE (F6) changes to the **Text** page.

CONFIGURE Lights, Display, Beeps, Text, Text page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Key Rpt Delay:>	User input	Key repeat delay is the time between the initial key press and when the key starts repeating. For example in numeric mode press and hold 1. Behaviour on screen: 1 - delay - 1111111111. In alpha mode the focus stays on one field and scrolls through the available characters: S - delay - T U 7 S T U 7.

Field	Option	Description
		Time between the initial key press and when the key starts repeating. Alphanumeric, numeric, **CE** or arrow keys in all general screens are delayed by the specified time.
<Alpha Mode:>	**Function Keys** or **Numeric Keys**	Alphanumeric input can either be through function or numeric keys.
<Deflt αNum:>	Up to 6 choices	Available if **<Alpha Mode: Function Keys>**. Sets the set of extra characters available through **αNUM** or on **F1**-**F6** whenever an entry is made. The choices available depend on the character sets loaded on the instrument and the language configured to be used on the instrument.

Next step

PAGE (F6) changes to the next page.

17.6 Start Up & Power Down

Description

- The settings on this screen
  - define the instrument start up screen.
  - define the behaviour of the instrument when starting up and when powering down.
  - define a PIN code which needs to be entered when starting up the instrument.

Start Up

- The screen entered after turning on the instrument can be configured.

Power Down

- Once power is restored after a power loss the instrument returns to the screen in which it was operating when the power failed. After restarting, the instrument uses the same job and configuration set as before the power loss. If either the job or configuration set are not available the first in the list is used.
- Two types of power loss could be experienced:
  - Sudden power loss: Internal or external battery being removed
  - Gradual power loss: Internal or external battery running down naturally

PIN Code

- A **P**ersonal **I**dentification **N**umber protection can be activated.

Type	Description
PIN protection active	Instrument prompts for PIN code entry • after starting up. • when changing the PIN code in **CONFIGURE Start Up & Power Down**.
PIN code generation	By the user.
Attempts for correct PIN code	Five. After five false attempts, a **P**ersonal **U**nbloc**K**ing code must be typed in.
PUK code generation	• By GeoMax.

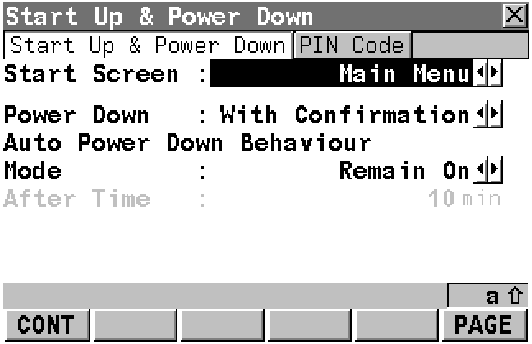
Access

Select **Main Menu: Config...\General Settings...\Start Up & Power Down**.

OR

Within the configuration set wizard. Refer to "11.2 Accessing Configuration Set Management".

CONFIGURE Start Up & Power Down Start Up & Power Down page



CONT (F1)
To accept changes and return to **Zoom80 Main Menu**.

Description of fields

Field	Option	Description
<Start Screen:>	Choicelist	Determines the first screen which is shown after turning on the instrument.
<Power Down:>		Sets the behaviour of the instrument shut down.
	With Confirmation	Instrument shut down must be confirmed.
	Directly	The instrument is shut down immediately without confirmation.
<Mode:>	**Turn Off**	The instrument turns off if no events have occurred after the time set in **<After Time:>**.

Field	Option	Description
	Remain On	The instrument does not power down automatically.
<After Time:>	User input	Available unless **<Mode: Remain On>** is selected. Minutes after which the instrument should turn off.

Next step
PAGE (F6) changes to the **PIN Code** page.

CONFIGURE
Start Up & Power Down,
PIN Code page

The appearance of the screen varies with the setting for **<Use PIN:>** when this screen is accessed.

<Use PIN: No>

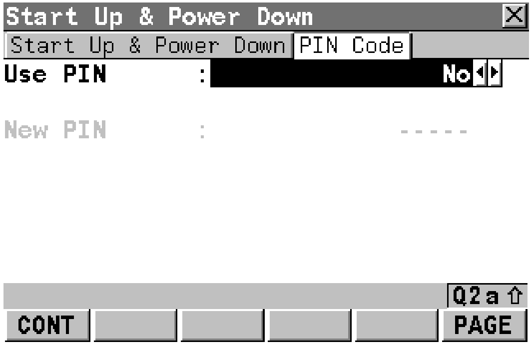
No PIN code has been set before.

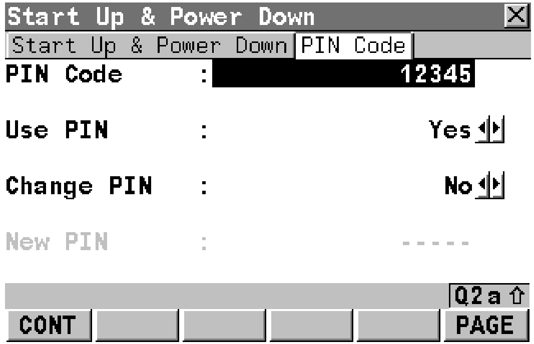
- The PIN code protection can be activated.
- Then a PIN code can be typed in.

<Use PIN: Yes>

A PIN code has been set before.

- The PIN code must be typed in order to change settings on this page.
- Then the PIN code protection can be deactivated.
- Or the PIN code can be changed.





Description of fields

Field	Option	Description
<Use PIN:>	**Yes** or **No**	Activates the PIN code protection. This setting is not part of the configuration set.

Field	Option	Description
<New PIN:>	User input	The PIN code must be a number with four to six digits.
<PIN Code:>	User input	The PIN code as previously defined on this page. The correct PIN code must be typed in within five attempts or the PUK code is required. Refer to "1 Instrument Protection with PIN".
<Change PIN:>	**Yes** or **No**	Activates **<New PIN:>** to type in a new PIN code.

Next step
PAGE (F6) changes to the first page on this screen.

18 Interfaces, Ports, Devices

18.1 Overall Concept

Terminology

Term	Description
Interface	The procedures, codes and protocols that enable two entities to interact for an exchange of data. Each interface is given a meaningful display name which enables easy distinction between interfaces.
Port	A connection through which a separate device may communicate with the instrument.
Device	The hardware which is connected to the chosen port.

Concept

Table

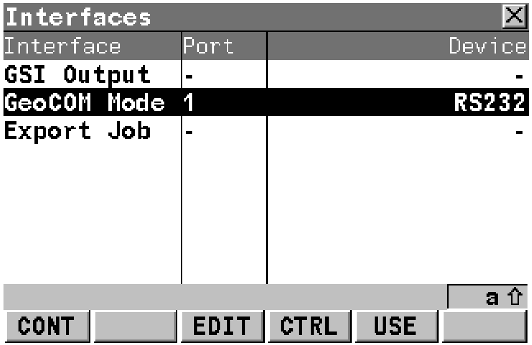
This table gives an overview of the interaction between an interface, port and device.

Concept		Example
Interface	What type of information is to be communicated between the instrument and device?	GeoCom Mode
Port	Which port is being used to connect the device to the instrument ?	Port 2(Handle)

Concept		Example
Device	Which device is being connected to the port and what are its communication settings and individual parameters ?	Baud Rate: 115200 Parity: None Data Bits: 8 Stop Bit: 1 Link Number: 1, Set as: Base

Screen

This screen gives an overview of all interfaces with the currently assigned port and device.

Point	Description
1.	 • **CONFIGURE Interfaces - EDIT (F3)** refers to **interface parameters**.

Point	Description
	To configure the parameters related to the highlighted interface (switching on/off the interface, port selection, device selection and device communication settings). • **CONFIGURE Interfaces** - **CTRL (F4)** refers to **device parameters**. To configure additional parameters related to the highlighted device. • **CONFIGURE Interfaces** - **USE (F5)** enables the immediate turning on/off of an interface, without the need for editing/configuring. The last used settings are automatically recalled.
2.	One port can only connect to one device at a time.
3.	One port may be used by more than one interface at a time.

Further information

IF more information is required on	THEN
interfaces	Refer to "18.2 Interfaces"
ports	Refer to "18.3 Ports"
devices	Refer to "18.4 Devices"
EDIT (F3) interface parameters	Refer to "19 Config...\Interfaces... - Editing The Interface"

IF more information is required on	THEN
CTRL (F4) device parameters	Refer to "20 Config...\Interfaces... - Controlling The Device"

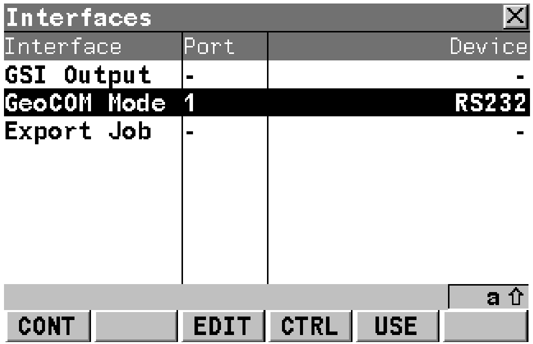
18.2 Interfaces

18.2.1 Overview of Interfaces

Description

The instrument has various interfaces configured to be used with a port and a device. The configuration varies depending on the individual application.

Available interfaces



18.2.2 Accessing CONFIGURE Interfaces

Access

Select **Main Menu: Config...\Interfaces...**.

OR

Press a hot key configured to access the screen **CONFIGURE Interfaces**.

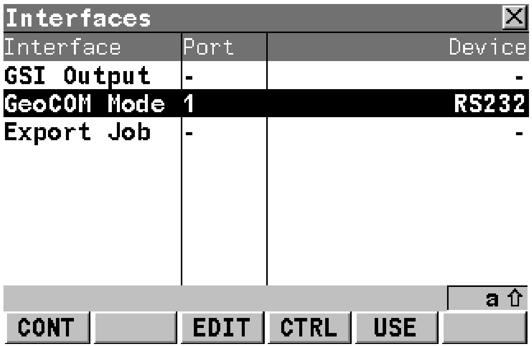
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

CONFIGURE Interfaces

The screen gives an overview of all interfaces with the currently assigned port and device.



CONT (F1)
To return to the screen from where this screen was accessed.

EDIT (F3)
To configure the parameters related to the highlighted interface.

CTRL (F4)
Available for certain devices connected to certain interfaces. To configure additional paramaters.

USE (F5)
To turn the highlighted interface on or off. If the interface is turned on then the settings which were last used with that interface are active. If the device which was last used with that interface is no longer available, the RS232 is assigned to that interface.

Next step

IF	THEN
an interface is to be turned on/off, a port is to be selected or a device is to be selected	Highlight the interface and **EDIT (F3)**. Refer to "19 Config...\Interfaces... - Editing The Interface"
a device attached to an interface is to be configured	Highlight the relevant interface and **CTRL (F4)**. Refer to "20 Config...\Interfaces... - Controlling The Device"
an interface is to be turned on/off	Highlight the relevant interface and **USE (F5)**.

18.3 Ports

Description

- The instrument is always fitted with the port located at the instrument base (port 1). Additional ports are available for ZRT80/ZRT81/ZRT82 (port 2) and for Blue-tooth (port 3).
- The list of available devices always depends on the selected port.

Available ports

Type

Port	Zoom80
Port 1	For power and/or communication, 5 pin LEMO-0
Port 2 (Handle)	Hotshoe connection for ZRT80/ZRT81/ZRT82
Port 3 (BT)	Bluetooth module for communication with Bluetooth capable devices

Location

Port	Description
Port 1	This port is located at the base of the instrument and is always available.
Port 2 (Handle)	This port is located on top of the side cover.
Port 3 (BT)	This port is housed within the side cover.

18.4 Devices

18.4.1 Overview of Devices

Description

- A device is the hardware which is connected to the chosen port. Devices are used to transmit and receive measurement data. Devices are also used by Zoom80 to communicate with the Getac controller.
- Before using any device with Zoom80 it is necessary to configure the interface with which it will be used. Refer to "19 Config...\Interfaces... - Editing The Interface" for information on how to configure interfaces.
- Some devices may be used with different interfaces for different applications.

Further information

IF more information is required on	THEN
radios for remote control	Refer to "18.4.5 Device - Radios for Remote Control".
RS232	Refer to "18.4.6 Device - RS232".

18.4.2 Accessing CONFIGURE Devices

Description

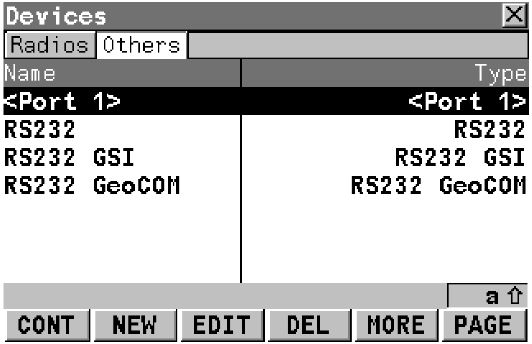
- Allows devices to be created, edited, selected and deleted.
- Refer to "20 Config...\Interfaces... - Controlling The Device" for more information.

Access step-by-step

Step	Description
1.	**Main Menu: Config...\Interfaces...**
2.	Highlight the appropriate interface based on the type of device that needs to be configured.
3.	**EDIT (F3)** to access **CONFIGURE XX**.
4.	**DEVCE (F5)** to access **CONFIGURE Devices**. Refer to paragraph "CONFIGURE Devices".

CONFIGURE Devices

This screen consists of two pages. The functionality described below is always the same.



CONT (F1)
To select the highlighted device and return to the screen from where this screen was accessed.

NEW (F2)
To create a new device. Refer to "18.4.3 Creating a New Device".

EDIT (F3)
To edit the highlighted device. Refer to "18.4.4 Editing a Device".

DEL (F4)
To delete the highlighted device.

MORE (F5)
To display information about the type of device and the creator of the device.

PAGE (F6)
To change to another page on this screen.

SHIFT DEFLT (F5)
To recall previously deleted default devices and to reset default devices to the default settings.

Description of columns

Column	Description
Name	Names of available devices.

Column	Description
Type	Type of device defined when creating the device.
Creator	The creator of the device. The creator can either be **Default** if the device is a default, or **User** if the device has been created. ☞ If a **Default** device is edited by using **EDIT (F3)** then its creator is still displayed as **Default**.

Next step

IF the desired device is	THEN
present in the list	highlight the desired device. **CONT (F1)** to close the screen and to return to the screen from where **CONFIGURE Devices** was accessed.
is not present in the list	**NEW (F2)**. Refer to "18.4.3 Creating a New Device".
is present in the list but needs to be edited	highlight the desired device. **EDIT (F3)**. Refer to "18.4.4 Editing a Device".

18.4.3 Creating a New Device

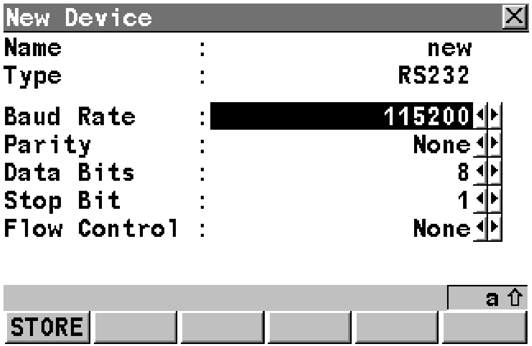
Description

Allows a new device to be configured.

Access step-by-step

Step	Description
1.	Refer to "18.4.2 Accessing CONFIGURE Devices" to access **CONFIGURE Devices**.
2.	Highlight a device of the same type as the device to be created, from the list.
3.	**NEW (F2)** to access **CONFIGURE New Device**.

CONFIGURE New Device



STORE (F1)
To store the new device and to return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Name:>	User input	Name of new device.
<Type:>	Output	Same device type as was highlighted when **NEW (F2)** was used.
<Baud Rate:>	From **1200** to **115200**	Frequency of data transfer from instrument to device in bits per second.
<Parity:>	**None, Odd** or **Even**	Error checksum at the end of a block of digital data.
<Data Bits:>	**7** or **8**	Number of bits in a block of digital data.
<Stop Bits:>	**1** or **2**	Number of bits at the end of a block of digital data.
<Flow Control:>	**None** or **RTS/CTS**	Available for some devices. Activates hardware handshake. When the instrument/device is ready for data, it asserts the **R**equest **T**o **S**end line indicating it is ready to receive data. This is read by the sender at the **C**lear **T**o **S**end input, indicating it is clear to send the data.

Next step

STORE (F1) to close the screen and to return to the screen from where **CONFIGURE Device** was accessed.

18.4.4 Editing a Device

Access step-by-step

Step	Description
1.	Refer to "18.4.2 Accessing CONFIGURE Devices" to access **CONFIGURE Devices**.
2.	Highlight the device to be edited from the list.
3.	**EDIT (F3)** to access **CONFIGURE Edit Device**.

CONFIGURE Edit Device

The availability of options may change depending on the selected device. Most fields are identical with the creation of a new device. Refer to "18.4.3 Creating a New Device" for information on the fields.

Next step

STORE (F1) to close the screen and to return to the screen from where **CONFIGURE Edit Device** was accessed.

18.4.5 Device - Radios for Remote Control

Typical uses	To remote control the Zoom80.
Supported radios	The radio used with Zoom80 for remote control is the ZRT80/ZRT81/ZRT82. Zoom80 has to be set to the correct communication mode to send and receive data and commands via the radio. A radio is also integrated in the Getac controller to allow communication.
User defined radios	Other radios than the default radios can be used. Their settings must be defined by creating a new radio configuration. Refer to "18.4.3 Creating a New Device". These radios must be connected with a cable. Refer to "Appendix D Cables" for information on cables.

18.4.6 Device - RS232

Typical uses

- To exchange information with a device via an RS232 interface.
- RS232 GeoCOM can be used to control the instrument via GeoCOM commands.
- RS232 GSI can be used to send data from the instrument to a computer.
- Port 1 is used to connect to RS232 devices with a cable. Refer to "Appendix D Cables" for information on cables.

Example of use

Step	Description
1.	A device with an RS232 interface must be connected to the instrument.
2.	Information can be exchanged between the instrument and the device. For example measurement data can be continuously sent out from the instrument.
3.	A connection is maintained until the instrument is turned off, the configuration is changed or the device is detached.

Supported RS232

Default RS232 devices

- RS232
- RS232_GSI
- RS232_GeoCOM

User defined RS232

All settings can be defined.

19 Config...\Interfaces... - Editing The Interface

19.1 GSI Output

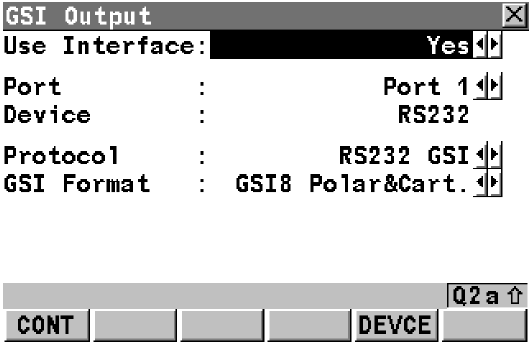
Description

Data is streamed through the serial port (RS232) and is stored to the active job. GSI data is stored when **<Use Interface: Yes>** and either **ALL (F1)** or **REC (F3)** is pressed. The format of the data depends on the option selected in **<Output Format:>**.

Access step-by-step

Step	Description
1.	Refer to "18.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**
2.	**CONFIGURE Interfaces** Highlight **GSI Output**.
3.	**EDIT (F3)** to access **CONFIGURE GSI Output**.

CONFIGURE GSI Output



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DEVCE (F5)
To create, select, edit or delete a device.

Description of fields

Field	Option	Description
<Use Inter-face:>	**Yes** or **No**	Activates the interface.
<Port:>	Output	This field is available when **<Use Interface: Yes>**. Port to be used.
<Device:>	Output	This field is available when **<Use Interface: Yes>**. Device to be used.

Field	Option	Description
<Protocol:>		This field is available when **<Use Interface: Yes>**. Protocol defines if the system expects a hand-shake or no handshake.
	RS232 GSI	A handshake is required. A data block is sent out from the instrument and a receive confirmation is expected. This handshake requires that GeoCom Mode be activated.
	None	No handshake is required.
<GSI Format:>	Output	This field is available when **<Use Interface: Yes>**.
	GSI8 Polar&Cart.	GSI Polar and Cartesian (8 data characters) (Point ID, Hz, V, SlopeDist, PPM, E, N, Elev.)
	GSI16 Polar	GSI Polar (16 data characters) (Point ID, Hz, V, SlopeDist, PPM, reflector height)
	GSI16 Cartesian	GSI Cartesian (16 data characters) (E, N, Elev, Reflector Height)
	Pt,N,E,Ht,Date	Coordinate data (Northing BEFORE Easting)
	Pt,E,N,Ht,Date	Coordinate data (Easting BEFORE Northing)

Field	Option	Description
	Pseudo NMEA GGA	Based on NMEA (**N**ational **M**arine **E**lectronics **A**ssociation), which is a standard for interfacing marine electronic devices.
	GSI8 Polar	GSI Polar (8 data characters) (Point ID, Hz, V, SlopeDist, PPM)
	GSI16 Polar2	GSI Polar (16 data characters) (Point ID, Hz, V, SlopeDist, PPM)

Next step

IF a device is	THEN
not to be created or edited	**CONT (F1)** closes the screen and returns to the screen from where **CONFIGURE GSI Output** was accessed.
to be created or edited	**DEVCE (F5)** to create or edit a device.

Output format - GSI Format

GSI data is transmitted in blocks. Every block consists of several data words, refer to the examples below. Every data word begins with a two character Word Index, the WI code, specifying the data type within this block. Each GSI-8 word has in total 16 characters, consisting of 7 information characters followed by 8 data characters and by the blank character ASCII code 32 at the end of the data word. The GSI-16 block is similar to the GSI-8 block but the block begins with * and the data word contains 16 characters for large values such as UTM coordinates, large alphanumeric codes, attributes or point ID's.

Example 1 shows a GSI-8 block sequence with the words for point ID (11), Easting coordinate (81) and Northing coordinate (82). Example 2 shows a GSI-16 block sequence with the words for point ID (11), horizontal (21) and vertical angle (22).

There are no hardcoded GSI files available

Type	GSI8 Polar&Cart	GSI16 Polar	GSI16 Cartesian
WI 11	Point ID	Point ID	Point ID
WI 21	Azimuth	Azimuth	-
WI 22	V	V	-
WI 31	SlopeDist	SlopeDist	-
WI 51	PPM Total/mm	PPM Total/mm	-
WI 81	East	-	East
WI 82	North	-	North
WI 83	Elev.	-	Elev.
WI 87	Refl. Ht	-	Refl. Ht

Example 1: GSI8
Each word has 16 characters of which 8 characters are used for the data block.

Word 1	Word 2	Word 3
110001+0000A110	81..00+00005387	82..00-00000992
110002+0000A111	81..00+00007586	82..00-00003031

110003+0000A112	81..00+00007536	82..00-00003080
110004+0000A113	81..00+00003839	82..00-00003080
110005+0000A114	81..00+00001241	82..00-00001344

Example 2: GSI16

Each word has 24 characters of which 16 characters are used for the data block.

Word 1	Word 2	Word 3
*110001+000000000PNC0055	21.002+0000000013384650	22.002+0000000005371500
*110002+000000000PNC0056	21.002+0000000012802530	22.002+0000000005255000
*110003+000000000PNC0057	21.002+0000000011222360	22.002+0000000005433800
*110004+000000000PNC0058	21.002+0000000010573550	22.002+0000000005817600
*110005+000000000PNC0059	21.002+0000000009983610	22.002+0000000005171400

GSI Word information

Pos.	Name	Description of values	Applicable for
1-2	Word Index (WI)		

Pos.	Name	Description of values	Applicable for
3	No significance	.: No information.	WI 11, WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87
4	Automatic index information	.: No information. 0: **<Compensator: Off>** 3: **<Compensator: On>**	WI 21, WI 22
5	Input mode	.: No information. 0: Measured values transferred from instrument 1: Manual input from keyboard 2: Measured value, **<Hz-Correction: On>**. 3: Measured value, **<Hz-Correction: Off>**. 4: Result calculated from functions	WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87

Pos.	Name	Description of values	Applicable for
6	Units	.: No information. 0: **<Distance Unit: Metre (m)>**, last digit 1 / 1000 m 1: **<Distance Unit: Us ft (ft)>,** last digit 1 / 1000 ft 2: **<Angle Unit: 400 gon>** 3: **<Angle Unit: 360 ° dec>** 4: **<Angle Unit: 360 ° ″ ′>**I 5: **<Angle Unit: 6400 mil>** 6: **<Distance Unit: Metre (m)>,** last digit 1 / 10000 m 7: **<Distance Unit: Us ft (ft)>,** last digit 1 / 10000 ft	WI 21, WI 22, WI 31, WI 81, WI 82, WI 83, WI 87
7	Sign	+: Positive value -: Negative value	WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87
8-15 8-23	Data	Data includes a sequence of 8 (16) numerical or alphanumerical characters. ☞ Certain data blocks are allowed to carry more than one value for example ppm/mm. This data is automatically transferred with the according sign before each single value.	WI 11, WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87

Pos.	Name	Description of values	Applicable for
16 24	Sepa- rating character	: Blank	WI 11, WI 21, WI 22, WI 31, WI 51, WI 81, WI 82, WI 83, WI 87

Output format - Pt,N,E,Ht,Date

Format

Point ID, Northing, Easting, Elevation, Date, Time <CR/LF>

Description of fields

The format settings are defined in **CONFIGURE Units & Formats**.

Field	Description
Point ID	Text describing the point identification
Northing	The northing coordinate.
Easting	The easting coordinate.
Elevation	The height coordinate.
Date	The measurement/origination date.
Time	The measurement/origination time.
<CR/LF>	**C**arriage **R**eturn **L**ine **F**eed

Example

2004,4997.635,6010.784,393.173,09/10/2001,16:34:12.2
2005,4997.647,6010.765,393.167,09/10/2001,16:34:12.4
2006,4997.657,6010.755,393.165,09/10/2001,16:34:12.7

Output format - Pt,E,N,Ht,Date

Format

This output format is identical to the Pt,N,E,Ht,Date format except the order of the Easting and Northing variables are reversed.

☞ Fields are always separated by a comma. A comma is never placed before the Checksum field. When information for a field is not available, the position in the data string is empty.

19.2 GeoCOM Mode

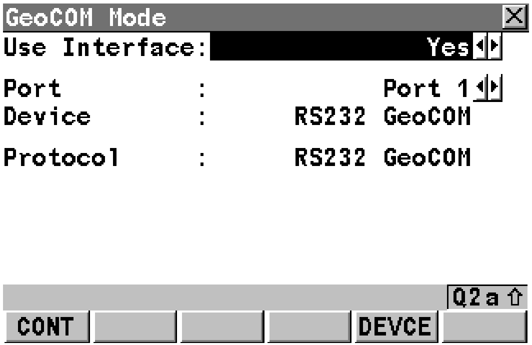
Description

The GeoCOM Mode permits communication of the Zoom80 with a Getac controller.

Access step-by-step

Step	Description
1.	Refer to "18.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**
2.	**CONFIGURE Interfaces** Highlight **GeoCOM Mode**.
3.	**EDIT (F3)** to access **CONFIGURE GeoCOM Mode**.

CONFIGURE GeoCOM Mode



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DEVCE (F5)
To create, select, edit or delete a device.

Description of fields

Field	Option	Description
<Use Inter-face:>	**Yes** or **No**	Activates the interface.
<Port:>	Output	Available if **<Use Interface: Yes>**. Port to be used.
<Device:>	Output	Available if **<Use Interface: Yes>**. Device to be used.
<Protocol:>	Output	Available if **<Use Interface: Yes>**. Protocol to be used.

Next step

IF a device is	THEN
not to be created or edited	**CONT (F1)** closes the screen and returns to the screen from where **CONFIGURE GeoCOM Mode** was accessed.
to be created or edited	**DEVCE (F5)** to create or edit a device.

19.3 Export Job

Description

- The Export Job interface allows data from a job to be exported from the instrument to an external device. Refer to "13.4 Exporting Data from a Job to another Device" for information on how to export data via RS232.
- The settings on this screen define the port and the device to which the data should be exported.

Access

Select **Main Menu: Config...\Interfaces...**. Highlight **Export Job**. **EDIT (F3)**.

OR

Select **Main Menu: Convert...\Export Data from Job**. Set **<Export To: RS232>**. **IFACE (F5)**.

CONFIGURE Export Job Interface

The availability of the fields depend on the setting for **<Device:>**.

CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DEVCE (F5)
To create, select, edit or delete a device.

Description of fields

Field	Option	Description
<Use Device:>	**Yes** or **No**	Activates the interface.
<Port:>	Output	Available if **<Use Interface: Yes>**. Port to be used.
<Device:>	Output	The device currently assigned to the selected port within the active configuration set. The device which is selected determines the availability of the next fields.

Next step

CONT (F1) returns to the screen from where **CONFIGURE Export Job Interface** was accessed.

20 Config...\Interfaces... - Controlling The Device

20.1 RS232

Description

RS232 is a standard serial communication method that is able to transfer data without the need for predefined time slots. RS232 can be used, with a Bluetooth housing, to provide a wireless connection to another Bluetooth enabled device, for example, a computer.

Configure RS232 connection step-by-step

Step	Description
1.	Refer to "18.2.2 Accessing CONFIGURE Interfaces" to access **CONFIGURE Interfaces**.
2.	In **CONFIGURE Interfaces** highlight an interface which has an RS232 device attached.
3.	**CTRL (F4)** to access **CONFIGURE RS232 Connection**.
4.	**CONFIGURE RS232 Connection** **<Device:>** The type of device highlighted when **CONFIGURE RS232 Connection** was accessed. **<Bluetooth:>** Some devices ask for the identification number of the Bluetooth. The identification number of GeoMax's Bluetooth is 0000. **<ID Address:>** Available for **<Bluetooth: Yes>**. The ID address of the Bluetooth device to be used.
	SRCH (F4) available for **<Bluetooth: Yes>**, to search for all available Bluetooth devices. If more than one Bluetooth device is found a list of available devices is provided.
5.	**CONT (F1)** returns to **CONFIGURE Interfaces**.

21 Tools...\Format Memory Device

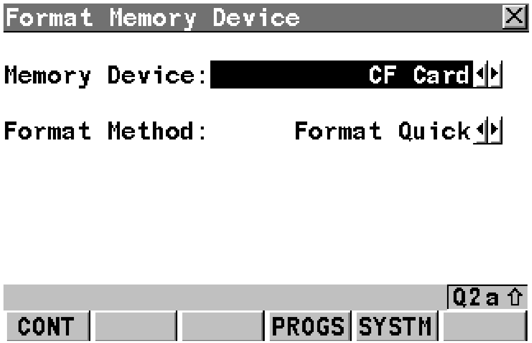
Description

Allows the CompactFlash card and the System RAM to be formatted. All data will be erased. Refer to "Appendix B Memory Types" for more information on the types of memory devices available.

Access

Select **Main Menu: Tools...\Format Memory Device**.

TOOLS Format Memory Device



CONT (F1)
To format a memory device and return to the screen from where this screen was accessed.

PROGS (F4)
To format the application programs memory.

SYSTM (F5)
To format System RAM memory.

Description of fields

Field	Option	Description
<Memory Device:>		The type of memory to be formatted.
	CF Card	For instruments without internal memory.

Field	Option	Description
	CF Card or **Internal Memeory**	For instruments with CompactFlash card and internal memory.
<Format Method:>	**Format Quick**	After formatting, data is not visible anymore but still exists on the memory device and is overwritten as and when required.
	Format Complete	Data is fully deleted.

Next step

IF	THEN
the CompactFlash card is to be formatted	**CONT (F1)** to format the memory device and return to **Zoom80 Main Menu**.
the application programs memory is to be formatted	**PROGS (F4)** to format the application programs memory. All loadable application programs are deleted.
the System RAM is to be formatted	**SYSTM (F5)** to format the System RAM.

☞ If the System RAM is formatted all system data such as user defined configuration sets and codelists will be lost.

22 Tools...\Transfer Objects...

Description

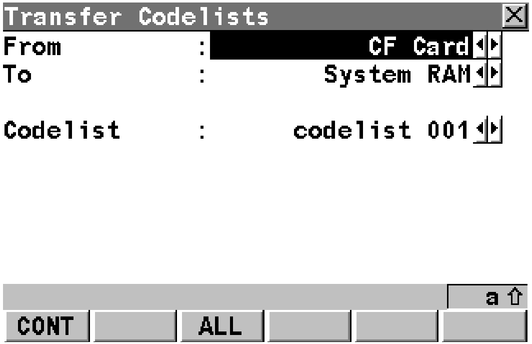
This chapter describes the basic procedure for transferring objects between the CompactFlash card and the System RAM. Refer to "Appendix C Directory Structure of the Memory Device" for information about file types and locations of files on the CompactFlash card.

Access

Select **Main Menu: Tools...\Transfer Objects...\XX**.

TOOLS Transfer XX

The available fields on the screen depend on the option selected in **Main Menu: Tools...\Transfer Objects...**.



CONT (F1)
To transfer an object and return to the screen from where this screen was accessed.

ALL (F3)
Available for some transfer object options. To transfer all objects.

Description of fields

Field	Option	Description
<From:>		Memory device to transfer object from.

Field	Option	Description
	CF card	Transfer from CompactFlash card.
	System RAM	Transfer from System RAM. Available unless object to transfer is a job.
	Internal Memory	Transfer from internal memory.
<To:>	Output	Memory device to transfer object to. Memory device not selected in **<From:>**.
<Codelist:>	Choicelist	To select the codelist to be transferred.
<Config Set:>	Choicelist	To select the configuration set to be transferred.
<Format File:>	Choicelist	To select the format files to be transferred.
<Job:>	Choicelist	To select the job to be transferred between CompactFlash card and internal memory.

Next step

IF all XX	THEN
are to be transferred	**ALL (F3)** transfers all objects in list.
are not to be transferred	**CONT (F1)** transfers selected object.

23 Tools...\Upload System Files...

23.1 Application Programs

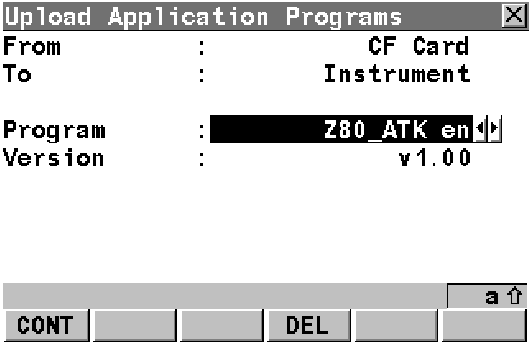
Description

Application program uploads are possible from the CompactFlash card to the application programs memory. These files are stored in the \SYSTEM directory of the memory device and use the extension *.a*.

Access

Select **Main Menu: Tools...\Upload System Files...\Application Programs**.

TOOLS
Upload Application Programs



CONT (F1)
To upload an application program and return to the screen from where this screen was accessed.

DEL (F4)
To delete an application program.

Description of fields

Field	Option	Description
<From:>	Output	Upload from CompactFlash card.

Field	Option	Description
<To:>	Output	Upload to application program memory.
<Program:>	Choicelist	List of program files stored on the CompactFlash card.
<Version:>	Output	Version of the program file chosen.

Next step

CONT (F1) uploads the selected application program.

23.2 System Languages

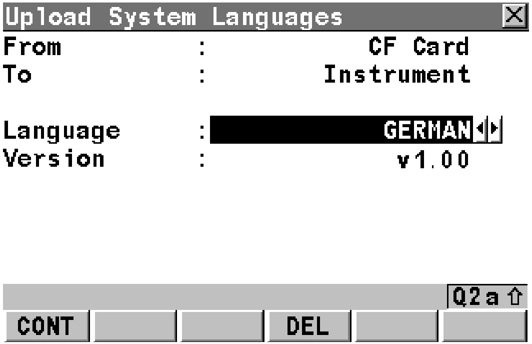
Description

System language uploads are possible from the CompactFlash card to the instrument. These files are stored in the \SYSTEM directory of the active memory device and use an extension that is individual to each language.

Access

Select **Main Menu: Tools...\Upload System Files...\System Languages**.

TOOLS Upload System Languages



CONT (F1)
To upload a system language and return to the screen from where this screen was accessed.

DEL (F4)
To delete a language from the System RAM.

Description of fields

Field	Option	Description
<From:>	Output	Upload from CompactFlash card.
<To:>	Output	Upload to the instrument.
<Language:>	Choicelist	List of language files stored on the CompactFlash card.

Field	Option	Description
<Version:>	Output	Version of the language file.

Next step

CONT (F1) uploads the selected language.

☞ It is not possible to have more than three language files stored on the instrument. English is always available as the default language and cannot be deleted.

23.3 Instrument Firmware

Description

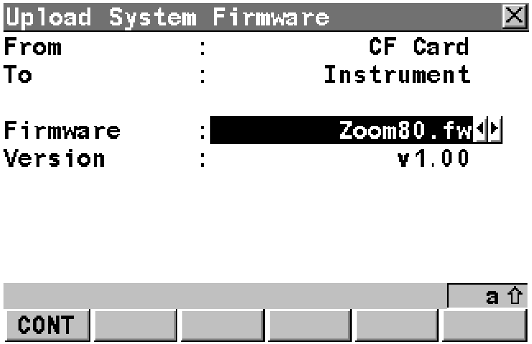
Firmware uploads are possible from the CompactFlash card to the instrument. These files are stored in the \SYSTEM directory of the active memory device and use the extension *.fw.

Firmware can be uploaded from GGO on a PC directly through a serial interface to the CompactFlash card in the instrument and from there to the instrument or the Getac.

Access

Select **Main Menu: Tools...\Upload System Files...\Instrument Firmware**.

TOOLS
Upload System Firmware



CONT (F1)
To upload firmware and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<From:>	Output	Upload from CompactFlash card.

Field	Option	Description
<To:>	Output	Upload to the instrument.
<Firmware:>	Choicelist	List of firmware files stored on the Compact-Flash card.
<Version:>	Output	Version of the firmware file.

Next step
CONT (F1) to upload firmware.

24 Tools...\Calculator

24.1 Overview

Description

The calculator can be used to perform the following arithmetic operations such as

- addition, subtraction, multiplication and division
- statistics
- trigonometry, hyperbolic trigonometry and calculations with Pi
- polar, rectangular and angle conversions
- powers, logs, roots and exponential functions.

Operating modes

The calculator has two operating modes - RPN mode and Standard mode.
The arithmetic operations available are identical, the difference lies in the way information is entered, stored and displayed on the screen.

Type	Description
RPN	**R**everse **P**olish **N**otation This operating mode was developed as a way of writing mathematical expressions without using parenthesis and brackets. Many scientific calculators, for example Hewlett Packard calculators, are implemented with this operating mode. Values are entered and kept in a working stack.
Standard	This operating mode is based on the principles of conventional pocket calculators. There is no stacking of values.

24.2 Accessing the Calculator

Access

Select **Main Menu: Tools...\Calculator**.

OR

Press a hot key configured to access the screen **TOOLS XX Calculator**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

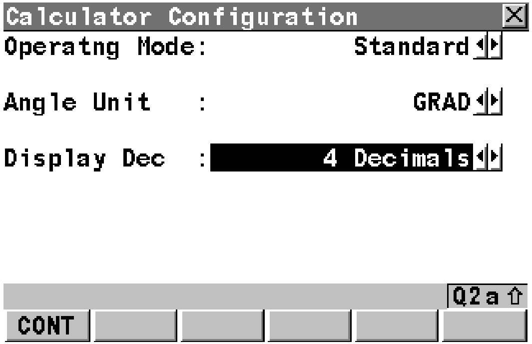
Press **CALC** in any screen when editing an input field for numeric characters, such as **<Azimuth:>** in **COGO Traverse Input**. Refer to "24.4.4 Calling and Closing the Calculator from an Input Field for Numeric Characters".

24.3 Configuring the Calculator

Access step-by-step

Step	Description
1.	Refer to "24.2 Accessing the Calculator" to access **TOOLS XX Calculator**.
2.	**SHIFT CONF (F2)** to access **TOOLS Calculator Configuration**.

TOOLS Calculator Configuration



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

Description of fields

Field	Option	Description
<Operatng Mode:>	**RPN**	The principle of, for example, Hewlett Packard calculators. Refer to "24.1 Overview" for more information. Refer to "24.4.1 RPN Mode" for a working example.

Field	Option	Description
	Standard	The principle of conventional pocket calculators. Refer to "24.1 Overview" for more information. Refer to "24.4.2 Standard Mode" for a working example.
<Angle Unit:>		The unit used for trigonometric functions in the calculator. The selection here is independent from the angle setting in **CONFIGURE Units & Formats**.
	DEG	Degrees
	RAD	Radians
	GRAD	Gon
<Display Dec:>	From **0 Decimals** to **10 Decimals**	The number of decimal places shown in **TOOLS Calculator**.

Next step

CONT (F1) confirms the selections made and returns to the screen from where **TOOLS Calculator Configuration** was accessed.

24.4 Using the Calculator

24.4.1 RPN Mode

Requirements

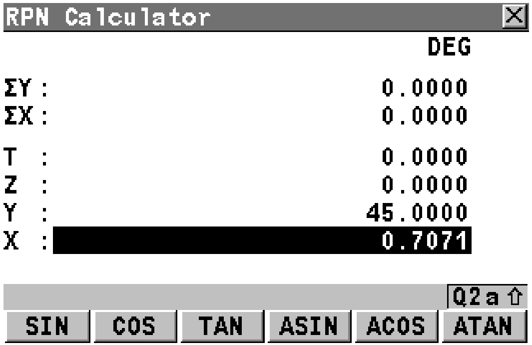
<Operatng Mode: RPN> in **TOOLS Calculator Configuration**.

Access

Refer to "24.2 Accessing the Calculator" to access **TOOLS RPN Calculator**.

TOOLS RPN Calculator

Refer to paragraph "Working example" for information about the operating principle.



The function keys **F1**-**F6** are allocated seven times. Using or the various allocations can be accessed. Refer to "24.4.3 Description of Softkeys" for information about the function keys.

Description of fields

Field	Option	Description
First field on the screen	Output	The unit used for trigonometric functions in the calculator as configured in **TOOLS Calculator Configuration**.

Field	Option	Description
	DEG	Degrees
	RAD	Radians
	GRAD	Gon
<ΣY:>	Output	The result of the sum or difference of values in **<Y:>** using **Σ+ (F1)** and **Σ- (F2)**.
<ΣX:>	Output	The result of the sum or difference of values in **<X:>** using **Σ+ (F1)** and **Σ- (F2)**.
<T:>	Output	Third stack. After an operation, the value from **<Z:>** is written here.
<Z:>	Output	Second stack. After an operation, the value from **<Y:>** is written here.
<Y:>	Output	First stack. After an operation, the value from **<X:>** is written here.
<X:>	User input	The value for the next operation.

Next step
SHIFT DONE (F4) returns to **Zoom80 Main Menu**.

Working example

Task: Calculate (3 + 5) / (7 + 6).

Step	Description
1.	Type in 3.
2.	**ENTER**

Step	Description
3.	Type in 5.
4.	**ENTER**
☞	**<Y: 3>**, **<X: 5>**
5.	**+ (F1)**
☞	**<X: 8>**
6.	Type in 7.
7.	**ENTER**
☞	**<Y: 8>**, **<X: 7>**
8.	Type in 6.
9.	**ENTER**
☞	**<Z: 8>**, **<Y: 7>**, **<X: 6>**
10.	**+ (F1)**
☞	**<Y: 8>**, **<X: 13>**
11.	**/ (F4)**
☞	**<X: 0.61538>**

24.4.2 Standard Mode

Requirements

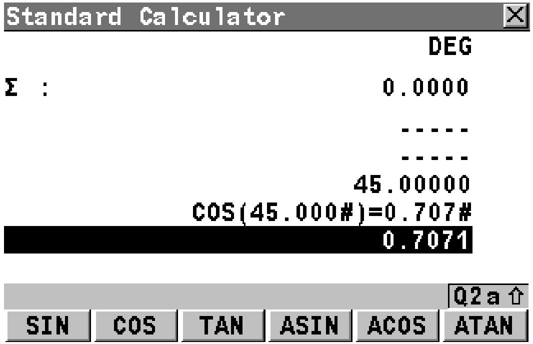
<Operatng Mode: Standard> in **TOOLS Calculator Configuration**.

Access

Refer to "24.2 Accessing the Calculator" to access **TOOLS Standard Calculator**.

TOOLS Standard Calculator

Refer to paragraph "Working example" for information about the operating principle.



The function keys **F1**-**F6** are allocated seven times. Using or the various allocations can be accessed. Refer to "24.4.3 Description of Softkeys" for information about the function keys.

Description of fields

Field	Option	Description
First field on the screen	Output	The unit used for trigonometric functions in the calculator as configured in **TOOLS Calculator Configuration**.
	DEG	Degrees

Field	Option	Description
	RAD	Radians
	GRAD	Gon
<Σ:>	Output	The result of the sum or difference of values in the last field on the screen using **Σ+ (F1)** and **Σ- (F2)**.
Third to sixth field on the screen	Output	Previously entered value OR Latest operation including result # indicates that the value is cut after the third decimal.
Last field on the screen	User input	The value for next operation or result from latest operation.

Next step

SHIFT DONE (F4) returns to **Zoom80 Main Menu**.

Working example

Task: Calculate (3 + 5) / (7 + 6).

Step	Description
1.	Type in 3.
2.	**ENTER**
3.	**+ (F1)**
4.	Type in 5.
5.	**ENTER**
☞	Last field on the screen displays **8.00000**.
6.	▲ such that **STO (F1)** is visible.
7.	**STO (F1)**
8.	▼ such that **+ (F1)** is visible.
9.	Type in 7.
10.	**ENTER**
11.	**+ (F1)**
12.	Type in 6.
13.	**ENTER**
☞	Last field on the screen displays **13.00000**.
☞	Remember **13.00000**.
14.	▲ such that **REC (F2)** is visible.
15.	**REC (F2)** to recall 8.00000.
16.	**ENTER**

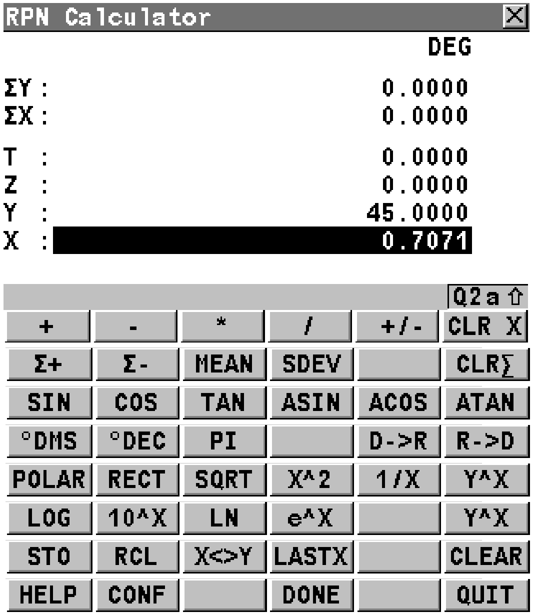
Step	Description
17.	such that / **(F4)** is visible.
18.	**/ (F4)**
19.	Type in 13.
20.	**ENTER**
	Last field on the screen displays **0.61538**.

24.4.3 Description of Softkeys

Overview of softkeys

The softkeys shown and described are those of **<Operatng Mode: RPN>**. Most of the softkeys are identical and their functionality is similar to that for **<Operatng Mode: Standard>**.

The function keys **F1**-**F6** are allocated seven times with softkeys. Using or the various allocations can be accessed.



Description of softkeys

First level

+	-	*	/	+/-	CLR X

+ (F1)
To add **<X:>** and **<Y:>**.

- (F2)
To subtract **<X:>** from **<Y:>**.

*** (F3)**
To multiply **<X:>** by **<Y:>**.

/ (F4)
To divide **<Y:>** by **<X:>**.

+/- (F5)
To change between positive and negative algebraic sign for **<X:>**.

CLR X (F6)
To clear **<X:>**.

▽ to access the **Second level**

Σ+	Σ-	MEAN	SDEV		CLRΣ

Σ+ (F1)
To add **<X:>** to **<ΣX:>** and **<Y:>** to **<ΣY:>**.

Σ- (F2)
To subtract **<X:>** from **<ΣX:>** and **<Y:>** from **<ΣY:>**.

MEAN (F3)
To calculate the mean **<ΣX>**.

SDEV (F4)
To calculate the standard deviation for **<ΣX>**.

CLRΣ (F6)
To clear **<ΣX>** and **<ΣX>**.

to access the **Third level**

SIN	COS	TAN	ASIN	ACOS	ATAN

SIN (F1)
To calculate sine of **<X:>**.

COS(F2)
To calculate cosine of **<X:>**.

TAN (F3)
To calculate tangent of **<X:>**.

ASIN (F4)
To calculate arcsine of **<X:>**.

ACOS (F5)
To calculate arccosine of **<X:>**.

ATAN (F6)
To calculate arctangent of **<X:>**.

to access the **Fourth level**

°DMS	°DEC	PI		D->R	R->D

°DMS (F1)
To convert decimal degrees into dd.mm.ss.

°DEC(F2)
To convert dd.mm.ss into decimal degrees.

PI (F3)
To insert **<X: 3.1415926536>**. The number of decimals depends on the selection for **<Display Dec:>** in **TOOLS Calculator Configuration**.

D -> R (F5)
To convert degrees into radians.

R -> D (F6)

To convert radians into degrees.

to access the **Fifth level**

POLAR (F1)

Conversion of rectangular coordinates into polar coordinates. The y coordinate must be visible in **<Y:>** and the x coordinate in **<X:>** when pressing this key. The angle is displayed in **<Y:>** and the distance in **<X:>**.

RECT(F2)

Conversion of polar coordinates into rectangular coordinates. The angle must be visible in **<Y:>** and the distance in **<X:>** when pressing this key. The y coordinate is displayed in **<Y:>**, the x coordinate in **<X:>**.

SQRT (F3)

To calculate $\sqrt{}$ **<X:>**.

X^2 (F4)

To calculate **<X:>**^{2}.

1/X (F5)

To inverse **<X:>**.

Y^X (F6)

To calculate $\mathbf{<Y:>}^{\mathbf{<X:>}}$.

▼ to access the **Sixth level**

LOG	10^X	LN	e^X		Y^X

LOG (F1)
To calculate the $log_{10}^{<X:>}$.

10^X(F2)
To calculate $10^{<X:>}$.

LN (F3)
To calculate the $log_{e}^{<X:>}$.

e^X (F4)
To calculate $e^{<X:>}$.

Y^X (F6)
To calculate $<Y:>^{<X:>}$.

▼ to access the **Seventh level**

STO	RCL	X<>Y	LASTX		CLEAR

STO (F1)
To store **<X:>** to the memory. Up to ten values can be stored.

RCL (F2)
To recall a value for **<X:>** from the memory. Up to ten values can be recalled.

X<>Y (F3)
To swap the values for **<X:>** and **<Y:>**.

LASTX (F4)
To recall the last **<X:>** before recent calculation.

CLEAR (F6)
To delete everything.

SHIFT to access the second level of function keys

SHIFT CONF (F2)
To configure the calculator.

SHIFT DONE (F4)
To return to **Zoom80 Main Menu**.

24.4.4 Calling and Closing the Calculator from an Input Field for Numeric Characters

COGO traverse calculation is used as example.

Call and close calculator step-by-step

Step	Description	Refer to chapter
1.	Select **Main Menu: Programs...\COGO** to access the screen **COGO COGO Begin**.	
2.	**COGO COGO Begin** Check the settings.	
3.	**CONT (F1)** to access **COGO COGO Menu**.	
4.	**COGO COGO Menu** Highlight **Traverse**.	
5.	**CONT (F1)** to access **COGO Traverse Input**.	
6.	**COGO Traverse Input** Highlight **<Azimuth:>**.	
7.	**ENTER**	
8.	**CALC (F5)** to access **TOOLS XX Calculator**.	
☞	If a value had already been typed in for **<Azimuth:>**, this value is taken over into the input field in **TOOLS XX Calculator**.	
9.	**TOOLS XX Calculator**	

Step	Description	Refer to chapter
	Perform the calculations.	24.4.1, 24.4.2
10.	**SHIFT DONE (F4)** to return to **COGO Traverse Input**.	
☞	The calculated value is taken over for **<Azimuth:>**.	

25 Tools...\File Viewer

Description

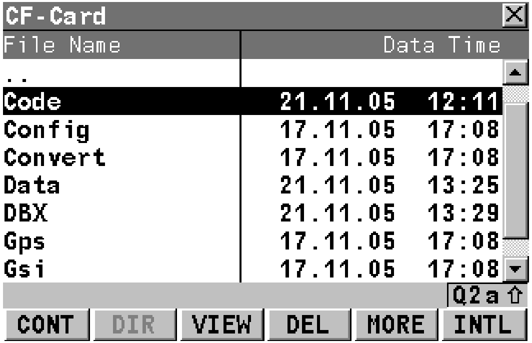
Allows ASCII files on the memory device to be viewed. The ASCII file can have up to 500 KB. Refer to "Appendix C Directory Structure of the Memory Device" for more information on the contents of folders on the memory device.

The \DBX directory cannot be accessed to view files.

Access

Select **Main Menu: Tools...\File Viewer**.

TOOLS Device\Directory



CONT (F1)
To access the highlighted directory or to view the highlighted file.

DIR (F2)
Available for a directory or **..** being highlighted. To access the highlighted directory or to move up one directory.

VIEW (F3)
Available for a file being highlighted. To view the highlighted file. Accesses **TOOLS View File: File Name**. Refer to "TOOLS View File: File Name".

DEL (F4)
Available for a file being highlighted. To delete the highlighted file.

MORE (F5)
To display information about the size of a directory or file.

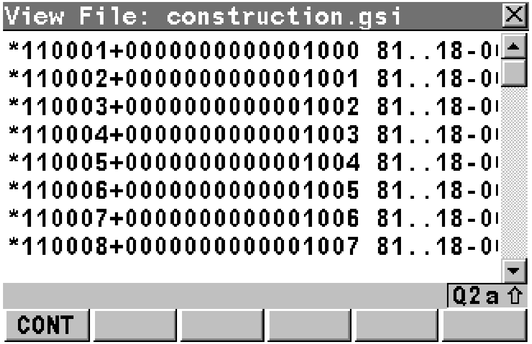
Description of columns

Column	Description
First	Directories and files are displayed if available. The file extension is shown for files. \ at the beginning of a line indicates a directory. .. is displayed at the top of the list if a directory has been accessed.
Second	Date of the directory or file.
Third	Time of the directory or file.

Next step

IF	THEN
the screen is to be quit	**ESC** to return to **Zoom80 Main Menu**.
a directory is to accessed	highlight the directory and **DIR (F2)**.
a file is to be viewed	highlight the file and **VIEW (F3)**. Refer to "TOOLS View File: File Name".

TOOLS
View File: File Name



CONT (F1)
To return to the screen from where this screen was accessed.

Keys

Keys	Function
	Moves up.
	Moves down.
	Moves right.
	Moves left.

Next step

CONT (F1) returns to the screen from where **TOOLS View File: File Name** was accessed.

26 Tools...\Licence Keys

Description

- A licence key can be used to activate application programs and protected options.
- A licence key file can be uploaded to the instrument. To upload a licence key file the file should be located on the \SYSTEM directory of the CompactFlash card. Licence key files use the naming convention L_123456.key, where 123456 is the instrument serial number.
- Licence keys can also be typed in manually in **Main Menu: Tools...\Licence Keys** or the first time the application program is started.

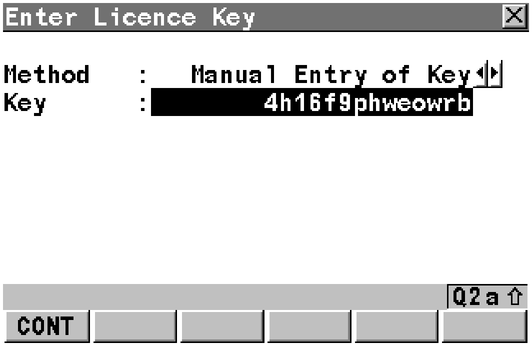
Access

Select **Main Menu: Tools...\Licence Keys**.

OR

Select an application program not yet activated.

TOOLS
Enter Licence Key



CONT (F1)
To accept changes and return to **Zoom80 Main Menu** or continue with application program.

SHIFT DEL (F4)
To delete all licence keys on the instrument.

Description of fields

Field	Option	Description
<Method:>		The method used to input the licence key to activate the application program or the protected options.
	Upload Key File	The licence key file is uploaded from the CompactFlash card. The licence key file must be stored in the \SYSTEM directory on the CompactFlash card.
	Manual Entry of Key	Allows the licence key to be typed in manually.
<Key:>	User input	Available for **<Method: Manual Entry of Key>**. The licence key required to activate an application program. Entry is not case sensitive.

Next step
CONT (F1) returns to **Zoom80 Main Menu** or continues with selected application program.

27 Tools...\Check & Adjust

27.1 Overview

Description

GeoMax instruments are manufactured, assembled and adjusted to the best possible quality. Quick temperature changes, shock or stress can cause deviations and influence the instrument accuracy.

It is therefore recommended to check and adjust the instrument from time to time. This can be done in the field by running through specific measurement procedures. The procedures are guided and have to be followed carefully and precisely as described in the following chapters. Some other instrument errors and mechanical parts can be adjusted mechanically.

Electronic adjustment

The following instrument errors can be checked & adjusted electronically:

l, t	Compensator longitudinal and transversal index errors
i	Vertical index error, related to the standing axis
c	Hz collimation error, also called line of sight error
a	Tilting axis error
Aim	Aim360 zero point error for Hz and V - option

Every angle measured in the daily work is corrected automatically if the compensator and the Hz-corrections are activated in the instrument configuration. Select **Main Menu: Config...\Instrument Settings...\Compensator** to check the settings.

The results from check and adjust are displayed as errors but used with the opposite sign as corrections when applied to measurements.

Mechanical adjustment

Refer to the GeoMax Zoom80 User Manual for details.

Precise measurements

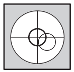
To get precise measurements in the daily work, it is important:

- To check and adjust the instrument from time to time.
- To take high precision measurements during the check and adjust procedures.
- To measure targets in two faces. Some of the instrument errors are eliminated by averaging the angles from both faces.
- To follow the four advices below.

☞ During the manufacturing process, the instrument errors are carefully determined and set to zero. As mentioned above, these errors can change and it is highly recommended to redetermine them in the following situations:

- Before the first use
- Before every high precision survey
- After rough or long transportations
- After long working periods
- After long storage periods
- If the temperature difference between current environment and the temperature at the last calibration is more than 20°C

☞



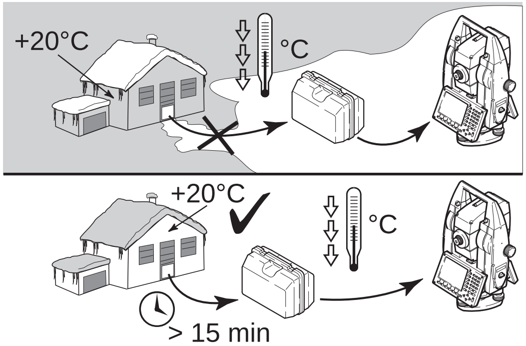
Before determining the instrument errors, the instrument has to be levelled up using the electronic level. **SHIFT F12** to access **STATUS Level & Laser Plummet**, Refer to "28.7 STATUS: Level & Laser Plummet". The tribrach, the tripod and the underground should be very stable and secure from vibrations or other disturbances.

☞

The instrument should be protected from direct sunlight in order to avoid thermal warming in general and especially on one side of the instrument housing.

It is also recommended to avoid strong heat shimmer and air turbulences.The best conditions can be found usually early in the morning and with overcast sky.

☞



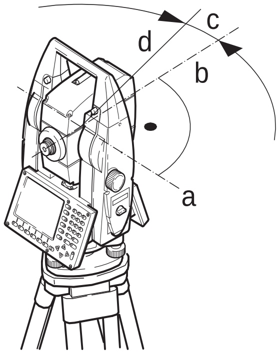
Before starting to work, the instrument has to become acclimatised to the ambient temperature. Approximately two minutes per °C temperature difference from storage to working environment but at least 15 min should be taken into account.

27.2 Details on Instrument Errors

General

Instrument errors occur, if the standing axis, the tilting axis and the line of sight are not precisely perpendicular to each other.

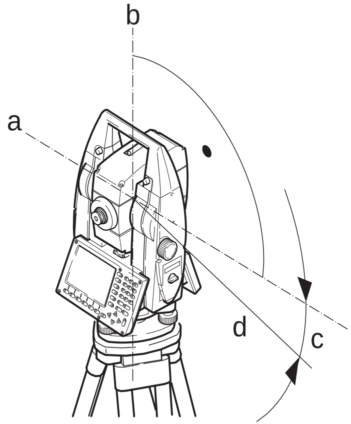
Hz collimation error (c)



a) Tilting axis
b) Line perpendicular to tilting axis
c) Hz collimation error (c), also called line of sight error
d) Line of sight

The Hz collimation error (c) is also called line of sight error. It is caused by the deviation between the optical line of sight, which means the direction in which the crosshairs points and the line perpendicular to the tilting axis. This error affects all Hz readings and increases with steep sightings.

Tilting axis error (a)

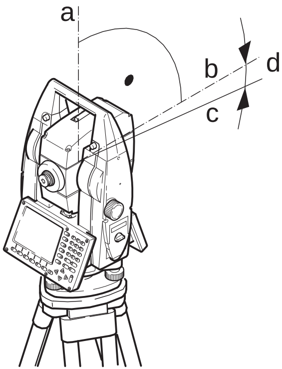


a) Axis perpendicular to the vertical axis
b) Mechanical vertical axis of the instrument, also called standing axis
c) Tilting axis error
d) Tilting axis

The tilting axis error (a) is caused by the deviation between the mechanical tilting axis and the line perpendicular to the vertical axis.

This error affects Hz angles. The affection is 0 in the horizon and increases with steep sights. To determine this error, it is necessary to point to a target located significantly below or above the horizontal plane. To avoid influences from the Hz collimation error (c), this has to be determined prior to the tilting axis error.

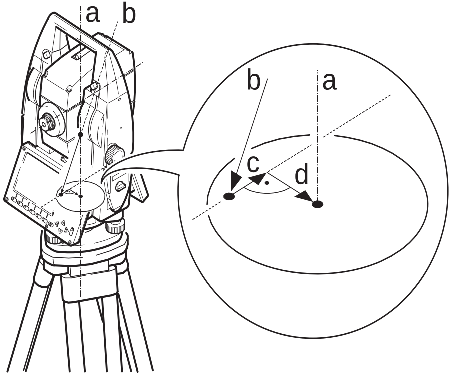
Vertical index error (i)



a) Mechanical vertical axis of the instrument, also called standing axis
b) Axis perpendicular to the vertical axis
c) V = 90° reading in a specific face
d) Vertical index error

A vertical index error (i) exists, if the 0° mark of the vertical circle reading doesn’t coincide with the mechanical vertical axis of the instrument, also called standing axis.
The V index error (i) is a constant error that affects all vertical angle readings.

Compensator index errors (l, t)



a) Mechanical vertical axis of the instrument, also called standing axis
b) Plumb line
c) Longitudinal component (l) of the compensator index error
d) Transversal component (t) of the compensator index error

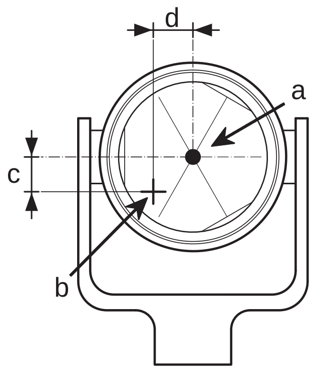
The compensator index errors (l, t) occur, if the vertical axis of the instrument and the plumbline are parallel but the zero points of the compensator and the circular level do not coincide. The calibration procedure electronically adjusts the zero point of the compensator.

The plane of the dual axis compensator of the Zoom80 is defined by a longitudinal component in direction of the telescope and a transversal component perpendicular to the telescope.

The longitudinal compensator index error (l) has a similar effect as the vertical index error and affects all vertical angle readings.

The transversal compensator index error (t) is similar to the tilting axis error. The effect of this error to the Hz angle readings is 0 at the horizon and increases with steep sightings.

Aim360 collimation errors



a) Centre of prism
b) Crosshairs
c) V component of Aim360 collimation error
d) Hz component of Aim360 collimation error

The Aim360 collimation error is the angular divergence between the line of sight, which means the direction in which the crosshairs point, and the Aim360 CCD camera axis, which detects the centre of the prism. Hz and V angles are corrected by the Hz and V components of the Aim360 calibration errors to measure exactly to the centre of the prism.

☞ Note, that even after adjustment of the Aim360, the crosshairs might not be positioned exactly on the centre of the prism after an Aim360 search. This is a normal effect. To speed up the Aim360 search, the telescope is not positioned exactly on the centre of the prism. The small rest deviations, the Aim360 offsets, are measured individually for each measurement and corrected electronically. This means that the Hz- and V- angles are corrected twice: first by the determined Aim360 errors for Hz and V and then by the individual small deviations of the current pointing, the Aim360 offsets.

Summary of errors to be adjusted electronically

Instrument error	Effects Hz	Effects V	Elimination with two face measurement	Automatically corrected with proper adjustment
c - Hz collimation error	✓	-	✓	✓
a - Tilting axis error	✓	-	✓	✓
l - Compensator index error	-	✓	✓	✓
t - Compensator index error	✓	-	✓	✓
i - V-Index error	-	✓	✓	✓
Aim360 Collimation error	✓	✓	-	✓

27.3 Accessing Check & Adjust Menu

Access

Select **Main Menu: Tools...\Check & Adjust...**

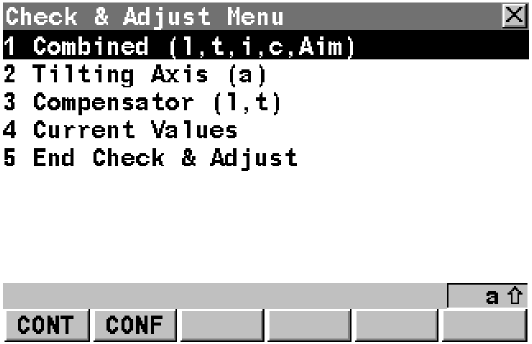
OR

Press a hot key configured to access the screen **TOOLS Check & Adjust Menu**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

TOOLS Check & Adjust Menu



CONT (F1)

To select the highlighted option and to continue with the subsequent screen.

CONF (F2)

To access the **TOOLS Configuration** screen. Refer to "27.4 Configure Check & Adjust".

Description of the Check & Adjust functions

Function	Description	Refer to chapter
Combined (l,t,i,c,Aim)	To determine the l, t, i, c and Aim360 instrument errors.	27.5

Function	Description	Refer to chapter
Tilting Axis (a)	To determine the tilting axis (a) error.	27.6
Compensator (l,t)	To determine the compensator (l, t) errors.	27.7
Current Values	To view the current instrument errors	27.8
End Check & Adjust	To exit the **TOOLS Check & Adjust Menu**.	

Next step

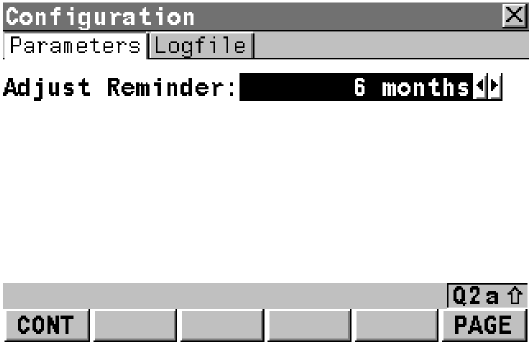
IF the task is to	THEN
determine the instrument errors	select one of the three available check and adjust procedures: **Combined (l, t, i, c, Aim)**, **Tilting Axis (a)** or **Compensator (l, t)**.
adjust the circular level	Refer to "27.9 Adjusting the Circular Level of the Instrument and Tribrach".
inspect the laser plummet	Refer to "27.11 Inspecting the Laser Plummet of the Instrument".
adjust the tripod	Refer to "27.12 Servicing the Tripod".
to end check and adjust	select **End Check & Adjust**.

27.4 Configure Check & Adjust

Access step-by-step

Step	Description
1.	Refer to "27.3 Accessing Check & Adjust Menu" to access **TOOLS Check & Adjust Menu**.
2.	**CONF (F2)** to access **TOOLS Configuration**.

TOOLS Configuration, Parameters page



CONT (F1)
To accept the settings and to return to the screen **TOOLS Check & Adjust Menu**

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Adjust Reminder:>	**2 weeks, 1 month, 3 months, 6 months, 12 months** or	A reminder message is displayed each time the instrument is turned on if one or more adjustment values were determined longer ago than the time specified with this parameter. This helps to redetermine the instrument errors on a regular basis.
	Never	A reminder message to readjust the instrument is never displayed. This setting is not recommended.

Next step

PAGE (F6) changes to the **Logfile** page.

TOOLS Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.

Field	Option	Description
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step
PAGE (F6) changes back to the **Parameters** page.

27.5 Combined Adjustment (l, t, i, c and Aim)

Access step-by-step

Step	Description
1.	Refer to "27.3 Accessing Check & Adjust Menu" to access **TOOLS Check & Adjust Menu**.
2.	In **TOOLS Check & Adjust Menu** highlight **Combined (l,t,i,c,Aim)**.
3.	**CONT (F1)** to access **TOOLS Combined I**.

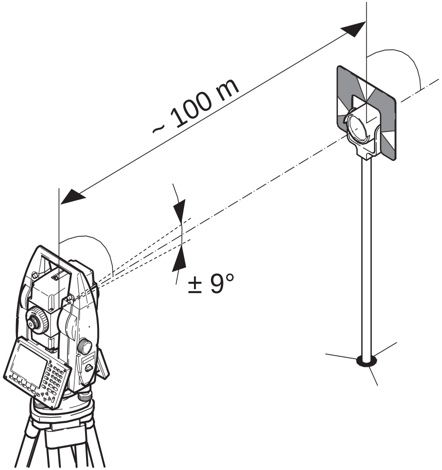
Description

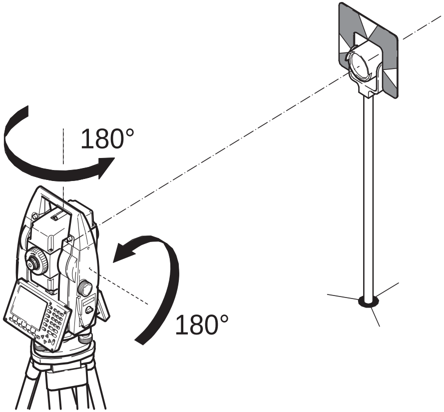
The combined adjustment procedure determines the following instrument errors in one process:

l, t	Compensator longitudinal and transversal index errors
i	Vertical index error, related to the standing axis
c	Hz collimation error, also called line of sight error
Aim Hz	Aim360 zero point error for Hz angle - option
Aim V	Aim360 zero point error for V angle - option

Combined procedure step-by-step

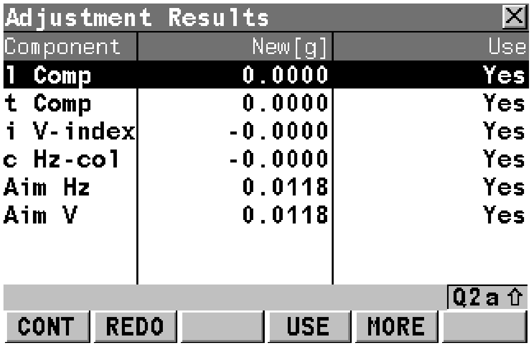
Step	Description
☞	Before determining the instrument errors, the instrument has to be: • levelled up using the electronic level • protected from direct sunlight • acclimatised to the ambient temperature, approximately two minutes per °C difference compared to the storage place. • Refer to "27.1 Overview" paragraph "Precise measurements" for more details.
1.	**TOOLS Check & Adjust Menu** Select the option **Combined (l,t,i,c,Aim)**
2.	**TOOLS Combined I** **<Aim Adjust: On>** Includes the determination of the Aim, Hz and V adjustment values. ☞ It is recommended to use a clean GeoMax circular prism as target. Do not use a 360° prism. **<Aim Adjust: Off>** Aim Hz and V adjustment value determination is not included. A prism is not necessarily required to run the procedure.

Step	Description	
3.		Aim the telescope accurately at a target at a distance of about 100 m. The target must be positioned within ± 9°/± 10 gon of the horizontal plane ☞ The procedure can be started in any telescope face. ☞ The fine pointing has to be performed manually in both faces.

Step	Description
4.	**MEAS (F1)** to measure and to continue to the next screen.  Motorised instruments change automatically to the other face.
5.	**TOOLS Combined II** **MEAS (F1)** to measure the same target in the other face and to calculate the instrument errors.
☞	If one or more errors are bigger than the predefined limits, the procedure has to be repeated. All measurements of the current run are rejected and are not averaged with the results from previous runs.
6.	**TOOLS Adjustment Accuracy** **<No. of Meas:>** Shows the number of runs executed. One run consists of a measurement in face I and face II.

Step	Description
	All other fields display the standard deviations of the determined adjustment errors. The standard deviations can be calculated from the second run onwards.
	It is recommended to measure at least two runs.
7.	**MEAS (F5)** if more runs have to be added. Continue with step 2. OR **CONT (F1)** to accept the measurements and to access **TOOLS Adjustment Results**. No more runs can be added later.

TOOLS Adjustment Results



CONT (F1)
To accept and store the new determined instrument errors, where **Yes** is set in the Use column. Writes to or appends to an existing logfile, if the logfile recording has been enabled. Refer to "27.4 Configure Check & Adjust".

USE (F4)
To set **Yes** or **No** in the **Use** column for the highlighted set.

MORE (F5)
To view additional information about the current used old instrument errors.

REDO (F2)
To reject all results and to repeat the complete check and adjust procedure. Refer to step 2. of paragraph "Combined procedure step-by-step".

Description of columns and fields

Column	Option	Description
New [g]	**-----**	Shows the new determined and averaged instrument errors. The unit is displayed in [].
Use	**Yes** **No**	Stores the new adjustment error. Keeps the currently used error active on the instrument and rejects the new one.
Old [g]	**-----**	Shows the old adjustment errors, which are currently valid on the instrument. The unit is displayed in [].

Next step

IF the results are	THEN
to be stored	**CONT (F1)** overwrites the old adjustment errors with the new ones, if **Yes** is set in the **Use** column.
to be determined again	**REDO (F2)** rejects all new determined adjustment values and repeats the whole procedure. Refer to step 2. of paragraph "Combined procedure step-by-step".

27.6 Tilting Axis Adjustment (a)

Access step-by-step

Step	Description
1.	Refer to "27.3 Accessing Check & Adjust Menu" to access **TOOLS Check & Adjust Menu**.
2.	In **TOOLS Check & Adjust Menu** highlight **Tilting Axis (a)**.
3.	**CONT (F1)** to access **TOOLS Tilting-Axis Adjustment I**.

Description

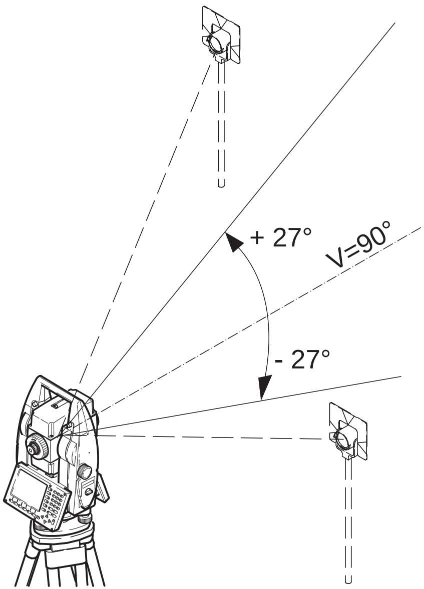
This procedure determines the following instrument error:

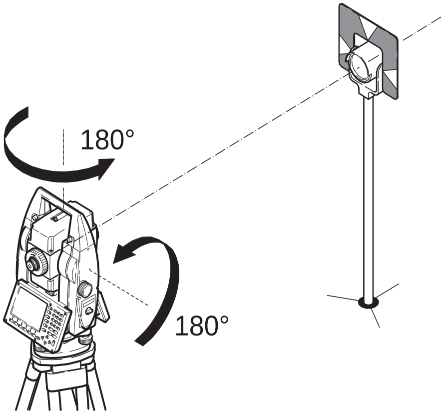
a Tilting axis error

Tilting axis adjustment step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

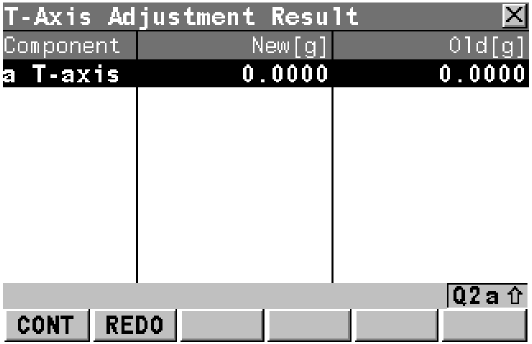
Step	Description	Refer to chapter
☞	Before determining the tilting axis error, the instrument has to be: • levelled up using the electronic level • protected from direct sunlight • acclimatised to the ambient temperature, approximately two minutes per °C difference compared to the storage place. • The Hz collimation error has to be determined before.	27.1, 27.5

Step	Description	Refer to chapter
1.	**TOOLS Check & Adjust Menu** Select the option: **Tilting Axis (a)**	
2.	**TOOLS Tilting-Axis Adjustment I**  Aim the telescope accurately at a target at a distance of about 100 m. For distances less than 100 m make sure to precisely point to the target. The target must be positioned within at least 27°/30 gon above or beneath the horizontal plane. ☞ The procedure can be started in any telescope face. ☞ The fine pointing has to be performed manually in both faces.	

Step	Description	Refer to chapter
3.	**MEAS (F1)** to measure and to continue to the next screen.  Motorised instruments change automatically to the other face.	
4.	**TOOLS Tilting Axis Adjustment II** **MEAS (F1)** to measure the same target in the other face and to calculate the tilting axis error.	
☞	If the error is bigger than the predefined limit, the procedure has to be repeated. The measurements of the current run are then rejected and not averaged with the results from previous runs.	
5.	**TOOLS T-Axis Adjustment Accuracy** **<No. of Meas:>** Shows the number of runs executed. One run consists of a measurement in face I and face II.	

Step	Description	Refer to chapter
	<σ a T-axis:> shows the standard deviation of the determined tilting axis error. The standard deviation can be calculated from the second run onwards.	
☞	It is recommended to measure at least 2 runs.	
6.	**MEAS (F5)** if more runs have to be added. Continue with step 2. OR **CONT (F1)** to accept the measurements and to access **TOOLS T-Axis Adjustment Result**. No more runs can be added later.	

TOOLS
T-Axis Adjustment Result



CONT (F1)
To accept and record the new determined tilting axis error. Writes to or appends to an existing logfile, if the logfile recording has been enabled. Refer to "27.4 Configure Check & Adjust".

REDO (F2)
To reject the result and to repeat the complete check and adjust procedure. Refer to step 2. of paragraph "Tilting axis adjustment step-by-step".

Description of columns and fields

Column	Option	Description
New [g]	**-----**	Shows the new determined and averaged tilting axis error. The unit is displayed in [].
Old [g]	**-----**	Shows the old instrument error, which is currently valid on the instrument. The unit is displayed in [].

Next step

IF the result is	THEN
to be stored	**CONT (F1)** overwrites the old tilting axis error with the new one.
to be determined again	**REDO (F2)** rejects the new determined tilting axis error and repeats the whole procedure. Refer to step 2. of paragraph "Tilting axis adjustment step-by-step".

27.7 Compensator Adjustment (l, t)

Access step-by-step

Step	Description
1.	Refer to "27.3 Accessing Check & Adjust Menu" to access **TOOLS Check & Adjust Menu**.
2.	In **TOOLS Check & Adjust Menu** highlight **Compensator (l,t)**.
3.	**CONT (F1)** to access **TOOLS Compensator Adjustment**.

Description

The compensator adjustment procedure determines the following instrument errors:

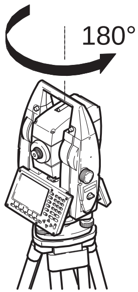
l Compensator longitudinal index error

t Compensator transversal index error

Compensator index adjustment step-by-step

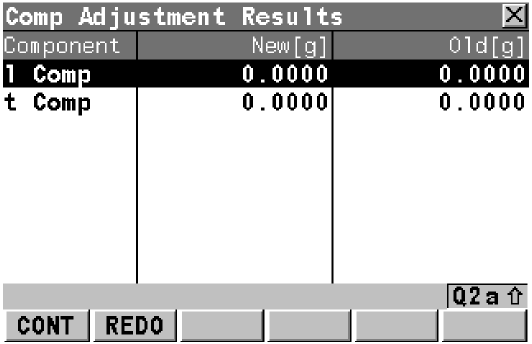
The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
☞	Before determining the compensator index errors, the instrument has to be: • levelled up using the electronic level • protected from direct sunlight • acclimatised to the ambient temperature, approximately two minutes per °C difference compared to the storage place.	27.1

Step	Description	Refer to chapter
1.	**TOOLS Check & Adjust Menu** Select the option: **Compensator (l, t)**	
2.	**TOOLS Compensator Adjustment** **MEAS (F1)** to measure the first face. No target has to be aimed at.  Motorised instruments change to the other face and release a measurement automatically.	
	If one or more errors are bigger than the predefined limits, the procedure has to be repeated. All measurements of the current run are rejected and are not averaged with the results from previous runs.	
3.	**TOOLS Comp Adjustment Accuracy** **<No. of Meas:>** Shows the number of runs executed. One run consists of a measurement in face I and face II.	

Step	Description	Refer to chapter
	<σ l Comp:> and **<σ t Comp:>** show the standard deviations of the determined adjustment errors. The standard deviations can be calculated from the second run onwards.	
	It is recommended to measure at least two runs.	
4.	**MEAS (F5)** if more runs have to be added. Continue with step 2. OR **CONT (F1)** to accept the measurements and to access **TOOLS Comp Adjustment Results**. No more runs can be added later.	

TOOLS Comp Adjustment Results



CONT (F1)
To accept and record the new determined instrument errors. Writes to or appends to an existing logfile, if the logfile recording has been enabled. Refer to "27.4 Configure Check & Adjust".

REDO (F2)
To reject all results and to repeat the complete check and adjust procedure. Refer to step 2. of paragraph "Compensator index adjustment step-by-step".

Description of columns and fields

Column	Option	Description
New [g]	**-----**	Shows the new determined and averaged instrument errors. The unit is displayed in [].
Old [g]	**-----**	Shows the old instrument errors, which are currently valid on the instrument. The unit is displayed in [].

Next step

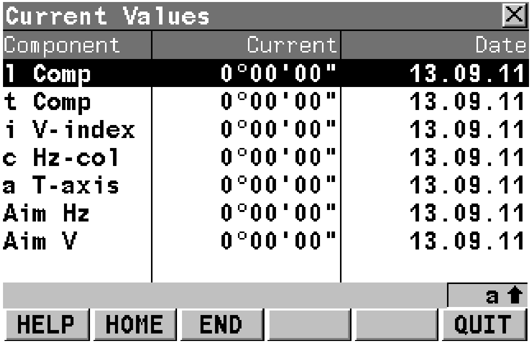
IF the results are	THEN
to be stored	**CONT (F1)** overwrites the old instrument errors with the new ones.
to be determined again	**REDO (F2)** rejects the new determined instrument errors and repeats the whole procedure. Refer to step 2. of paragraph "Compensator index adjustment step-by-step".

27.8 Current Instrument Errors

Access

Step	Description
1.	Refer to "27.3 Accessing Check & Adjust Menu" to access **TOOLS Check & Adjust Menu**.
2.	In **TOOLS Check & Adjust Menu** highlight **Current Values**.
3.	**CONT (F1)** to access **TOOLS Current Values**.

TOOLS Current Values



CONT (F1)
To return to the **TOOLS Check & Adjust Menu** screen. Refer to "27.3 Accessing Check & Adjust Menu".

MORE (F5)
To display information about the date of the determination, the standard deviation of the errors and the temperature during the determination.

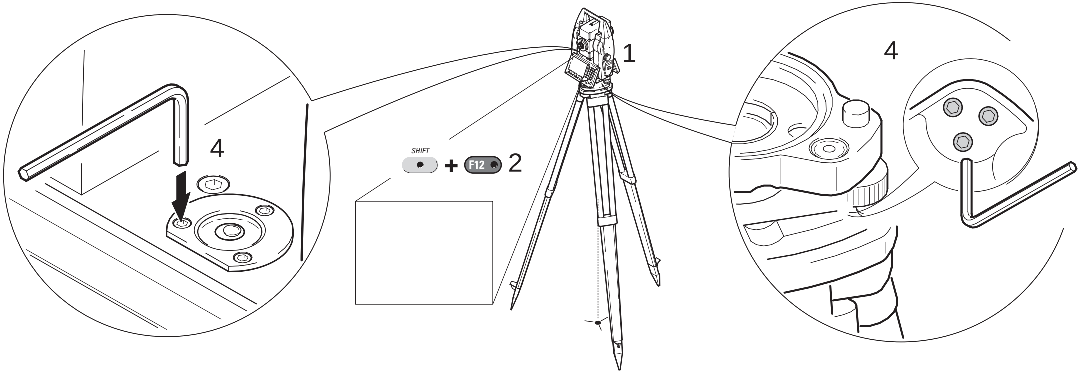
Next step

CONT (F1) returns to **TOOLS Check & Adjust Menu** screen. Refer to "27.3 Accessing Check & Adjust Menu".

Note that the temperature of the environment around the instrument may differ from the temperature shown on the screen as it is the internal temperature of the instrument.

27.9 Adjusting the Circular Level of the Instrument and Tribrach

Adjusting the circular level step-by-step

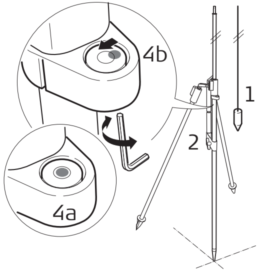


Step	Description
1.	Place and secure the instrument into the tribrach and onto a tripod.
2.	Using the tribrach footscrews, level the instrument with the electronic level. **SHIFT F12** to access **STATUS Level & Laser Plummet**.
3.	Check the position of the circular level on the instrument and tribrach.
4.	a) If both circular levels are centered, no adjustments are necessary
	b) If one or both circular levels are not centered, adjust as follows:

Step	Description
	Instrument: If it extends beyond the circle, use the supplied allen key to centre it with the adjustment screws. Turn the instrument by 200 gon (180°). Repeat the adjustment procedure if the circular level does not stay centered.
	Tribrach: If it extends beyond the circle, use the supplied allen key to centre it with the adjustment screws.
☞	After the adjustments, all adjusting screws should have the same tightening tension and no adjusting screw shall be loose.

27.10 Adjusting the Circular Level of the Prism Pole

Adjusting the circular level step-by-step

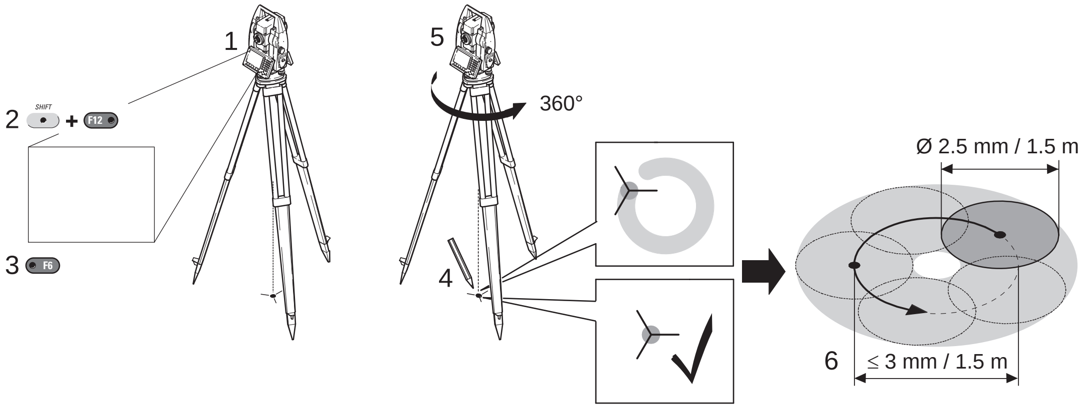


Step	Description
1.	Suspend a plumb line.
2.	Using a pole bipod, align the prism pole parallel to the plumb line.
3.	Check the position of the circular level on the prism pole.
4.	a) If the circular level is centered, no adjustment is necessary.
	b) If the circular level is not centered, use an allen key to centre it with the adjustment screws.
☞	After the adjustments, all adjusting screws should have the same tightening tension and no adjusting screw shall be loose.

27.11 Inspecting the Laser Plummet of the Instrument

☞ The laser plummet is located in the vertical axis of the instrument. Under normal conditions of use, the laser plummet does not need adjusting. If an adjustment is necessary due to external influences, the instrument has to be returned to any GeoMax authorized service workshop.

Inspecting the laser plummet step-by-step



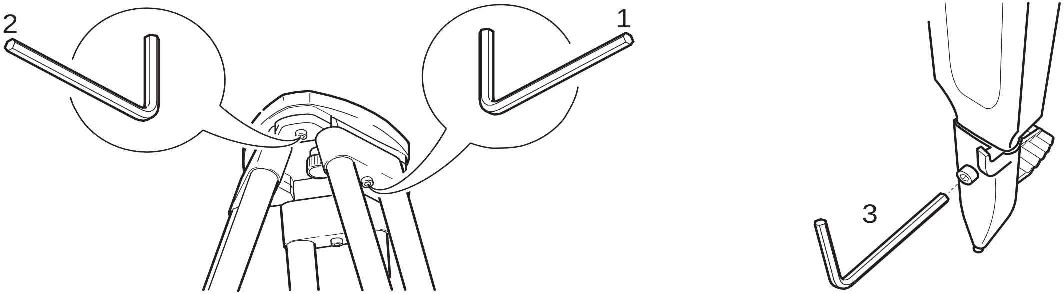
The following table explains the most common settings.

Step	Description
1.	Place and secure the instrument into the tribrach and onto a tripod.
2.	Using the tribrach footscrews, level the instrument with the electronic level. **SHIFT F12** to access **STATUS Level & Laser Plummet**.

Step	Description
3.	**PAGE (F6)** to access the **Laser Plummet** page. Switch on the laser plummet. Inspection of the laser plummet should be carried out on a bright, smooth and horizontal surface, like a sheet of paper.
4.	Mark the centre of the red dot on the ground.
5.	Turn the instrument through 360° slowly, carefully observing the movement of the red laser dot.
☞	The maximum diameter of the circular movement described by the centre of the laser point should not exceed 3 mm at a distance of 1.5 m.
6.	If the centre of the laser dot describes a perceptible circular movement or moves more than 3 mm away from the point which was first marked, an adjustment may be required. Inform your nearest GeoMax authorized service workshop. Depending on brightness and surface, the diameter of the laser dot can vary. At 1.5 m it is about 2.5 mm.

27.12 Servicing the Tripod

Servicing the tripod step-by-step



The following table explains the most common settings.

Step	Description
☞	The connections between metal and timber components must always be firm and tight.
1.	Tighten the leg cap screws moderately, with the supplied allen key.
2.	Tighten the articulated joints on the tripod head just enough to keep the tripod legs open when lifting the tripod off the ground.
3.	Tighten the allen screws of the tripod legs.

28 STATUS

28.1 STATUS Functions

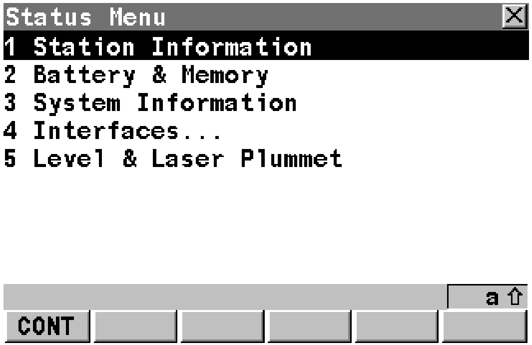
Description

The STATUS functions help using the instrument by showing the state of many instrument functions. All fields are output fields. Unavailable information is indicated by -----.

Access

Press **USER** and then **STAT (F3)**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS
Status Menu



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

Description of the STATUS functions

STATUS function	Description	Refer to chapter
Station Information	Information related to the current station set on the instrument.	28.2
Battery & Memory	Information related to use and status of battery and memory.	28.3
System Information	Information related to the instrument hardware and firmware.	28.4
Interfaces...	Information related to the configuration and use of interfaces, port and devices.	28.5
Bluetooth	Information related to the configuration and use of Bluetooth interfaces.	28.6
Level & Laser Plummet	Information related to electronic level and laser plummet.	28.7

28.2 STATUS: Station Information

Access

Select **STATUS: Station Information**.

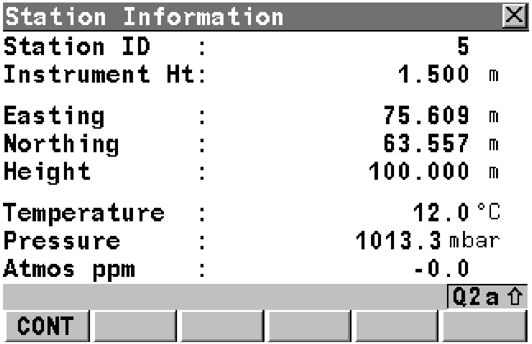
Refer to "28.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS Station Information**.

Refer to "2.1 Hot Keys" for information on hot keys.

STATUS Station Information



CONT (F1)
To exit **STATUS Station Information**.

Description of fields

Field	Description
<Station ID:>	Station ID of the current station set-up.
<Instrument Ht:>	Instrument height of the current station set-up.

Field	Description
<Easting:>	Easting value of the instrument position.
<Northing:>	Northing value of the instrument position.
<Ortho Ht:>	The orthometric height of the instrument position is displayed.
<Tempera-ture:>	Temperature set on the instrument.
<Pressure:>	Pressure set on the instrument.
<Atmos ppm:>	Atmospheric ppm set on the instrument.

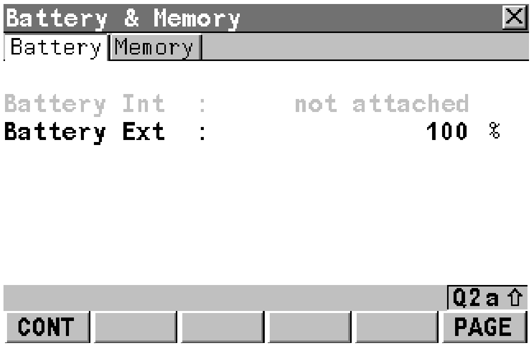
Next step
CONT (F1) to exit **STATUS Station Information**.

28.3 STATUS: Battery & Memory

Access

Select **STATUS: Battery & Memory**.
Refer to "28.1 STATUS Functions" on how to access the STATUS menu.
OR
Press a hot key configured to access the screen **STATUS Battery & Memory**.
Refer to "2.1 Hot Keys" for information on hot keys.
OR
Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.
OR
Tap the battery icon.
OR
Tap the CompactFlash card icon.

STATUS Battery & Memory, Battery page



CONT (F1)
To exit **STATUS Battery & Memory**.
PAGE (F6)
To change to another page on this screen.

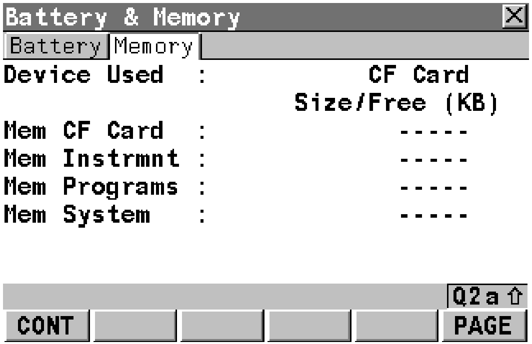
Description of fields

Field	Description
Any field	The percentage of remaining power capacity for all batteries are displayed numerically. Batteries not in use are shown in grey. For internal and external battery being attached at the same time the internal battery is used until it is empty and then the external battery is used.

Next step
PAGE (F6) changes to the **Memory** page.

STATUS
Battery & Memory,
Memory page

If no information for a field is available, for example no CompactFlash card is inserted, then ----- is displayed.



CONT (F1)
To exit **STATUS Battery & Memory**.
PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Description
<Device Used:>	The memory device in use.
<Mem CF Card:>	The total/free memory for data storage on the CompactFlash card.
<Mem Instrmnt:>	The total/free memory for data storage on the internal memory. A grey field and grey ----- indicate an unavailable internal memory.
<Mem Programs:>	The total/free system memory used for application programs.
<Mem System:>	The total/free system memory. The system memory stores • instrument related files such as system settings. • survey related files such as codelists and configuration sets.

Next step
CONT (F1) to exit **STATUS Battery & Memory**.

28.4 STATUS: System Information

Access

Select **STATUS: System Information**.

Refer to "28.1 STATUS Functions" on how to access the STATUS menu.

OR

Press a hot key configured to access the screen **STATUS System Information**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS System Information, Instrument page

Shows the type of instrument, the serial number, the equipment number, the ID of the instrument, the currently active system language and the availability of additional instrument hardware options such as Scout360.

Next step

PAGE (F6) changes to the **Firmware** page.

STATUS System Information, Firmware page

Shows the versions of all system firmware.

Description of fields

Field	Description
<Firmware:>	Firmware version of the onboard software.
<Build User Iface:>	Build version of the onboard software.

Field	Description
<Build Processb.:>	Build version of the processor board.
<Telescope Fw:>	Firmware version of the telescope.
<Boot:>	Firmware version of the boot software.
<API:>	Firmware version for the application program interface.
<EF Interface:>	Firmware version for the electric front interface.
<Keyboard/Display:>	Firmware version for the graphical user interface.

Next step
PAGE (F6) changes to the **Application** page.

STATUS System Information, Application page

Shows the versions of all uploaded application programs.

Next step
CONT (F1) exits **STATUS System Information**.

28.5 STATUS: Interfaces...

Description

STATUS Interfaces gives an overview of all interfaces with the port and the devices currently assigned.

Access

Select **STATUS: Interfaces...**.
Refer to "28.1 STATUS Functions" on how to access the STATUS menu.

OR

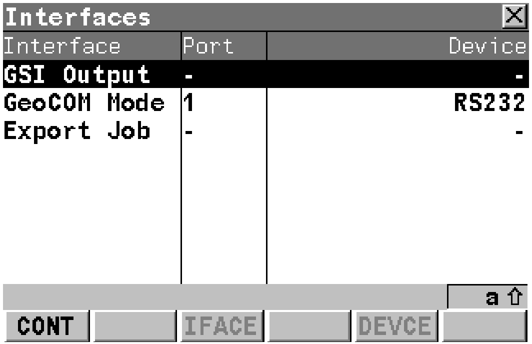
Press a hot key configured to access the screen **STATUS Interfaces**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

STATUS Interfaces

The screen gives an overview of all interfaces with the currently assigned port and device. Unavailable information is indicated by -----.



CONT (F1)
To exit **STATUS Interfaces**.

28.6 STATUS: Bluetooth

Description

This screen shows

- Bluetooth ports available and configured.
- the device attached and connected to each Bluetooth port.
- the ID address of each device.

Access

Select **STATUS: Bluetooth**.

Refer to "28.1 STATUS Functions" on how to access the STATUS menu.

OR

Tap the Bluetooth icon.

STATUS Bluetooth

The way information is displayed indicates the configuration status of the Bluetooth port and the connection status of the device.

Information displayed	Bluetooth port configured	Device connected
in black	✓	✓
in grey	✓	-
as **-----**	-	-

Next step

CONT (F1) exits **STATUS Bluetooth**.

28.7 STATUS: Level & Laser Plummet

Description

The electronic level is shown and can be centred.

Access

Select **STATUS: Level & Laser Plummet**.

Refer to "28.1 STATUS Functions" on how to access the STATUS menu.

OR

Press **SHIFT F12**.

OR

Press a hot key configured to access the screen **STATUS Level & Laser Plummet**. Refer to "2.1 Hot Keys" for information on hot keys.

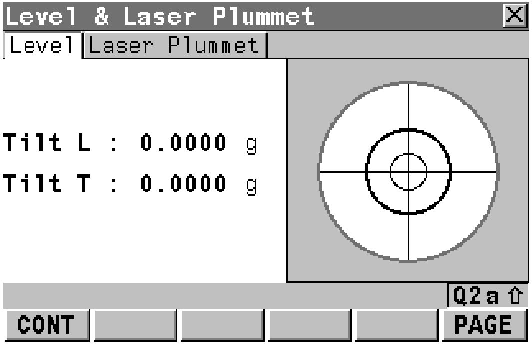
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

☞

The level moves linear with the inclination values **<Tilt L:>** and **<Tilt T:>.** On the screen closest to the circular level, the electronic level moves down if the value in **<Tilt L:>** gets bigger and vice versa. If the value for **<Tilt T:>** gets bigger the level moves left and vice versa.

STATUS Level & Laser Plummet, Level page



CONT (F1)
To exit **STATUS Level & Laser Plummet**.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Description
<Tilt L:>	Longitudinal tilt of the vertical axis.
<Tilt T:>	Transversal tilt of the vertical axis.

Next step

PAGE (F6) changes to the **Laser Plummet** page.

STATUS Level & Laser Plummet, Laser Plummet page

Description of fields

Field	Option	Description
<Laser Plummet:>	**On** or **Off**	To turn the laser plummet on or off. Is always set on when accessing this screen. Changing this setting turns the laser plummet on or off immediately.
<Intensity:>	From **0 %** to **100 %**	The percentage of the intensity of the laser plummet is displayed numerically and graphically. The minimum value is 10%. Changing this value with the right and left arrow keys changes the intensity of the laser plummet immediately.

Next step

CONT (F1) exits **STATUS Level & Laser Plummet**.

29 Functions

29.1 EDM

Description

Electronic **D**istance **M**easurement **EDM** is the sensor used for distance measurements.

There are three different **<EDM Type:>** and five different **<EDM Mode:>** the instrument can work in. These terms are described below.

Refer to "16.1 EDM & Aim360 Settings" and to "3 Quick Settings - SHIFT USER" for more information.

EDM types

EDM Type	Description
IR	**<EDM Type: Reflector (IR)>** allows to measure the distance to a prism or reflector tape with the visible red laser. The last used options for **<Reflector:>**, **<Add. Constant:>**, **<Reflector Ht:>** and **<EDM Mode:>** are applied. For **<Automation: Aim>** or **<Automation: Track360>, <EDM Type: Reflector (IR)>** is automatically set. ☞ It is important to select the currently used **<Reflector:>** from the list to gain correct results.

EDM Type	Description
RL	**<EDM Type: Reflctrless (RL)>** allows to measure distances to objects without a reflector with the visible red laser. The last used option for **<EDM Mode:>** is applied, **<Reflector: Reflectorless>** and **<Reflector Ht: 0.000>** are set. **<Automation: None>** is set.
LO	**<EDM Type: Long Range (LO)>** allows to measure very long distances to prisms. The last used option for **<EDM Mode:>** and **<Reflector:>** are applied, **<Automation: None>** is set.

EDM modes

EDM Mode	Description
Standard	Pressing **ALL (F1)** or **DIST (F2)** a single measurement is performed with focus on accuracy and not on time.
Fast	Pressing **ALL (F1)** or **DIST (F2)** a single measurement is performed with focus on time, accuracy not as high as for **<EDM Mode: Standard>**.
Tracking	Pressing **ALL (F1)** or **DIST (F2)** continuous measurements are performed with focus on fast measurements. Press **REC (F3)** to store the measurements. **STOP (F1)** to stop tracking.
Average	Pressing **ALL (F1)** or **DIST (F2)** with **<Avg Max #Dist: n>** n measurements are performed with **<EDM Mode: Standard>**. During measurements the current average and standard deviation are displayed.

EDM Mode	Description
SynchroTrack	Available only for **<EDM Type: Reflector (IR)>**. This is the measurement mode for more precise measurements in Track360 mode. Pressing **ALL (F1)** or **DIST (F2)** a linear interpolation between the previous and following angle measurement is performed, based upon the timestamp of the EDM measurement. Using this interpolation procedure, a higher accuracy for all dynamic applications is possible.

29.2 Prism Search Methods

29.2.1 Aim360

Description

Aim360 is the sensor which recognises and measures the position of a prism by means of a CCD array. A laser beam is transmitted and the reflected beam is received by the built in CCD array. The position of the reflected spot with respect to the centre of the CCD is computed. These Aim360 offsets are used to correct the horizontal and vertical angles. The Aim360 offsets are also used to control the motors which turn the instrument to centre the crosshairs to the prism. In order to minimise the time for measuring, the crosshairs are not moved to the exact centre of the prism. The Aim360 offset can be up to 500 cc depending on selected **<EDM Mode:>**. The Aim360 measures the Aim360 offsets between the crosshairs and prism centre and corrects the Hz and V angles accordingly. Therefore the Hz and V angles are measured to the prism-centre, even if the crosshairs are not aimed precisely at the centre of the prism.

For **<Automation: Aim360>** the instrument can find a static prism and measure a distance once **ALL (F1)** or **DIST (F2)** is pressed. The instrument does not follow a moving prism.

Refer to "16.1 EDM & Aim360 Settings" and to "3 Quick Settings - SHIFT USER" for more information.

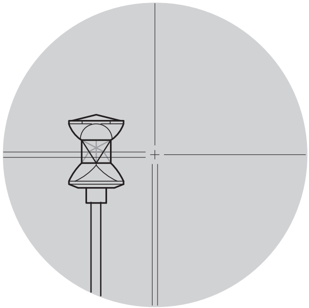
Field of view

The telescope field of view is the region seen when looking through the telescope. The Aim field of view is the region seen by the Aim360.

Next step

IF the reflector is	THEN
in the field of view	Refer to paragraph "Aim360 measurement" for more information.
not in the field of view	Refer to paragraph "Aim360 search" for more information.

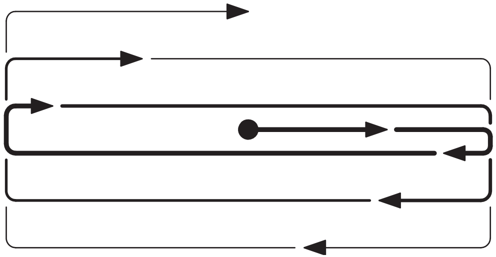
Aim360 measurement



If the reflector is in the field of view and **<Automation: Aim360>** the crosshairs are automatically positioned to the reflector when, for example **ALL (F1)** or **DIST (F2)** is pressed. No Aim search is started.

☞ The displayed values are always related to the centre of the prism after **ALL (F1)** or **DIST (F2)** is pressed. For **ALL (F1)** these values are displayed only shortly after the key press.
The crosshairs of the telescope may not fully coincide with the centre of the prism when viewed through the telescope. The remaining Aim360 offsets for the horizontal and vertical angles are measured by the Aim360 sensor and applied to the measured and displayed angles.

Aim360 search



If the reflector is not in the field of view when **ALL (F1)** or **DIST (F2)** is pressed, an Aim360 search is started. For the Aim360 search the Aim window is scanned line by line starting at the current telescope position.
If the

- prism was not found: **RETRY (F5)** can be pressed to search for the reflector in an increased area.
- prism was found: The Aim360 measurement is performed to position the telescope to the centre of the prism.

Aim window

The Aim window is a relative window based on the current telescope position. The horizontal and vertical extent can be defined. Pressing **ALL (F1)**, **DIST (F2)** or **T.GO (F5)** starts an Aim360 search in the Aim window.

Dynamic Aim window

For **<Search with: Aim360>** after loss of lock and prediction the prism is searched for with Aim360 in a dynamic Aim window. This window covers a horizontal region from the position of loss of lock to the current telescope position and the same extent on the other side. The vertical dimension of the dynamic window is one third of the horizontal expansion. Refer to "29.3 Track360" for information on Track360.

Automation modes

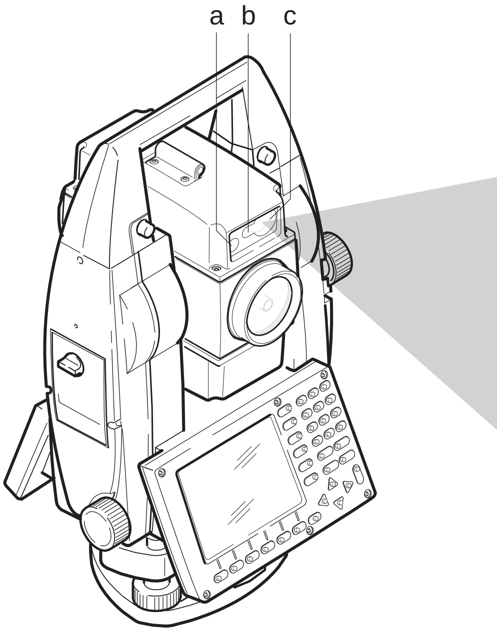
Automation	Description
None	Points are measured with **<Automation: None>**. Aim360 search and/or Aim360 measurement are not performed.
Aim360	**<Automation: Aim360>** is set. The Aim360 sensor is used for measurements to static reflectors. If needed an Aim360 measurement or Aim360 search is performed after pressing **ALL (F1)** or **DIST (F2)**. The accuracy of Aim360 measurements depends on the set **<EDM Mode:>**.
Track360	**<Automation: Track360>** is set. The Aim360 sensor is used to follow moving prisms and to find prisms after loss of lock. Depending on **<EDM Mode:>** single or continuous measurements are performed pressing **ALL (F1)** or **DIST (F2)**.

29.2.2 Scout360

Description

Available on Zoom80 R. The Scout360 module allows an automatic prism detection within a short period of time. In the **QUICK SET Change Settings to:** screen the Scout360 function can be started by pressing **SCT-> (F6)** or **SHIFT SCT<- (F5)**.

Functionality



The Scout360 sensor consists of a transmitter (b) and a receiver (c). Both are installed in the telescope.

When Scout360 is activated, the instrument starts to rotate around its standing axis.The transmitter emits a vertical laser swath. If the laser swath detects a prism, the rotation of the instrument is stopped. Afterwards a Aim360 measurement in vertical direction is performed.

a) NavLight
b) Transmitter
c) Receiver

☞ If a Scout window is defined and active, Scout360 is executed within the defined limits.

360° search

For **<Scout Window: Off>** and **SCT-> (F6)** the prism is searched for with Scout360 in the 360° window. The default search with Scout360 consists of a short swing in anti-clockwise direction followed by a complete 360° turn in clockwise direction. If a prism is detected the movement is stopped and an Aim360 search is performed.

Scout Window

The Scout window can be defined individually. It is specified by absolute angles and does not change its position. The Scout window can be set in the **CONFIGURE Search Windows, Scout Window** page by aiming at two opposite points of the Scout window. For **<Scout Window: On>** and **SCT-> (F6)** a prism is searched for with Scout360 in the Scout window. Refer to "16.2 Search Windows" for more information on setting the Scout window.

Dynamic Scout window

For **<Scout Window: Off>**, **<Search with: Scout360>**, loss of lock and after prediction the prism is searched for in a dynamic Scout window. This window covers a region at the position after prediction of horizontal 100 gon by vertical 40 gon. Refer to "29.3 Track360" for information on Track360.

Direction of search

The direction which the instrument turns during the search routine can be define via hot key. Refer to "2.1 Hot Keys". The setting for the hot key has no influence to the Quick Settings, the automatic Scout360 after loss of lock and the predefined search window.

29.3 Track360

Description

Track360 enables instruments to follow a moving prism. The Aim360 sensor is active. When **<Automation: Track360>** and a distance measurement is initiated with **DIST (F2)** or **T.GO (F5)** is pressed, an Aim360 search is executed. The instrument locks onto the prism and follows its movements. Aim360 offsets are continuously applied to the angle measurements. When the instrument loses lock to the reflector, a search is executed with either Scout360 or Aim360 depending on settings.

Refer to "16 Config...\Instrument Settings..." and to "3 Quick Settings - SHIFT USER" for more information.

☞ If the speed of the reflector is too fast, the target may be lost. Make sure that the speed does not exceed the figure given in the technical data.

Enable Track360

<Automation: Track360>. The instrument is not yet locked onto the reflector and the Aim360 sensor is not active. Pressing **ALL (F1)**, **DIST (F2)**, **T.GO (F5)** or **CONT (F1)** in **QUICK SET Orientation With Compass**, **QUICK SET Positioning Hz/V**, **QUICK SET Move by Joystick** or **QUICK SET Check Recorded Pt/Backsight Pt** the Aim360 is used to find the reflector. Pressing **SCT-> (F6)** Scout360 is used to find the prism. When the reflector is found, the instrument locks onto the reflector. The instrument follows the moving reflector. The Aim360 sensor is active.

As long as the instrument is locked on, Aim360 offsets are continuously applied to the angle measurements. If the instrument loses lock to the prism the instrument may search for the prism with Aim360 or Scout360.

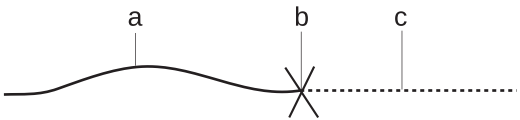
Loss of lock

When the instrument is locked onto a reflector, lock may be lost if the movement of the reflector is too fast for the instrument to follow or the reflector is hidden behind an object. After lock is lost, the prediction is used to find the prism again. Refer to paragraph "Prediction" for more information.

The Aim360 sensor is still active.

☞ Whenever the prism is moved in the field of view of the telescope the instrument locks automatically to the prism.

Prediction



a) Moving reflector locked onto by the instrument
b) Loss of lock
c) Prediction

As long as the prism is being tracked by the instrument a mathematical filter continuously calculates the average speed and direction of the prism. If the line of sight between instrument and prism is disturbed, the instrument keeps on moving using these calculated values.This behaviour is called prediction. The prediction time can be configured.

During prediction the Track360 icon is displayed. If the prism comes into the field of view of the Aim360 it automatically locks on again.

Prism search after prediction

After prediction, the prism is searched for depending on the settings in the **CONFIGURE Automatic Prism Search** and **CONFIGURE Search Windows, Scout Window** screens.

- **<Search with: No Search>**. If prism moved in field of view, prism is not searched for until **ALL (F1)**, **DIST (F2)**, **T.GO (F5)**, **CONT (F1)**, **SCT-> (F6)** or **SHIFT SCT<- (F5)** is pressed.

- **<Search with: Aim360>**. prism is searched for in the dynamic Aim window with Aim360.
- **<Search with: Scout360>** and **<Scout Window: On>**: prism is searched for in the Scout window with Scout360.
- **<Search with: Scout360>** and **<Scout Window: Off>**: prism is searched for in the dynamic Scout window.
- **<Search with: Last Point>**: The instrument turns back to the last stored point.

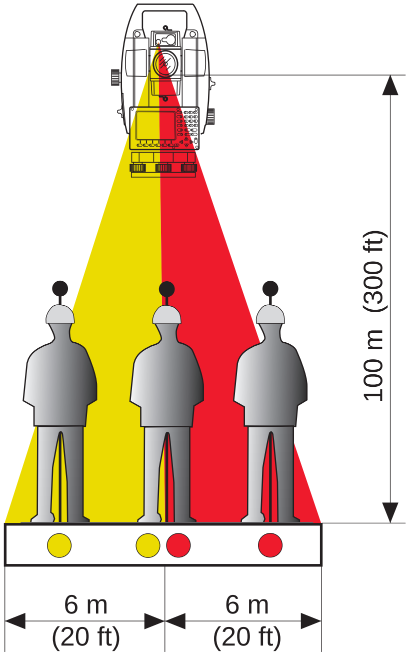
Relock	Independent of **<Search with:>** the instrument can relock onto the prism. Refer to paragraph "Enable Track360" for information on how to enable lock.

29.4 NavLight

Description

The NavLight, navigation light consists of two differently coloured flashing lights in the telescope housing of the Zoom80. The NavLight is used for guidance into the line of sight. If the left light is seen, the prism should be moved right and vice versa. If both flashing lights can be seen, the prism is in the line of sight of the instrument.

Functionality



The NavLight can be used

- to help guiding the reflector into the telescope line of sight when the instrument is remotely controlled and **<Automation: Track360>**.
- to stake out points

The instrument emits two differently colored flashing cones of light. At a target distance of 100 m the cones have a width of 6 m. Between the two cones of light a sector with a width of 30 mm is created where both guide lights are visible simultaneously. In this position the prism is in the line of sight of the instrument.

Using the NavLight step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Set **<Automation: Track360>** and press **COMPS (F1)** or **Hz/V (F2)** or **JSTCK (F3)** on the **QUICK SET Change Settings to:** screen OR Set **<NavLight: On>** on the **CONFIGURE Lights, Display, Beeps, Text, Lights** page.	3.2 17.5
2.	Align instrument line of sight and prism, where both flashing NavLight lights can be seen simultaneously.	
3.	**CONT (F1)** to lock onto the prism.	
4.	If the instrument has locked onto the prism the NavLight is turned off automatically.	
☞	If the NavLight was turned on in the **CONFIGURE Lights, Display, Beeps, Text, Lights** page, it has to be turned off by setting **<NavLight: Off>**.	

☞ The NavLight is turned off automatically once the instrument has locked onto a prism.

29.5 Illumination

Description

There are several different illumination types built into the instrument that all fulfill different functions. Some are to support measurements, for example the visible red laser pointer. Others, such as the screen illumination, are for more convenient work with the instrument. These different types of illumination are described below.

Laser plummet

The laser plummet allows setting up the instrument over a marked point. The laser beam is emitted from the bottom of the instrument, pointing to the ground. When the instrument is levelled and the laser beam points exactly at the ground point, the instrument is set up correctly.

The laser plummet can be turned on and off. It is turned on automatically when opening the **STATUS Level and Laser Plummet** screen and turned off when leaving the screen.

Visible red laser pointer

The visible red laser pointer is used for reflectorless measurements. The visible red laser pointer is arranged coaxially with the line of sight of the telescope and emitted through the objective. If the instrument is well adjusted, the visible red laser beam coincides with the line of sight.

☞ The direction of the beam should be inspected before precise distance measurements are executed, since an excessive deviation of the laser beam from the line of sight can cause inaccurate results.

Screen/key illumination

The screen and key illumination allows a more convenient working with the instrument when the lighting conditions are not ideal. They can be turned on in the **CONFIGURE Lights, Displays, Beeps, Text, Lights** page. To access this screen press **SHIFT F11** in any application program. Changes to the setting become effective instantly. Refer to "17.5 Lights, Display, Beeps, Text" for more information on screen and key illumination settings.

30 MapView Interactive Display Feature

30.1 Overview

Description

MapView is an interactive display feature embedded in the firmware but used by all application programs as well as data management. MapView provides a graphical display of the survey elements which allows for a better overall understanding of how the data being used and measured relates to each other.

Depending on the application program and where in the application program MapView is accessed from, different modes, and their associated functionality, are available.

The displayed data in all modes of MapView can be shifted by using both the arrow keys and the touchscreen.

MapView modes

MapView is available in three modes:

Map mode:
- Part of data management.
- Is also available within some application programs, for example, the Reference Line application program.
- Can be used to view, select and edit points, lines and areas.
- Available as the **Map** page in data management and some application programs.

Plot mode:
- Is available to view results in various application programs. For example, COGO application program.
- Available as the **Plot** page in some application programs.

Survey mode:
- Part of the Survey application program.
- Is available within some application programs, for example, Stakeout application program.

- Can be used to select lines and areas.
- Same as Map mode but also shows the positions of the instrument and the reflector.
- Provides special functionality when staking out points.
- Available as the Map page in Survey and some application programs.

Modes within application programs	It is possible to access different MapView modes from the same application program. For example, **REFLINE Choose Reference Line**, **Map** page accesses MapView in map mode, whereas, **REFLINE XX Stakeout**, **Map** page accesses MapView in survey mode.
Displayable data	The data displayed in MapView is defined by the application program through which it was accessed, filters set in **MANAGE Sorts & Filters**, and the selections made in **XX MapView Configuration**.

30.2 Accessing MapView

Description

The MapView interactive display feature is provided as a page within all application programs and data management. It is accessed through the application program itself. Depending on the application program and from where in the application program MapView is accessed, different MapView modes are available.

Access step-by-step

Example access for map mode:

Step	Description
1.	Select **Main Menu: Manage...\Data**. OR Press a hot key configured to access the screen **MANAGE Data: Job Name**. Refer to "2.1 Hot Keys" for information on hot keys. OR Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key. OR From a choicelist in some screens for example in application programs.
2.	**PAGE (F6)** until **MANAGE Data: Job Name**, **Map** page is active.

Example access for plot mode:

Step	Description
1.	Press **PROG**. Highlight **COGO**. **CONT (F1)**. Refer to "31.2 Accessing the Programs Menu" for information on the **PROG** key. OR Press a hot key configured to access the screen **COGO COGO Begin**. Refer to "2.1 Hot Keys" for information on hot keys. OR Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.
2.	**CONT (F1)** to access **COGO COGO Menu**.
3.	**COGO COGO Menu** Highlight **Intersections**.
4.	**CONT (F1)** to access **COGO Intersection Input**.
5.	**COGO Intersection Input** Choose a method and enter appropriate data.
6.	**CALC (F1)** to access **COGO XX Results**.
7.	**PAGE (F6)** until **COGO XX Results**, **Plot** page is active.

Example access for survey mode:

Step	Description
1.	Select **Main Menu: Survey**. OR Press a hot key configured to access the screen **SURVEY Survey Begin**. Refer to "2.1 Hot Keys" for information on hot keys. OR Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key. OR Press **PROG**. Highlight **Survey**. **CONT (F1)**. Refer to "31.2 Accessing the Programs Menu" for information on the **PROG** key.
2.	**CONT (F1)** to access **SURVEY Survey: Job Name**.
3.	**PAGE (F6)** until **SURVEY Survey: Job Name**, **Map** page is active.

☞ MapView can be open multiple times, for example as **SURVEY Survey: Job Name**, **Map** page accessed from **Zoom80 Main Menu** and as **MANAGE Data: Job Name**, **Map** page accessed using the **USER** key.

30.3 Configuring MapView

Description

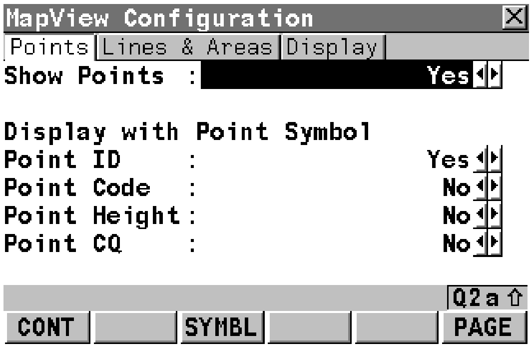
Allows options to be set which are used as default options within MapView. These settings are stored within the configuration set and apply to all **Map** and **Plot** pages, regardless of how MapView is accessed.

☞ Any changes made in **XX MapView Configuration** affect the appearance of MapView in all application programs, not just the active application program.

Access step-by-step

Step	Description
1.	Refer to "30.2 Accessing MapView" to access MapView in map, plot or survey mode.
2.	**SHIFT CONF (F2)** to access **XX MapView Configuration**.

XX MapView Configuration, Points page



CONT (F1)
To confirm the selections and to return to the screen from where this screen was accessed.

SYMBL (F3)
To view all point symbols and their descriptions.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Show Points:>	**Yes** or **No**	Determines if points are displayed in MapView.
<Point ID:>	**Yes** or **No**	Available for **<Show Points: Yes>**. Determines if the ID of a point is displayed.
<Point Code:>	**Yes** or **No**	Available for **<Show Points: Yes>**. Determines if the code of a point is displayed.
<Point Height:>	**Yes** or **No**	Available for **<Show Points: Yes>**. Determines if the height of a point is displayed.
<Point CQ:>	**Yes** or **No**	Available for **<Show Points: Yes>**. Determines if the coordinate quality of a point is displayed.

Displayable point information

200
Tree
435.000
0.000

a) **<Point ID:>**
b) **<Point Code:>**
c) **<Point Height:>**
d) **<Point CQ:>**

Next step

PAGE (F6) changes to the **Lines&Areas** page. Refer to paragraph "XX MapView Configuration, Lines&Areas page".

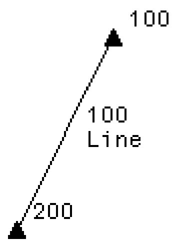
XX MapView Configuration, Lines&Areas page

Description of fields

Field	Option	Description
<Show Lines:>	**Yes** or **No**	Determines if lines are displayed in MapView.
<Show Line ID:>	**Yes** or **No**	Available for **<Show Lines: Yes>**. Determines if the ID of a line is displayed.
<Show Line Code:>	**Yes** or **No**	Available for **<Show Lines: Yes>**. Determines if the code of a line is displayed.
<Show Areas:>	**Yes** or **No**	Determines if areas are displayed in MapView.
<Show Area ID:>	**Yes** or **No**	Available for **<Show Areas: Yes>**. Determines if the ID of an area is displayed.
<Show Area Code:>	**Yes** or **No**	Available for **<Show Areas: Yes>**. Determines if the code of an area is displayed.

Displayable line/area information

A line is shown as example.



a) **<Show Line ID:>**
b) **<Show Line Code:>**

Next step

PAGE (F6) changes to the **Display** page. Refer to paragraph "XX MapView Configuration, Display page".

XX MapView Configuration, Display page

Description of fields

Field	Option	Description
<Show Pt Info:>	**When <200 Pts** or **As Configured**	Determines if point information is shown or not. For **<Show Pt Info: When <200 Pts>** point information is not shown when more than 200 points are displayed. For **<Show Pt Info: As Configured>** the point information, as configured in **XX MapView Configuration, Points** page, is shown regardless of the number of points being displayed.
<Rotate 180°:>	**Yes** or **No**	Available for **<Datum View: Local>**. To rotate the map by 180°. The north arrow is not rotated and still orientated towards the top of the screen.
<Toolbar:>	**On** or **Off**	Determines if the toolbar of touch icons are displayed. Refer to "30.4.3 Toolbar".
<Curr Pos Info:>		Determines if a certain information related to the current position is displayed in the lower left corner of the map (only visible in survey mode).
	<None>	No information is displayed in the map.
	Point ID	Point ID of the current position.

Field	Option	Description
	Code	Code of the current position.
	Attrib 01	User defined attribute.
	Attrib 02	User defined attribute.
	Attrib 03	User defined attribute.
	Attrib 04	User defined attribute.
	Attrib 05	User defined attribute.
	Quality 3D	Current 3D coordinate quality of the computed position.
The following fields are relevant for Survey Mode:		
<Show Path:>	**Yes** or **No**	Displays the path of the reflector as a dashed line.
<Center To:>	Choicelist	To centre the map on the reflector or the instrument.
	Reflector	To centre the map on the reflector.
		For EDM mode standard, fast or average, the map will centre onto the last measured point.
		For EDM mode tracking or synchrotrack, the map will centre onto the current reflector position.
		These behaviours are true for all automation settings

Field	Option	Description
	Total Station	To centre the map on the instrument.

Next step

CONT (F1) confirms the selections and returns to where **XX MapView Configuration** was accessed.

30.4 MapView Components

30.4.1 Softkeys

Description

Standard functionality is provided by a number of softkeys within MapView. These softkeys are available regardless of the mode in which MapView was accessed and always perform the same functions.

Standard softkeys

The softkeys described below are standard on all MapView screens. For descriptions of mode specific softkeys see appropriate chapters.

Softkey	Description
ZOOM+ (F4)	To zoom into the map. ☞ Pressing **ESC** stops the zooming process. All keys become active again.
ZOOM- (F5)	To zoom out of the map. ☞ Pressing **ESC** stops the zooming process. All keys become active again.
PAGE (F6)	To change to another page on this screen.
SHIFT CONF (F2)	To configure MapView. Accesses **XX MapView Configuration**. Refer to "30.3 Configuring MapView".
SHIFT FIT (F3)	To fit all displayable data into the screen area. Refer to "30.4.3 Toolbar" for more information.

Touch screen functions

Some softkey functionality can be replaced by touch screen functions.

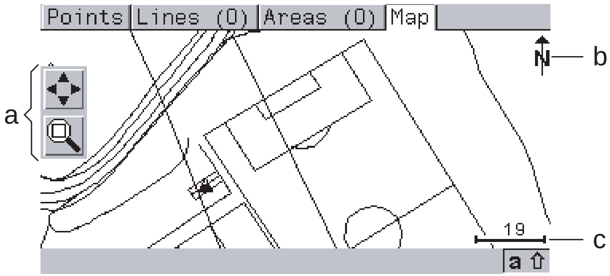
Softkey	Touch equivalent
PAGE (F6)	Tap on a page tab.
SHIFT FIT (F3)	Tap on fit touch icon. Refer to "30.4.3 Toolbar".

30.4.2 Screen Area

Description

The MapView screen area is very similar in all cases. The positions of the scale bar, the North arrow and the toolbar, if visible, do not change.

Standard screen



a) Toolbar
b) North arrow
c) Scale bar

Reflector

Reflectors are displayed on the **Map** page. The reflector path is shown as dashed line.

Symbol	Description
	Measured position.

Instrument station

Symbol	Description
	Position of the instrument station.

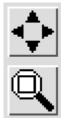
Scale bar

Symbol	Description
	Scale of the current screen. The minimum is 0.5 m. There is no maximum for the zoom but the scale cannot display values greater than 99000 m. In this case the value displayed will be >99000 m.

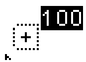
North arrow

Symbol	Description
	North arrow. North is always orientated towards the top of the screen.

Toolbar

Symbol	Description
	Touch icon toolbar. Refer to "30.4.3 Toolbar" for more information about the functionality of the touch icons in the toolbar.

Point with focus

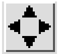
Symbol	Description
	The point that has the focus.

30.4.3 Toolbar

Description

Touch icons are available in a toolbar, if **<Toolbar: On>** in **XX MapView Configuration**, **Display** page. The toolbar is always located on the left hand side of the screen. Some of the functions performed by the touch icons can also be replicated using a softkey in the same mode as when the touch icon appears. The softkey equivalent to each touch icon, if one exists, are indicated below.

Touch icons in the toolbar

Touch icon	Softkey	Description
	**SHIFT FIT (F3)**	Available as a touch icon in map mode. The fit touch icon fits all displayable data, according to filters and the map configuration, into the screen area, using the largest possible scale.
	-	The windowing touch icon zooms to a specified area window. An area window can be drawn by tapping on the top left and the bottom right corner of the area. This causes the screen to zoom to the selected area.
	-	Available in survey mode. This touch icon displays the current direction as dashed line. A location on the **Map** page can then be tapped and the instrument turns to this direction.

30.4.4 Point Symbols

Points

When **<Show Points: Yes>** in **XX MapView Configuration**, points are displayed, in all modes, according to their class.

Symbol	Description
	3D control point is a point of class **CTRL** with horizontal and vertical coordinate components.
	2D control point is a point of class **CTRL** with horizontal coordinate components.
	Adjusted point is a point of class **ADJ**.
	Reference point is a point of class **REF**.
	Average point is a point of class **AVGE**.
	Measured point is a point of class **MEAS**.
+	Estimated point is a point of class **EST**.

Points of class **NONE** or points of class **CTRL**/**MEAS** with a height only component cannot be displayed in MapView.

A list of the point types available, and their description, is available by pressing **SYMBL (F3)** in **XX MapView Configuration**, **Points** page. Refer to "30.3 Configuring MapView".

30.5 Map Mode

30.5.1 MapView in Map Mode

Description

The map mode of MapView is available as the **Map** page in data management and some application programs. It can be used to display, select and edit points, lines and areas.

Access

Refer to "30.2 Accessing MapView" paragraph "Example access for map mode:".

OR

From a choicelist in some screens, for example, in application programs, which access data management.

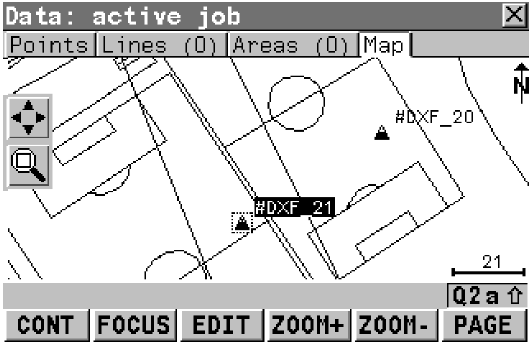
OR

As a part of an application program, for example, COGO.

☞ The **MANAGE Data: Job Name**, **Map** page is used as the example below. The functions described are the same for all **Map** pages in map mode.

MANAGE Data: Job Name, Map page

The softkeys described below are specific to MapView in map mode. Refer to "30.4.1 Softkeys" for descriptions of the standard softkeys.



FOCUS (F2) or **DONE (F2)**
: To activate the focus tool and select a point without using the touch screen. Refer to "30.5.2 Selecting Points, Lines and Areas".

EDIT (F3)
: To edit the highlighted point's parameters. Accesses **MANAGE Edit Point: Point ID**.

SHIFT CENTR (F4)
: To centre the screen around the point with the current focus, or the focus tool if **DONE (F2)** is visible.

SHIFT FILTR (F5)
: Available for **FOCUS (F2)**. To change the filter settings. Accesses **MANAGE Sorts & Filters**.

Touch screen functions

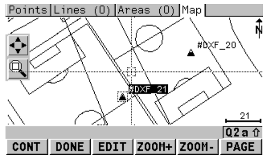
Key	Touch equivalent
FOCUS (F2)	Tap on a point.

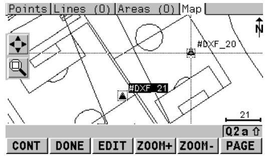
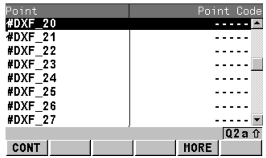
30.5.2 Selecting Points, Lines and Areas

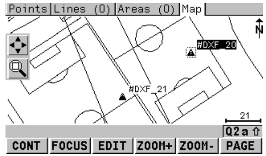
Description

Selecting a point, line or area in the map mode of MapView is possible using both the softkeys and the touch screen. The functionality of all screens and field are similar for the selecting of a point, line or area. The step-by-step instructions for selecting a point using the softkeys can be applied for lines and areas.

Select a point using the softkeys step-by-step

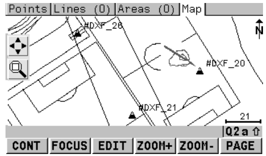
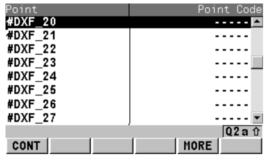
Step	Description	Display
1.	Refer to "30.5.1 MapView in Map Mode" to access **MANAGE Data: Job Name**, **Map** page.	
	If no point field is highlighted on the previous page when the **Map** page is accessed, then any point that is selected will be assigned to the first point field on the previous page, the second point to the second point field, etc. If a point field is highlighted when the **Map** page is accessed then the point selected will be assigned to that field.	
2.	**FOCUS (F2)** to activate the focus tool. The focus tool is made up of a square placed at the centre of dashed crosshairs. The focus tool always starts at the centre of the screen area.	

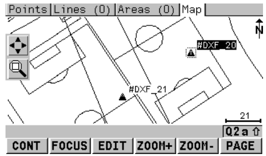
Step	Description	Display
3.	Use the arrow keys to navigate the focus tool to the point to select. A point is available for selection when the square is centred around the point symbol.	
☞	When there are multiple points within the same area and the precise selection is unclear, pressing **ENTER** will access **XX Select Point**.	
4.	Press **ENTER** to select the point. The point parameter text, as defined in **XX Map View Configuration, Points** page, is highlighted.	
5.	Have multiple points been selected? • If **yes**, continue with step 6. • If **no**, continue with step 8.	
6.	**XX Select Point** **Point ID** The ID of the points within range of the point selection. **Point Code** The code of the points within range of the point selection. Select the desired point.	

Step	Description	Display
☞	**MORE (F5)** to display information about the point code, the 3D coordinate quality and class, the time the point was stored and the date the point was stored.	
7.	**CONT (F1)** returns to **MANAGE Data: Job Name**, **Map** page with the focus on the selected point.	
8.	**DONE (F2)** exits the focus tool.	

Selecting a point using the touch screen step-by-step

Step	Description	Display
1.	Refer to "30.5.1 MapView in Map Mode" to access **MANAGE Data: Job Name**, **Map** page.	
☞	If no point field is highlighted on the previous page when the **Map** page is accessed, then any point that is selected will be assigned to the first point field on the previous page, the second point to the second point field, etc. If a point field is highlighted when the **Map** page is accessed then the point selected will be assigned to that field.	

Step	Description	Display
2.	Tap on the point to be selected.	
	When there are multiple points within the same area and the precise selection is unclear, tapping on the point will access **XX Select Point**.	
3.	Have multiple points been selected? • If **yes**, continue with step 4. • If **no**, continue with step 6.	
4.	**XX Select Point** **Point ID** The ID of the points within range of the point selection. **Point Code** The code of the points within range of the point selection. Select the desired point.	
	MORE (F5) to display information about the point code, the 3D coordinate quality and class, the time the point was stored and the date the point was stored.	
5.	**CONT (F1)** returns to **MANAGE Data: Job Name**, **Map** page with the focus on the selected point.	

Step	Description	Display
6.	A square is centred on the selected point and the point parameter text, as defined in **XX MapView Configuration**, **Points** page, is highlighted.	

30.6 Plot Mode - MapView Screen Area

Description

The plot mode of MapView is available as the **Plot** page in an application program and can be used to view the results of the application program. Results are shown in black, all other information, that is displayable, is shown in grey.

Access

Refer to "30.2 Accessing MapView" paragraph "Example access for plot mode:".

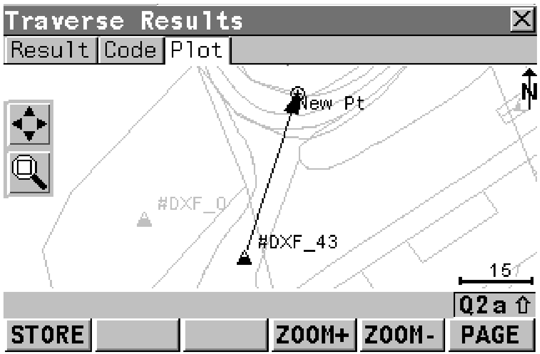
OR

As a part of an application program, for example, COGO.

The **COGO XX Results**, **Plot** page is used as the example below. The functions described are the same for all **Plot** pages.

COGO XX Results, Plot page

The softkeys described below are specific to MapView in plot mode. Refer to "30.4.1 Softkeys" for descriptions of the standard softkeys.



SHIFT FACE (F1) and **SHIFT PLANE (F1)**
Available in **REFPLANE XX Reference Plane, Plot** page. To change between the face and the plane view of the plane.

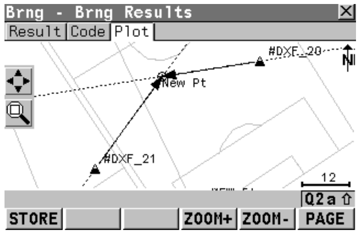
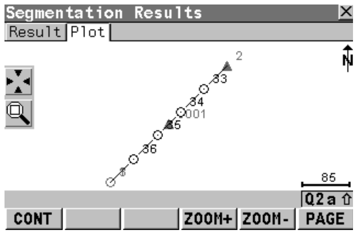
SHIFT FIT R (F4)
To fit the results in the screen area.

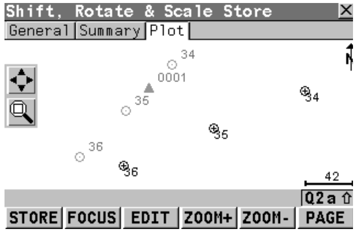
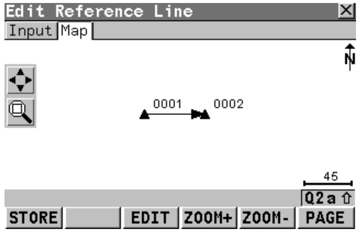
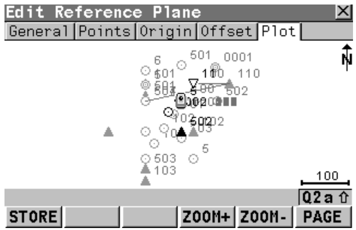
SHIFT RFRSH (F5)
To refresh the screen.

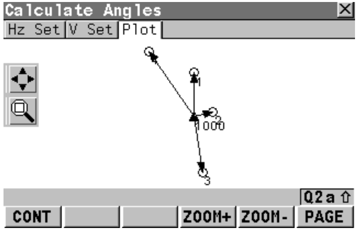
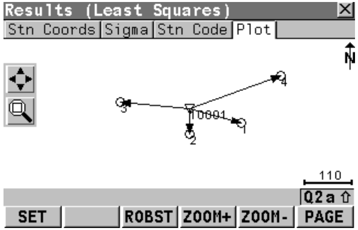
Touch screen functions

Key	Touch Equivalent
SHIFT FIT R (F4)	Tap on fit results touch icon. Refer to "30.4.3 Toolbar".

Example of results displayed in MapView on Plot page

Application	Display	Description
COGO Inter-section, Bearing - Bearing		Intersecting lines with known bearings from known points.
COGO line calculation, Segmentation		Points defining the line and those created on the line

Application	Display	Description
COGO Shift, Rotate & Scale		Original points in grey, calculated COGO points in black
Reference Line, Edit Reference Line		Reference line or arc
Reference Plane, Edit Reference Plane		A dashed rectangle indicates the face view of the plane.

Application	Display	Description
Sets of Angles, Calculating Angles		Directions from station to sets of angle points
Setup		Directions to resection points.

30.7 Survey Mode

30.7.1 MapView in Survey Mode

Description

The survey mode of MapView is available as the Map page in Survey and is used to display the position of the instrument station during a survey. It can also be used to select lines and areas. It is also used by the Stakeout, Reference Line and Reference Plane application programs to assist in the staking out/measuring of points.

Refer to "30.7.2 MapView in Staking Out Survey Mode" for more information about using MapView when staking out points.

Access

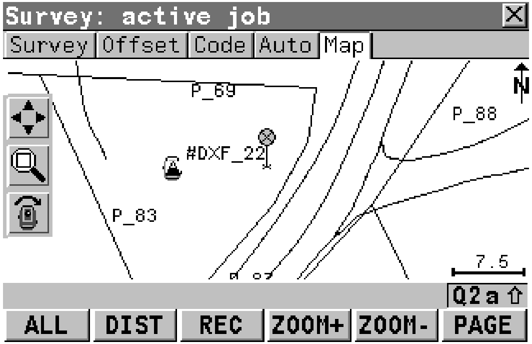
Refer to "30.2 Accessing MapView" paragraph "Example access for survey mode:".

☞

The **SURVEY Survey: Job Name**, **Map** page is used as the example below. The functions described are the same for all **Map** pages in survey mode.

SURVEY
Survey: Job Name, Map page

The softkeys described below are specific to MapView in survey mode. Refer to "30.4.1 Softkeys" for descriptions of the standard softkeys.



SHIFT CENTR (F4)
To centre the screen around the point with the current focus or the focus tool, if **FOCUS (F2)** is active.

SHIFT RFRSH (F5)
To refresh the screen.

Touch screen functions

Key	Touch equivalent
SHIFT CENTR (F4)	Tap on centre touch icon. Refer to "30.4.3 Toolbar".

30.7.2 MapView in Staking Out Survey Mode

Description

When staking out a point in Stakeout or Reference Line application programs, the **Map** page is available. The MapView survey mode is provided for this operation, with some differences.

- With the Getac active points can be selected, using the touch screen, as points to be staked.
- An arrow indicating the direction from the current position to the point to be staked is provided.
- A box provides information such as the distance to the stakeout point and the CUT/FILL value so the point to be staked can be found.

Data displayed

For Stakeout application program.

- From **<Job:>** and **<Stakeout Job:>**, all point symbols are shown in green, point ID's in black and displayable lines and areas in a colour defined in **MANAGE New Line** or **MANAGE Edit Line**.
- If the survey is to be orientated to a reference line/arc, the line is displayed in black.

For Reference Line application program.

- From **<Job:>**, all point symbols are shown in green, point ID's and displayable lines and areas are shown in black.
- From **<Control Job:>**, all point ID's and point symbols are shown in grey, displayable lines and areas are shown in a colour defined in **MANAGE New Line** or **MANAGE Edit Line**.
- The point to be staked is displayed in black.
- The reference line/arc is displayed in black.

☞ The **STAKEOUT XX Stakeout**, **Map** page is used as the example below. The functions described are the same for all **Map** pages available when staking out.

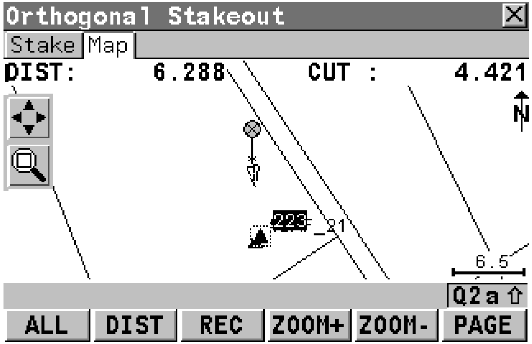
Access step-by-step

Example access for MapView in survey mode, Stakeout

Step	Description
1.	Select **Main Menu: Programs...\Stakeout**. OR Press **PROG**. Highlight **Stakeout**. **CONT (F1)**. OR Press a hot key configured to access the screen **STAKEOUT Stakeout Begin**. Refer to "2.1 Hot Keys" for information on hot keys. OR Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key. OR Press **STAKE (F5)** from another application program, for example COGO.
2.	**CONT (F1)** to access **STAKEOUT XX Stakeout**.
3.	**PAGE (F6)** until **STAKEOUT XX Stakeout**, **Map** page is active.

STAKEOUT XX Stakeout, Map page

The softkeys described below are specific to MapView in survey mode, staking out. Refer to "30.4.1 Softkeys" for descriptions of the standard softkeys.



SHIFT CENTR (F4)
To centre the screen around the reflector.

Description of fields

Field	Option	Description
<DIST:>	Output	Horizontal distance from the current position to the point to be staked.
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked.
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked.

30.7.3 Selecting Lines and Areas

Description

Selecting a line or area in the survey mode of MapView is possible using the touch screen. The functionality of all screens and field are similar for the selecting of a line or area. The step-by-step instructions for selecting a line using the touch-screen can be applied for areas.

Selecting a line step-by-step

Step	Description
1.	Select **Main Menu: Survey**. OR Select **Main Menu: Programs...\Survey**. OR Press a hot key configured to access the screen **SURVEY Survey Begin**. Refer to "2.1 Hot Keys" for information on hot keys. OR Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key. OR Press **PROG**. Highlight Survey. **CONT (F1)**. Refer to "31.2 Accessing the Programs Menu" for information on the **PROG** key.
2.	**PAGE (F6)** until **SURVEY XX Survey**, **Map** page is active.
3. ☞	Tap on the line to be selected. When there are multiple lines within the same area and the precise selection is unclear, tapping on the line will access **XX Select Line**.

Step	Description
4.	Have multiple lines been selected ? • If **yes**, continue with step 5. • If **no**, continue with step 7.
5.	**XX Select Line** **Point ID** The ID of the lines within range of the line selection. **Point Code** The code of the lines within range of the point selection. Select the desired line.
☞	**MORE (F5)** to display information about the line code, the start time, the end time, the length and the Open status of the line.
6.	**CONT (F1)** returns to **SURVEY Data: Job Name**, **Map** page.
7.	A message appears in the message line. • Line Line Name was opened (If the line was close before). • Line Line Name was closed (If the line was open before).

31 Application Programs - General

31.1 Overview

Description

Application programs are software packages supporting specific tasks. Available are:

- Survey (integrated into the instrument firmware and cannot be deleted)
- Setup (integrated into the instrument firmware and cannot be deleted)

- Alignment Tool Kit
- COGO
- DTM Stakeout
- Hidden Point
- Reference Line
- Reference Plane
- Road - this program could contain the following:
  - Roads
  - Tunnel

- Sets of Angles - this program could contain the following:
  - Sets of Angles
  - Monitoring
- Stakeout
- Survey Cross Section
- Traverse
- Volume Calculations

For an explanation of the application programs refer to the relevant chapters.

Loadable and non-loadable application programs

Loadable application programs:	• Can be loaded onto the instrument. • Can be deleted from the instrument.
Non-loadable application programs:	• Are always available on the instrument. • Survey and Setup are non-loadable application programs. To get updates for these programs, the system software has to be reloaded.

Licence key

Some loadable application programs are protected. They are activated through a specific licence key. This can either be typed in **Main Menu: Tools...\Licence Keys** or the first time the application program is started. Refer to "26 Tools...\Licence Keys" for information on how to type in or upload a licence key.
A licence key is required for:

- DTM Stakeout
- Reference Line
- Reference Plane
- Road (includes Tunnel, which requires a separate licence key)
- Sets of Angles (includes Monitoring, which requires a separate licence key)
- Survey Cross Section
- Traverse
- Volume Calculations
- Hidden Point

31.2 Accessing the Programs Menu

Description

The application programs menu contains all loaded application programs including Survey and Setup. They are listed in the order in which they were loaded. Selecting an option in the menu starts the application program assigned to the option. Configurations and measurements that can be performed depend on the application program.
The screen of the application programs menu is called **Zoom80 Programs**.

Access to the application programs menu

Select **Main Menu: Programs...**.

OR

Press **PROG**.

Zoom80 Programs

CONT (F1)
To start the highlighted application program.

Next step

Select an option in the menu to open the application. Refer to the chapter on the individual application programs.

☞ Four application programs can be open at one time. **XX Begin** is shown for the application program opened first, but not for the following application programs.

---

32 COGO

32.1 Overview

Description

COGO is an application program to perform **co**ordinate **geo**metry calculations such as

- coordinates of points.
- bearings between points.
- distances between points.

The calculations can be made from

- existing point data in the job, known distances or known azimuths.
- measured points.
- entered coordinates.

In contrast to remote point measurements within the Survey application program, COGO is more of a calculation program than a measuring program.

☞ Changing coordinates of a point which has been previously used in COGO does not result in the point being recomputed.

COGO calculation methods

The COGO calculation methods are:

- Inverse.
- Traverse.
- Intersections.
- Line calculations.
- Arc calculations.
- Shift, Rotate & Scale (Manual)
- Shift, Rotate & Scale (Match Pts)
- Area Division

Distances and azimuths	Type of distances: Grid Type of azimuths: The azimuths are grid azimuths relative to the local grid.
Coding of COGO points	• Thematical coding is available in **COGO XX Results** after the COGO calculation. Thematical coding of COGO points is identical to coding measured points. Refer to "9 Coding" for information on coding. • For the COGO calculation shift, rotate & scale, the codes from the original points are taken over for the calculated COGO points.
Properties of COGO points	The properties stored with COGO points are: • Class: Either **MEAS** or **CTRL** depending on the COGO calculation method. • Sub class: **COGO** • Source: **Arc Base Pt**, **Arc Centre Pt**, **Arc Offset Pt**, **Arc Segmt Pt**, **COGO Area Divsn.**, **COGO Shift/Rtn**, **COGO Traverse**, **Intsct (Brg Brg)**, **Intsct (Brg Dst)**, **Intsct (Dst Dst)**, **Intsct (4 Pts)**, **Line Base Pt**, **Line Offset Pt** or **Line Segmt Pt** depending on the COGO calculation method used • Instrument source: **TPS**

32.2 Accessing COGO

Access

Select **Main Menu: Programs...\COGO**.

OR

Press **PROG**. Highlight **COGO**. **CONT (F1)**. Refer to "31.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

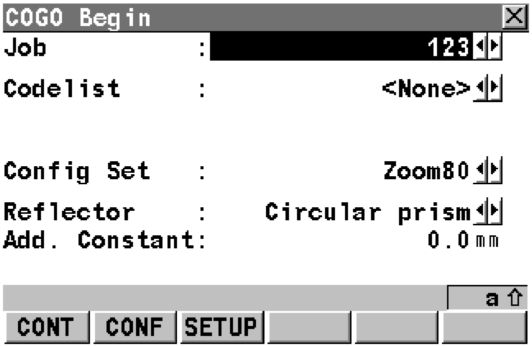
Press a hot key configured to access the screen **COGO COGO Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

The screens for each COGO calculation method can be accessed directly by pressing a configured hot key or **USER** where **COGO COGO Begin** is not accessed. The currently active configuration set and job are used.

COGO
COGO Begin



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure the COGO application program. Accesses **COGO Configuration**. Refer to "32.3 Configuring COGO".

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

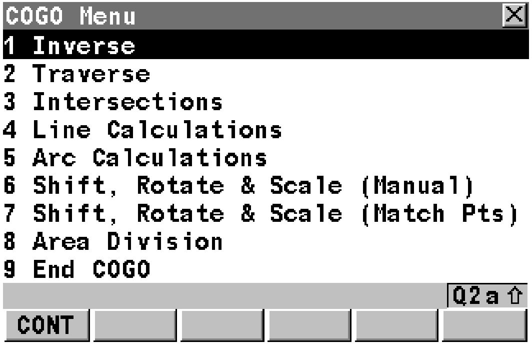
Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Codelist:>	Choicelist	No codes are stored in the selected **<Job:>**. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step
CONT (F1) accepts changes and accesses **COGO COGO Menu**.

COGO
COGO Menu

The COGO menu lists all COGO calculation methods and the option to end COGO.



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

SHIFT CONF (F2)
To configure the COGO application program. Accesses **COGO Configuration**. Refer to "32.3 Configuring COGO".

Description of the COGO menu options

COGO menu options	Description	Refer to chapter
Inverse	To calculate the direction, the distance and the 3D coordinate differences between: • two known points, • a known point and a given line, • a known point and a given arc. Points with full coordinate triplets, position only points and height only points can be used.	32.4
Traverse	To calculate the position of new points using	32.5

COGO menu options	Description	Refer to chapter
	• the azimuth/bearing and the distance from a known point. Offset optional. • the angle and the distance from a known point. Offset optional. Points with full coordinate triplets and position only points can be used.	
Intersections	To calculate the position of an intersection point using • bearings from two known points. • a bearing and a distance from two known points. • distances from two known points. • four points. • two lines Points with full coordinate triplets and position only points can be used.	32.6
Line Calculations	To calculate the base point of the line using • two known points and an offset point. • a bearing and a distance from a known point and an offset point. To calculate the offset point of the line using	32.7

COGO menu options	Description	Refer to chapter
	• two known points that define the line, a distance along the line and an offset. • a distance along a bearing from a known point and offset. To calculate new points on a line using • two known points that define the line and either the segment length or the number of segments. • a bearing and distance from a known point that define the line and either the segment length or the number of segments.	
Arc Calculations	To calculate: • the arc centre. • the base point of the arc. • the offset point of the arc. • new points on an arc. The arc can be defined using • three points. • a radius to two known points.	32.8

COGO menu options	Description	Refer to chapter
	• a radius and two tangents, each of it defined by a point and the intersection point of the tangents. • the length of an arc and two tangents, each of it defined by a point and the inter-section point of the tangents. • the length of a chord and two tangents, each of it defined by a point and the inter-section point of the tangents. Known must be also, depending on the arc calculation method • an offset point. • either the segment length or the number of segments.	
Shift, Rotate & Scale (Manual)	To calculate the position of new points using • coordinates of known points • shifts. • rotation. • scale. Heights are not scaled. The values for shifts, rotation and/or scale are entered manually.	32.9

COGO menu options	Description	Refer to chapter
	Points with full coordinate triplets, position only points and height only points can be used.	
Shift, Rotate & Scale (Match Pts)	To calculate the coordinates of new points using the shifts, rotation and scale computed from selected points. Points with full coordinate triplets, position only points and height only points can be used.	32.10
Area Division	To divide an area by a • defined line • percentage • size of a sub area.	32.11
End COGO	To end COGO and return to the screen from where COGO was accessed.	

Next step

IF	THEN
a COGO calculation method is to be started	highlight the relevant option and press **CONT (F1)**. Refer to the chapters stated above.

IF	THEN
COGO is to be configured	**SHIFT CONF (F2)**. Refer to "32.3 Configuring COGO".
COGO is to be ended	highlight **End COGO** and **CONT (F1)**.

32.3 Configuring COGO

Access

Select **Main Menu: Programs...\COGO**. In **COGO COGO Begin** press **CONF (F2)** to access **COGO Configuration**.

OR

Press **PROG**. Highlight **COGO**. **CONT (F1)**. In **COGO COGO Begin** press **CONF (F2)** to access **COGO Configuration**.

OR

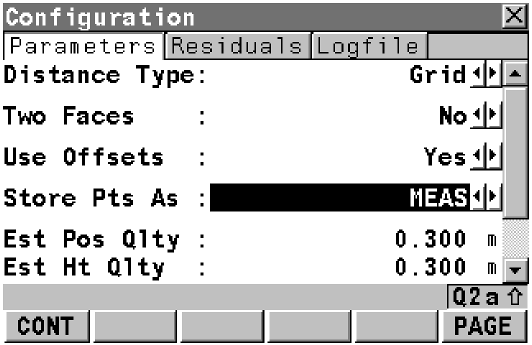
Press **SHIFT CONF (F2)** in **COGO COGO Menu**. Refer to "32.2 Accessing COGO".

OR

Press **SHIFT CONF (F2)** in **COGO XX**.

COGO Configuration, Parameters page

This screen consists of the **Parameters** page, **Residuals** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Distance Type:>		The type of distances and offsets to be accepted as input, shown as output and used in the calculation.
	Grid	Distances are calculated as the trigonometric distance between the position of two points. The distance field is **<HDist-Grid:>**.
<Two Faces:>		Defines if the instrument measures the second face automatically after storing the first.
	Yes	After storing a measurement with **ALL (F1)** or **REC (F3)** motorised instruments change face automatically. The measurements of face I and face II are averaged on the base of face I. The averaged value is stored.
	No	No automatic measurement in two faces.
<Use Offsets:>	**Yes** or **No**	Activates the use of offsets in the COGO calculations. Input fields for the offsets are available in **COGO XX**.
<Store Pts As:>	**MEAS** or **CTRL**	To store the cogo point with point class MEAS or with point class CTRL.

Field	Option	Description
		Points stored with point class MEAS can be stored with the same point ID. The averaging functionality (configured under job management) can then be used to calculate an average for these points. Points stored with point class CTRL can only be stored with a unique point ID. A message is always displayed when a point is about to be stored with an already existing point ID. The user can then decide to either keep the existing point or overwrite the existing point.
<Est Pos Qlty:>	User input	The estimated value for the position quality assigned to all calculated COGO points which is used for the averaging calculation.
<Est Ht Qlty:>	User input	The estimated value for the height quality assigned to all calculated heights which is used for the averaging calculation.
When the Intersections **<Method: TPS Obs-TPS Obs>**, the following fields apply:		
<Compute Ht:>	Output text	Defines the height being used.
	Using Average	Using an average of the two observations.
	Use Upper Height	Using the upper height.

Field	Option	Description
	Use Lower Height	Using the lower height.

Next step

PAGE (F6) changes to the **Residuals** page. Refer to paragraph "COGO Configuration, Residuals page".

COGO Configuration, Residuals page

This page applies to COGO Shift, Rotate & Scale (Match Pts).

Description of fields

Field	Option	Description
<Easting:>	User input	The limit above which Easting residuals will be flagged as possible outliers.
<Northing:>	User input	The limit above which Northing residuals will be flagged as possible outliers.
<Height:>	User input	The limit above which Height residuals will be flagged as possible outliers.
<Residual Distbtn:>		The method by which the residuals of the control points will be distributed throughout the transformation area.
	None	No distribution is made. Residuals remain with their associated points.

Field	Option	Description
	1/Distance XX	Distributes the residuals according to the distance between each control point and the newly transformed point.
	Multiquad-ratic	Distributes the residuals using a multiquad-ratic interpolation approach.

Next step

PAGE (F6) changes to the **Logfile** page. Refer to paragraph "COGO Configuration, Logfile page".

COGO Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

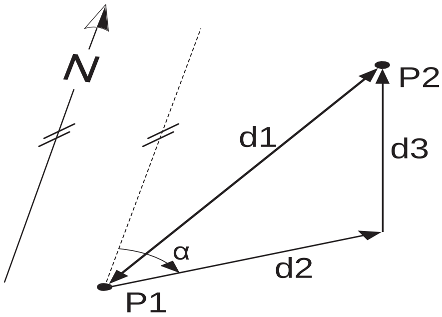
☞ **<Azimuth:>** is used throughout this chapter. This should always be considered to also mean **<Bearing:>**.

32.4 COGO Calculation - Inverse Method

32.4.1 Overview

Description

It is possible to compute an inverse result between point, line and arc elements:



Option 1: inverse between point - point

To compute an inverse between two known points.

Known elements:

P1 First known point (From)

P2 Second known point (To)

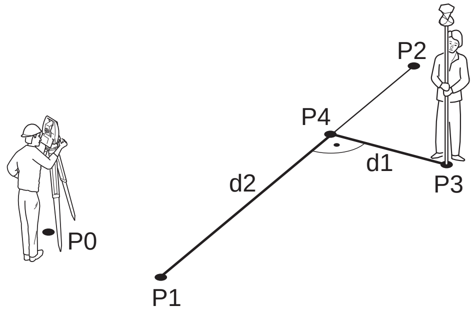
Unknown elements:

α Direction from P1 to P2

d1 Slope distance between P1 and P2

d2 Horizontal distance between P1 and P2

d3 Height difference between P1 and P2



Option 2: inverse between point - line

To compute an inverse between a known point and a given line (the inverse is computed as the perpendicular between the known point and the given line).

Known elements:

P0 Instrument station

P1 Starting point

P2 End point or the direction from P1 to P2

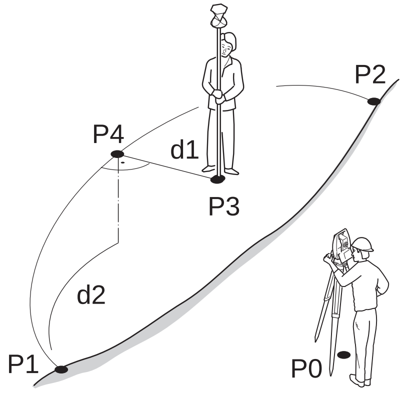
P3 Offset point

Unknown elements:

P4 Base point

d1 The perpendicular offset to the base point

d2 The distance along the line



Option 3: inverse between point - arc

To compute an inverse between a known point and a given arc (the inverse is computed as the perpendicular between the known point and the given arc).

Known elements:

P0 Instrument station
P1 Starting point
P2 End point
P3 Offset point
P4 Second point or arc radius or arc/chord length

Unknown elements:

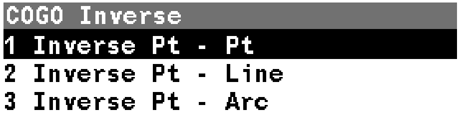
P4 Base point
d1 The perpendicular offset to the base point
d2 The distance along the arc

The coordinates of the points must be known. The points:

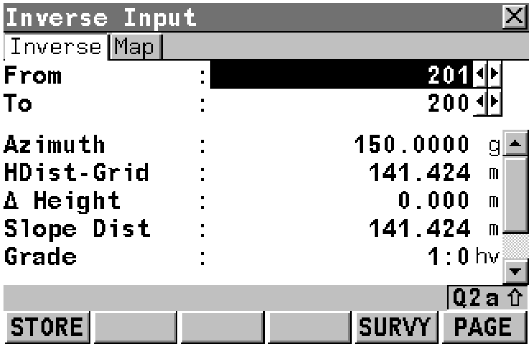
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered manually.

32.4.2 Inverse Between Two Known Points (Pt - Pt)

Starting step-by-step

Step	Description
1.	
2.	

Calculating



STORE (F1)
To store the result.

SURVY (F5)
To measure a known point for the calculation.

SHIFT CONF (F2)
To configure the program.

PAGE (F6)
To change to another page on the screen.

Description of fields

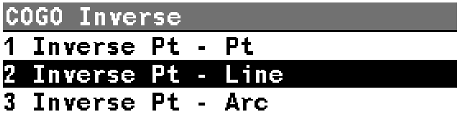
Field	Option	Description
<From:> or **<To:>**	Choicelist	The point ID of the two known points. To type in coordinates for a known point open the choicelist. Press **NEW (F2)** to create a new point.
<Azimuth:>	Output	The direction from the first point to the second point.
<HDist-XX:>	Output	The horizontal distance between the two points.
<ΔHeight:>	Output	The height difference between the two points.
<Slope Dist:>	Output	The slope distance between the two points.
<Grade:>	Output	The grade between the two points.
<ΔEasting:>	Output	The difference in Easting between the two points.
<ΔNorthing:>	Output	The difference in Northing between the two points.

Storing the results step-by-step

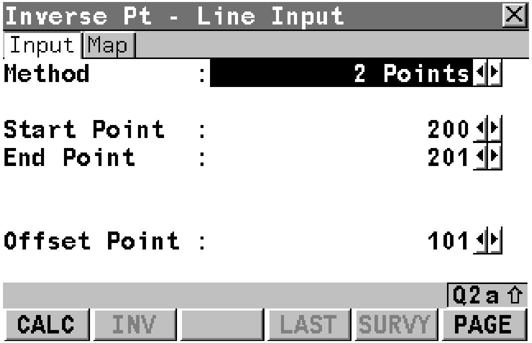
Step	Description
1.	Press **STORE (F1)** to store the inverse result to the active job. There are no points stored to the database, only the inverse result.
2.	Inverse results can be exported from the job using a format file. The format file is created with Format Manager in GGO.

32.4.3 Inverse Between a Known Point and a Line (Pt - Line)

Starting step-by-step

Step	Description
1.	
2.	

Calculating



CALC (F1)
To calculate the result.

INV (F2)
To calculate the inverse between two points.

LAST (F4)
To select the values for distance and offset from previous COGO inverse calculations.

SURVY (F5)
To measure a known point for the calculation.

SHIFT CONF (F2)
To configure the program.

SHIFT MODIF (F4)
To modify the original azimuth, distance or offset value.

PAGE (F6)
To change to another page on the screen.

Description of fields

Field	Option	Description
<Method:>		**2 Points** or **Pt/Brg/Dist**. The method for calculating the inverse result.
<Start Point:>	Choicelist	The point ID defining the start of the line.
<End Point:>	Choicelist	The point ID defining the end of the line.

Field	Option	Description
<Azimuth:>	Output	The direction from the first point to the second point.
<HDist-XX:>	Output	The horizontal distance between the two points.
<Offset Point:>	Choicelist	The point ID defining an offset to the line.

Storing the results step-by-step

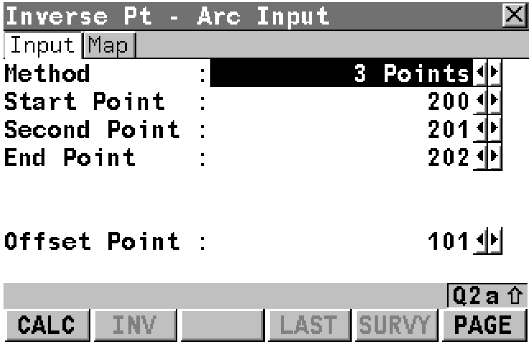
Step	Description
1.	Press **CALC (F1)** to calculate the inverse result and move to the results screen.
2.	Press **STORE (F1)** to store the inverse result to the active job. There are no points stored to the database, only the inverse result.
3.	Inverse results can be exported from the job using a format file. The format file is created with Format Manager in GGO.

32.4.4 Inverse Between a Known Point and an Arc (Pt - Arc)

Starting step-by-step

Step	Description
1.	COGO Menu 1 Inverse 2 Traverse 3 Intersections
2.	COGO Inverse 1 Inverse Pt - Pt 2 Inverse Pt - Line 3 Inverse Pt - Arc

Calculating



CALC (F1)
To calculate the result.

INV (F2)
To calculate the inverse between two points.

LAST (F4)
To select the values for distance and offset from previous COGO Inverse calculations.

SURVY (F5)
To measure a known point for the calculation.

SHIFT CONF (F2)
To configure the program.

SHIFT MODIF (F4)
To modify the original azimuth, distance or offset value.

PAGE (F6)
To change to another page on the screen.

Description of fields

Field	Option	Description
<Method:>		**3 Points** or **2 Points/Radius** or **2 Tgnts/Radius** or **2 Tgnts/Arc Lngt** or **2 Tgnts/Chrd Lngt**. The method for calculating the inverse result.

Field	Option	Description
<Start Point:>	Choicelist	The point ID defining the start of the arc.
<Second Point:>	Choicelist	The point ID defining a second point on the arc.
<End Point:>	Choicelist	The point ID defining the end of the arc.
<Arc Length:>	User Input	The arc length.
<Azimuth:>	Output	The direction from the first point to the second point.
<Chord Length:>	User Input	The chord length of the arc.
<HDist-XX:>	Output	The horizontal distance between the two points.
<Offset Point:>	Choicelist	The point ID defining an offset to the arc.
<PI Point:>	Choicelist	The point ID defining the intersection of the tangents.
<Point 1:>	Choicelist	The point ID (with PI Point) defining the 1st tangent.
<Point 2:>	Choicelist	The point ID (with PI Point) defining the 2nd tangent.
<Radius:>	User Input	The radius of the arc.

Storing the results step-by-step

Step	Description
1.	Press **CALC (F1)** to calculate the inverse result and move to the results screen.
2.	Press **STORE (F1)** to store the inverse result to the active job. There are no points stored to the database, only the inverse result.
3.	Inverse results can be exported from the job using a format file. The format file is created with Format Manager in GGO.

32.5 COGO Calculation - Traverse Method

32.5.1 Overview

Description

Elements that must be known are
- the coordinates of one point.
- the direction from the known point to the COGO point.
- the distance from the known point to the COGO point.
- offsets, if required and configured.

The coordinates of the known point
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

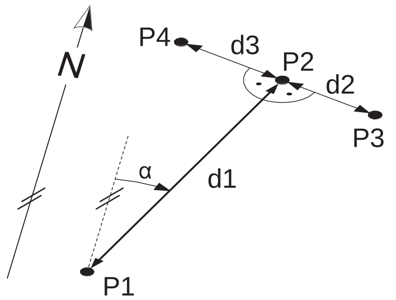
The direction from the known point to the COGO point can be an azimuth or an angle.

Points with full coordinate triplets and position only points can be used. Position only is calculated, height can be typed in.

A COGO traverse calculation can be calculated for
- a single point.
- multiple points. Several single points are calculated in one sequence.
- sideshots.

Diagram

COGO traverse calculation with offset for a single point



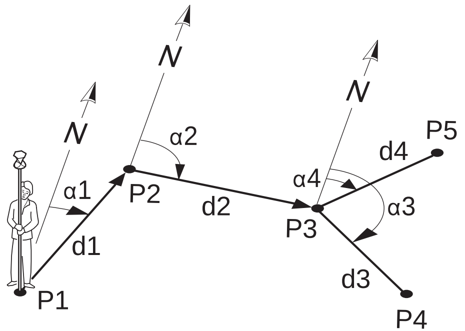
Known

P1	Known point
α	Direction from P1 to P2
d1	Distance between P1 and P2
d2	Positive offset to the right
d3	Negative offset to the left

Unknown

P2	COGO point without offset
P3	COGO point with positive offset
P4	COGO point with negative offset

COGO traverse calculation without offset for multiple points



Known

P1	Known point
α1	Direction from P1 to P2
α2	Direction from P2 to P3
α3	Direction from P3 to P4
α4	Direction from P3 to P5
d1	Distance between P1 and P2
d2	Distance between P2 and P3
d3	Distance between P3 and P4
d4	Distance between P3 and P5

Unknown

P2	First COGO point
P3	Second COGO point
P4	Third COGO point - sideshot
P5	Fourth COGO point

32.5.2 Traverse with Azimuth/Bearing

COGO traverse calculation with azimuth/bearing step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "32.2 Accessing COGO" to access **COGO Traverse Input**.	
☞	**COGO Traverse Input**, **Input** page **SHIFT CONF (F2)** to configure the COGO application program.	32.3
2.	**COGO Traverse Input**, **Input** page **<Method: Azimuth>** **<From:>** The point ID of the known point for the COGO calculation. Select a point to be used.	
☞	**SURVY (F5)** when **<From:>** is highlighted. To measure a known point for the COGO calculation.	42.2
☞	For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point.	30.5
☞	To type in coordinates for a known point open the choicelist when **<From:>** is highlighted. Press **NEW (F2)** to create a new point.	7.3.2
3.	**COGO Traverse Input**, **Input** page	

Step	Description	Refer to chapter
	<Azimuth:> The direction from the known point to the COGO point. **<HDist-XX:>** The horizontal distance between the known point and the COGO point. **<Offset:>** Available for **<Use Offsets: Yes>** in **COGO Configuration**, **Parameters** page. The offset of the COGO point from the line of direction. A positive offset is to the right, a negative offset is to the left. Type in the azimuth, the distance and the offset, if required.	
☞	The values for the azimuth, the distance and the offset can be calculated from two existing points. **INV (F2)** when **<Azimuth:>**, **<HDist-XX:>** or **<Offset:>** is highlighted. To perform a COGO inverse calculation. ☞ Upon pressing **STORE (F1)** in **COGO Inverse**, the result from the COGO inverse calculation is copied to the field which was highlighted when **INV (F2)** was pressed. ☞ For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result of the COGO inverse calculation is written to the logfile.	32.4
☞	The values for the azimuth, the distance and the offset can be selected from previous COGO inverse calculations.	32.12

Step	Description	Refer to chapter
	LAST (F4) when **<Azimuth:>**, **<HDist-XX:>** or **<Offset:>** is highlighted. To recall previous results from COGO inverse calculations. Upon pressing **CONT (F1)** in **COGO Last Inverse Calculations**, the selected result is copied to the field which was highlighted when **LAST (F4)** was pressed.	
	The values for the azimuth, the distance and the offset can be mathematically modified. **SHIFT MODIF (F4)** when **<Azimuth:>**, **<HDist-XX:>** or **<Offset:>** is highlighted. To add, subtract, multiply and divide values.	32.13
4.	Is the COGO point a foresight? • If **yes**, **CALC (F1)**. The result is calculated and displayed in **COGO Traverse Results**. After storing the result and returning to **COGO Traverse Input**, **Input** page, the point displayed in **<From:>** is the newly calculated COGO point. The next COGO calculation can be continued from this new point.	

Step	Description	Refer to chapter
	• If **no**, **SSHOT (F3)**. The result is calculated and displayed in **COGO Traverse Results**. After storing the result and returning to **COGO Traverse Input**, **Input** page, the point originally selected in **<From:>** is still displayed. The next COGO calculation can be continued from that same point.	
5.	**COGO Traverse Results**, **Result** page	
	<Point ID:> The identifier for the COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**. The point ID can be changed.	15.1
	The calculated coordinates are displayed.	
	Type in a point ID.	
	STAKE (F5) to access the Stakeout application program and stake out the calculated COGO point. After staking and storing the COGO point, **COGO Traverse Results**, **Result** page is displayed.	41.4
	SHIFT INDIV (F5) for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	15.1
6.	**PAGE (F6)** changes to the **Code** page.	
7.	**COGO Traverse Results**, **Code** page	9 and 7.3.2

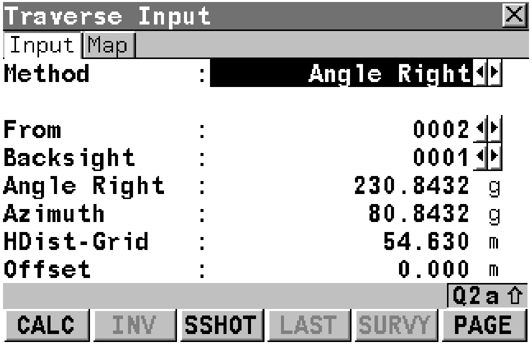
Step	Description	Refer to chapter
	<Code:>/**<Point Code:>** The thematical code. All codes of the job can be selected. Type in a code if required.	
8.	**PAGE (F6)** changes to the **Plot** page.	
9.	**COGO Traverse Results**, **Plot** page An arrow points from the known point to the calculated COGO point.	30.6
☞	**SHIFT QUIT (F6)** does not store the COGO point and exits COGO calculations.	
10.	**STORE (F1)** to store the result and return to **COGO Traverse Input**, **Input** page.	
☞	For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result is written to the logfile.	
11.	Are more COGO traverse calculations to be made? • If **yes**, repeat steps 2. to 11. • If **no**, continue with step 12.	
12.	**SHIFT QUIT (F6)** to exit COGO calculation.	

32.5.3 Traverse with Angle Right

Access

Refer to "32.2 Accessing COGO" to access **COGO Traverse Input**.

COGO Traverse Input, Input page



CALC (F1)
To calculate the COGO point.

INV (F2)
To calculate the values for the distance and the offset from two existing points. Available if **<HDist-XX:>** or **<Offset:>** is highlighted.

SSHOT (F3)
To calculate the point as a sideshot.

LAST (F4)
To select the values for the distance and the offset from previous COGO inverse calculations. Available if **<HDist-XX:>** or **<Offset:>** is highlighted.

SURVY (F5)
To measure a point for the COGO calculation. Available if **<From:>** or **<Backsight:>** is highlighted.

SHIFT CONF (F2)
To configure the COGO application program.

SHIFT MODIF (F4)

To mathematically modify the values for the angle right, the distance and the offset. Available if **<Angle Right:>, <HDist-XX:>** or **<Offset:>** is highlighted.

Description of fields

Field	Option	Description
<Method:>	**Angle Right**	The direction from the known point to the COGO point is an angle.
<From:>	Choicelist	The point ID of the known point for the COGO calculation.
<Backsight:>	Choicelist	The point ID of a point used as backsight.
<Angle Right:>	User input	The angle between **<Backsight:>** and the new COGO point to be calculated from the point selected as **<From:>**. A positive value is for clockwise angles. A negative value is for counterclockwise angles.
<Azimuth:>	Output	The direction from the known point to the COGO point calculated from **<Angle Right:>**.
<HDist-XX:>	User input	The horizontal distance between the known point and the COGO point.

Field	Option	Description
<Offset:>	User input	The offset of the COGO point from the line of direction. A positive offset is to the right, a negative offset is to the left.

Next step

The work flow is very similar to a COGO traverse calculation with azimuth/bearing. Refer to "32.5.2 Traverse with Azimuth/Bearing".

32.6 COGO Calculation - Intersections Method

32.6.1 Intersection with Bearing - Bearing

Description

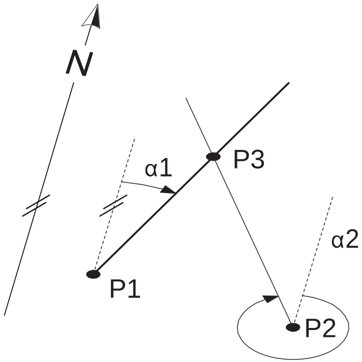
The COGO intersection calculation bearing - bearing calculates the intersection point of two lines. A line is defined by a point and a direction.

Elements that must be known are
- the coordinates of two points.
- the direction from these known points to the COGO point.
- offsets if required and configured.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used. Position only is calculated, height can be typed in.

Diagram



Known
P1 First known point
P2 Second known point
α1 Direction from P1 to P3
α2 Direction from P2 to P3
Unknown
P3 COGO point

COGO intersection calculation with bearing - bearing step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "32.2 Accessing COGO" to access **COGO Intersection Input**.	
☞	**COGO Intersection Input**, **Input** page **SHIFT CONF (F2)** to configure the COGO application program.	32.3
2.	**COGO Intersection Input**, **Input** page **<Method: Brng - Brng>** **<1st Point:>** The point ID of the first known point for the COGO calculation.	

Step	Description	Refer to chapter
	Select the point stored in the job.	
☞	**SURVY (F5)** when **<1st Point:>** is highlighted. To measure a point for the COGO calculation.	42.2
☞	For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point.	30.5
☞	To type in coordinates for a known point open the choicelist when **<1st Point:>** is highlighted. Press **NEW (F2)** to create a new point.	7.3.2
3.	**COGO Intersection Input**, **Input** page **<Azimuth:>** The direction from the first known point to the COGO point. **<Offset:>** Available for **<Use Offsets: Yes>** in **COGO Configuration**, **Parameters** page. The offset of the COGO point from the line of direction. A positive offset is to the right, a negative offset is to the left. Type in the azimuth and the offset, if required.	
☞	The values for the azimuth and the offset can be calculated from two existing points. **INV (F2)** when **<Azimuth:>** or **<Offset:>** is highlighted. To perform a COGO inverse calculation.	32.4

Step	Description	Refer to chapter
	☞ Upon pressing **STORE (F1)** in **COGO Inverse**, the result from the COGO inverse calculation is copied to the field which was highlighted when **INV (F2)** was pressed. ☞ For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result of the COGO inverse calculation is written to the logfile.	
☞	The values for the azimuth and the offset can be selected from previous COGO inverse calculations. **LAST (F4)** when **<Azimuth:>** or **<Offset:>** is highlighted. To recall previous results from COGO inverse calculations. Upon pressing **CONT (F1)** in **COGO Last Inverse Calculations**, the selected result is copied to the field which was highlighted when **LAST (F4)** was pressed.	32.12
☞	The values for the azimuth and the offset can be mathematically modified. **SHIFT MODIF (F4)** when **<Azimuth:>** or **<Offset:>** is highlighted. To add, subtract, multiply and divide values.	32.13
4.	**COGO Intersection Input**, **Input** page The procedure to input the second known point and the azimuth is identical to the procedure for the first known point. Repeat steps 2. and 3.	
5.	**CALC (F1)** to calculate the result.	

Step	Description	Refer to chapter
6.	**COGO Brng - Brng Results**, **Result** page	
	<Point ID:> The identifier for the COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**. The point ID can be changed.	15.1
	The calculated coordinates are displayed. Type in a point ID.	
☞	**STAKE (F5)** to access the Stakeout application program and stake out the calculated COGO point.	41.4
	After staking and storing the COGO point **COGO Brng - Brng Results**, **Result** page is displayed.	
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	15.1
7.	**PAGE (F6)** changes to the **Code** page.	
8.	**COGO Brng - Brng Results**, **Code** page	9 and 7.3.2
	<Code:>/**<Point Code:>** The thematical code. All codes of the job can be selected.	
	Type in a code if required.	
9.	**PAGE (F6)** changes to the **Plot** page.	
10.	**COGO Brng - Brng Results**, **Plot** page	30.6

Step	Description	Refer to chapter
	Arrows point from the known points to the calculated COGO point.	
☞	**SHIFT QUIT (F6)** does not store the COGO point and exits COGO calculation.	
11.	**STORE (F1)** to store the result and return to **COGO Intersection Input**, **Input** page.	
☞	For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result is written to the logfile.	
12.	Are more COGO intersection calculations to be made? • If **yes**, repeat steps 2. to 12. **<Method:>** in **COGO Intersection Input**, **Input** page can be changed. Refer to the relevant chapters for the other COGO intersection calculation methods. • If **no**, continue with step 13.	32.6.2, 32.6.3 or 32.6.4.
13.	**SHIFT QUIT (F6)** to exit COGO calculation.	

32.6.2 Intersection with Bearing - Distance

Description

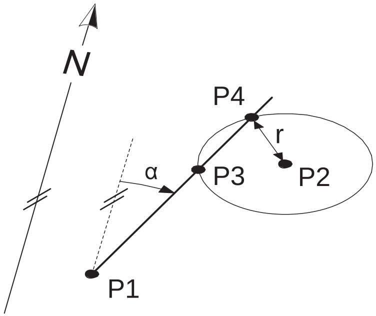
The COGO intersection calculation bearing - distance calculates the intersection point of a line and a circle. The line is defined by a point and a direction. The circle is defined by the centre point and the radius.

Elements that must be known are
- the coordinates of two points.
- the direction from one known point to the COGO point.
- the distance from the second known point to the COGO point.
- offsets if required and configured.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used.

Diagram



Known

P1 First known point
P2 Second known point
α Direction from P1 to P3 and P4
r Radius, as defined by the distance from P2 to P4 and P3

Unknown

P3 First COGO point
P4 Second COGO point

COGO intersection calculation with bearing - distance step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	The procedure of a COGO intersection calculation with bearing - distance is similar to a COGO intersection calculation with bearing - bearing. Follow the steps 1. to 5. in paragraph "COGO intersection calculation with bearing - bearing step-by-step". The differences are: • **<Method: Brng - Dist>** is to be selected in **COGO Intersection Input**, **Input** page. • For the second known point **<HDist-XX:>** is used instead of **<Azimuth:>**. The keys and advice mentioned are still valid.	32.6.1

Step	Description	Refer to chapter
2.	**CALC (F1)** to calculate the COGO points.	
☞	Two results are calculated.	
3.	**COGO Brng - Dist Results**, **Result1** page **<Point ID:>** The identifier for the first result of the COGO point depending on the point ID template configured for <**Survey Pts:>** in **CONFIGURE ID Templates**. The point ID can be changed. The calculated coordinates are displayed. Type in a point ID.	15.1
☞	**STAKE (F5)** to access the Stakeout application program and stake out the calculated COGO point. After staking and storing the COGO point **COGO Brng - Brng Results**, **Result1** page is displayed.	41.4
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	15.1
☞	**PAGE (F6)** changes to the **Code** page where a code and attributes can be selected.	9
☞	Pressing **PAGE (F6)** twice changes to the **Plot** page. Both COGO points and known points are displayed.	30.6
☞	**SHIFT QUIT (F6)** does not store the COGO points and exits COGO calculations.	

Step	Description	Refer to chapter
☞	**RSLT1 (F3)** or **RSLT2 (F3)** to view the first and second result.	
4.	**COGO Brng - Dist Results**, **Result1** page s the first result to be stored? • If **yes**, **STORE (F1)** to store the result and activate the **Result2** page. For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result is written to the logfile. • If **no**, **RSLT2 (F3)** to activate the **Result2** page.	
5.	**COGO Brng - Dist Results**, **Result2** page Repeat step 3.	
6.	**COGO Brng - Dist Results**, **Result2** page Is the second result to be stored? • If **yes**, **STORE (F1)** to store the result and return to **COGO Intersection Input**, **Input** page. For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result is written to the logfile. • If **no**, **ESC** does not store the COGO point and returns to **COGO Intersection Input**, **Input** page.	
7.	Are more COGO intersection calculations to be done?	

Step	Description	Refer to chapter
	• If **yes**, repeat steps 1. to 7. **<Method:>** in **COGO Intersection Input**, **Input** page can be changed. Refer to the relevant chapters for other COGO intersection calculation method than **<Method: Brng - Dist>**. • If **no**, continue with step 8.	32.6.1, 32.6.3 or 32.6.4
8.	**SHIFT QUIT (F6)** exit COGO calculation.	

32.6.3 Intersection with Distance - Distance

Description

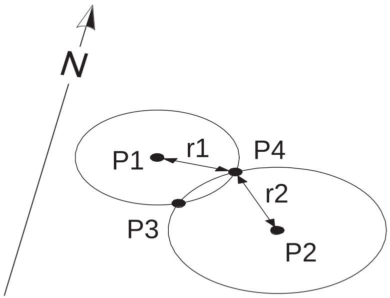
The COGO intersection calculation distance - distance calculates the intersection point of two circles. The circles are defined by the known point as the centre point and the distance from the known point to the COGO point as the radius.

Elements that must be known are
- the coordinates of two points.
- the distance from the known points to the COGO point.

The coordinates of the known points
- may be taken from the active job.
- may be manually occupied during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used.

Diagram



Known

P1 First known point
P2 Second known point
r1 Radius, as defined by the distance from P1 to P3 or P4
r2 Radius, as defined by the distance from P2 to P3 or P4

Unknown

P3 First COGO point
P4 Second COGO point

COGO intersection calculation with distance - distance step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	The procedure for a COGO intersection calculation with distance - distance is very similar to a COGO intersection calculation with bearing - bearing.	
	Follow the steps 1. to 5. in paragraph "COGO intersection calculation with bearing - bearing step-by-step". The differences are: • **<Method: Dist - Dist>** is to be selected in **COGO Intersection Input**, **Input** page. • For both known points **<HDist-XX:>** is used instead of **<Azimuth:>**. The keys mentioned are still valid. • **<Offset:>** is unavailable.	32.6.1
2.	The remaining procedure is identical to a COGO intersection calculation with bearing - distance. The screen is called **COGO Dist - Dist Results**.	
	Follow the steps 2. to 8. in paragraph "COGO intersection calculation with bearing - distance step-by-step".	32.6.2

32.6.4 Intersection with By Points

Description

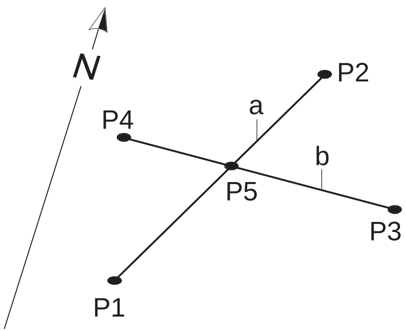
The COGO intersection calculation by points calculates the intersection point of two lines. A line is defined by two points.

Elements that must be known are
- the coordinates of four points.
- offsets of the lines if required and configured.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Points with full coordinate triplets and position only points can be used.

Diagram



Known

P1 First known point
P2 Second known point
P3 Third known point
P4 Fourth known point
a Line from P1 to P2
b Line from P3 to P4

Unknown

P5 COGO point

COGO intersection calculation with by points step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "32.2 Accessing COGO" to access **COGO Intersection Input**.	
☞	**COGO Intersection Input**, **Input** page **SHIFT CONF (F2)** to configure the COGO application program.	32.3.
2.	**COGO Intersection Input**, **Input** page **<Method: By Points>** **<1st Point:>** The point ID of the known start point of the first line for the COGO calculation. **<2nd Point:>** The point ID of the known end point of the first line for the COGO calculation. Select the points stored in the job.	
☞	**SURVY (F5)** when **<1st Point:>** or **<2nd Point:>** is highlighted. To measure a known point for the COGO calculation.	42.2
☞	For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point.	30.5
☞	To type in coordinates for a known point open the choicelist when **<1st Point:>** or **<2nd Point:>** is highlighted. Press **NEW (F2)** to create a new point.	7.3.2

Step	Description	Refer to chapter
3.	**COGO Intersection Input**, **Input** page **<Offset:>** Available for **<Use Offsets: Yes>** in **COGO Configuration**, **Parameters** page. The offset of the line in the direction **<1st Point:>** to **<2nd Point:>**. A positive offset is to the right, a negative offset is to the left. Type in the offset if required.	
☞	The value for the offset can be calculated from two existing points. **INV (F2)** when **<Offset:>** is highlighted. To perform a COGO inverse calculation. ☞ Upon pressing **STORE (F1)** in **COGO Inverse**, the result from the COGO inverse calculation is copied to the field which was highlighted when **INV (F2)** was pressed. ☞ For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result of the COGO inverse calculation is written to the logfile.	32.4
☞	The value for the offset can be selected from previous COGO inverse calculations. **LAST (F4)** when **<Offset:>** is highlighted. To recall previous results from COGO inverse calculations. Upon pressing **CONT (F1)** in **COGO Last Inverse Calculations**, the selected result is copied to the field.	32.12

Step	Description	Refer to chapter
☞	The value for the offset can be mathematically modified. **SHIFT MODIF (F4)** when **<Offset:>** is highlighted. To add, subtract, multiply and divide values.	32.13
4.	**COGO Intersection Input**, **Input** page The procedure for the third and fourth known point and the offset is identical to the procedure for the first and second known point. Repeat steps 2. and 3.	
5.	The remaining procedure is identical to a COGO intersection calculation with bearing - bearing. The screen is called **COGO By Points Results**. On the **Plot** page two solid lines are displayed. Follow the steps 5. to 13. in paragraph "COGO intersection calculation with bearing - bearing step-by-step".	 32.6.1

32.6.5 Intersection with TPS Observation - TPS Observation

Description

The COGO intersection calculation TPS observation - TPS observation calculates the intersection point of two lines. A line is defined by a TPS station and a TPS measurement from this station.

Elements that must be known are

- the coordinates of two points.
- azimuths of the lines.

The coordinates of the known points

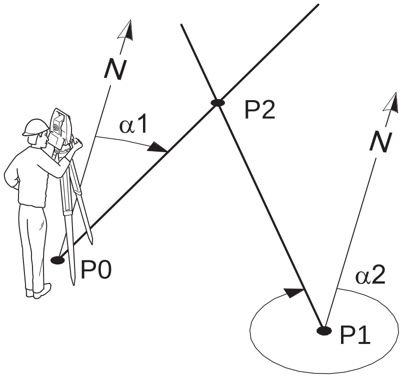
- must be taken from the active job.
- must be TPS station points.

The azimuths of the lines

- must be TPS measurements angle measurements from the known points.
- can be two angle measurements or an angle measurement and a distance measurement.

Points with full coordinate triplets and position only points can be used.

Diagram



Known
P0 First known point (TPS station)
P1 Second known point (TPS station)
α1 Direction from P0 to P2
α2 Direction from P1 to P2
Unknown
P2 COGO point

COGO intersection calculation with TPS Obs - TPS Obs step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "32.2 Accessing COGO" to access **COGO Intersection Input**.	
☞	**COGO Intersection Input**, **Input** page **SHIFT CONF (F2)** to configure the COGO application program.	32.3
2.	**COGO Intersection Input**, **Input** page <Method: TPS Obs-TPS Obs>	

Step	Description	Refer to chapter
	<1st TPS Stn:> The point ID of the first TPS station which is the known start point of the first line for the COGO calculation. **<TPS Measmnt:>** The point ID of the TPS measurement which is the known end point of the first line for the COGO calculation. **<Azimuth:>** The azimuth related to the known end point of the first line for the COGO calculation. **<2nd TPS Stn:>** The point ID of the second TPS station which is the known start point of the second line for the COGO calculation. **<TPS Measmnt:>** The point ID of the TPS measurement which is the known end point of the second line for the COGO calculation. **<Azimuth:>** The azimuth related to the known end point of the second line for the COGO calculation. Points can only be selected from the active job. Points for the **<2nd TPS Stn:>** and the **<TPS Measmnt:>** from that station can also be directly measured when using this method.	
☞	The value for the azimuth can be calculated from two existing points.	32.4

Step	Description	Refer to chapter
	INV (F2) when **<Azimuth:>** is highlighted. To perform a COGO inverse calculation. ☞ Upon pressing **STORE (F1)** in **COGO Inverse**, the result from the COGO inverse calculation is copied to the field which was highlighted when **INV (F2)** was pressed. ☞ For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result of the COGO inverse calculation is written to the logfile.	
☞	The value for the azimuth can be selected from previous COGO inverse calculations. **LAST (F4)** when **<Azimuth:>** is highlighted. To recall previous results from COGO inverse calculations. Upon pressing **CONT (F1)** in **COGO Last Inverse Calculations**, the selected result is copied to the field.	32.12

32.7 COGO Calculation - Line Calculations Method

32.7.1 Line Calculation - Base Point

Description

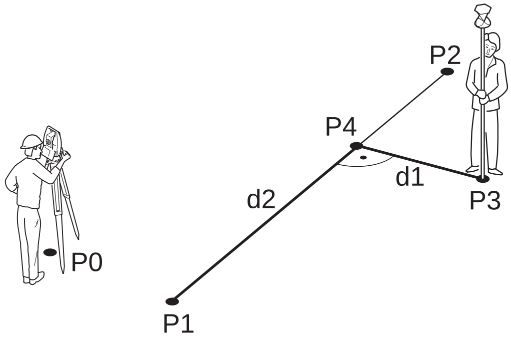
The COGO line calculation base point calculates the base point, station and offset of a point in relation to a line.

Elements that must be known are
- coordinates of two points and an offset point.

OR
- coordinates of one point and an offset point
- bearing and distance from one point

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram



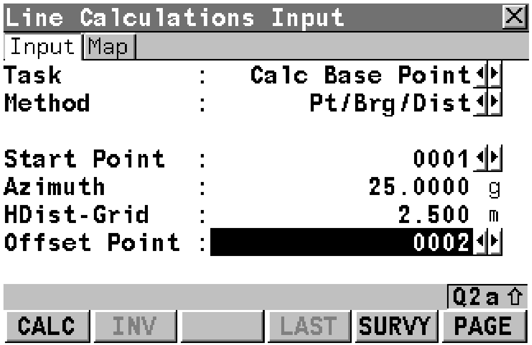
P0 Instrument station
P1 **<Start Point:>**
P2 **<End Point:>**
P3 **<Offset Point:>**
P4 Base point
d1 **<Offset-XX:>**
d2 **<ΔLine-XX:>**

☞ Line management is not available for COGO line calculations.

Access

Refer to "32.2 Accessing COGO" to access **COGO Line Calculations Input**.

COGO
Line Calculations
Input,
Input page



CALC (F1)
To calculate COGO point.

INV (F2)
To calculate the values for the distance and the offset from two existing points. Available if **<Azimuth:>** or **<HDist-XX:>** is highlighted.

LAST (F4)
To select the values for the distance and the offset from previous COGO inverse calculations. Available if **<Azimuth:>** or **<HDist-XX:>** is highlighted.

SURVY (F5)
To measure a point for the COGO calculation. Available if **<Start Point:>** or **<End Point:>** is highlighted.

SHIFT CONF (F2)
To configure the COGO application program.

SHIFT MODIF (F4)
To mathematically modify the values. Available if **<Azimuth:>**, **<ΔLine-XX:>** or **<HDist-XX:>** is highlighted.

Description of fields

Field	Option	Description
<Task:>	**Calc Base Point**	Calculates the base point, the station and offset of a point in relation to a line.
	Calc Offset Point	Calculates the coordinates of a new point after input of station and offset values in relation to a line.
	Segmentation	Calculates the coordinates of new points on a line either equally spaced or with defined segments.
<Method:>		The method by which the line will be defined.
	2 Points	Uses two known points to define the line.
	Pt/Brg/Dist	Defines the line using a known point, a distance and an azimuth of the line.

Field	Option	Description
<Start Point:>	Choicelist	The start point of the line. All points from **COGO Data: Job Name** can be selected.
<End Point:>	Choicelist	Available for **<Method: 2 Points>**. The end point of the line. All points from **COGO Data: Job Name** can be selected.
<Azimuth:>	User input	Available for **<Method: Pt/Brg/Dist>**. The azimuth of the line.
<HDist-XX:>	User input	Available for **<Method: Pt/Brg/Dist>**. The horizontal distance from the start point to the end point of the line.
<ΔLine-XX:>	User input	Available for **<Task: Calc Offset Point>**. Horizontal distance from start point to base point.
<Offset Point:>	Choicelist	Available for **<Task: Calc Offset Point>**. The offset point.
<Offset-XX:>	User input	Available for **<Task: Calc Offset Point>**. Offset from base point to offset point. Positive to the right and negative to the left of the line.

Next step

PAGE (F6) accesses **Map** page. Refer to paragraph "COGO Line Calculations Input, Map page".

COGO Line Calculations Input, Map page

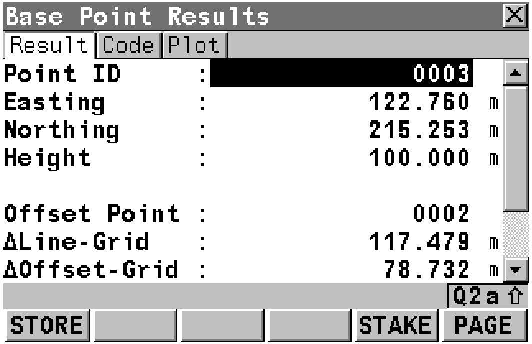
The **Map** page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

IF	THEN
<Task: Calc Base Point>	**CALC (F1)** accesses **COGO Base Point Results**. Refer to paragraph "COGO XX Point Results, Result page".
<Task: Calc Offset Point>	**CALC (F1)** accesses **COGO Offset Point Results**. Refer to paragrahp "COGO XX Point Results, Result page".
<Task: Segmentation>	**CALC (F1)** accesses **COGO Define Segmentation**. Refer to paragraph "32.7.3 Line Calculation - Segmentation".

COGO XX Point Results, Result page

The result screens for base point and offset point are very similar. The explanations given for the softkeys below are valid for the **Result** page.



STORE (F1)
To store result and to return to **COGO Line Calculations Input**.

STAKE (F5)
To access the Stakeout application program and stake out the calculated COGO point.

PAGE (F6)
To change to another page on this screen.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for the COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**.
<Offset Point:>	Output	Point ID of offset point. Available for **<Task: Calc Base Point>**.

Field	Option	Description
<ΔLine-XX:>	Output	Horizontal distance from start point to base point. Available for **<Task: Calc Base Point>**.
<ΔOffset-XX:>	Output	Offset from base point to offset point. Positive to the right and negative to the left of the line. Available for **<Task: Calc Base Point>**.
<Line Length:>	Output	Length of line from start point to end point.
<Line Brng:>	Output	Bearing of line from start point to end point.
<Offs Pt Brng:>	Output	Bearing of offset point from base point to offset point.

Next step

PAGE (F6) changes to the **Code** page.

COGO XX Point Results, Code page

The functionality of the **Code** page is similar to **COGO Traverse Result, Code** page.

Next step

PAGE (F6) changes to the **Plot** page.

COGO XX Point Results, Plot page

The functionality of the **Plot** page is similar to **COGO Traverse Results, Plot** page.

Next step

STORE (F1) stores the result and accesses **COGO Line Calculations Input, Input** page.

32.7.2 Line Calculation - Offset Point

Description

The COGO line calculation offset point calculates the coordinates of a new point after input of station and offset values in relation to a line.

Elements that must be known are
- coordinates of two points.
- offsets.

OR
- coordinates of one point.
- bearing and distance from one point.
- offsets.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

☞ Line management is not available for COGO line calculations.

COGO line calculation offset point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "32.2 Accessing COGO" to access **COGO Line Calculations Input**.	

Step	Description	Refer to chapter
☞	**COGO Line Calculations Input, Input** page. **SHIFT CONF (F2)** to configure the COGO application program.	32.3
2.	**COGO Line Calculations Input, Input** page. **<Task: Calc Offset Point>**	32.7.1
3.	**CALC (F1)** calculates the results.	
4.	**COGO Offset Point Results, Result** page **STORE (F1)** stores the results.	32.7.1

32.7.3 Line Calculation - Segmentation

Description

The COGO line calculation segmentation calculates the coordinates of new points on a line.

Elements that must be known are
- coordinates of the start and the end point of the line

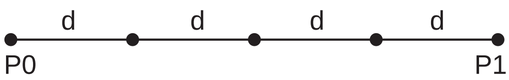
OR
- a bearing and distance from a known point that define the line

AND EITHER
- the number of segments dividing the line

OR
- a segment length for the line.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram

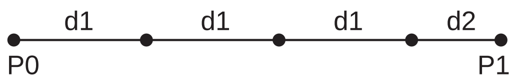


Line divided by **<Method: No. of Segments>**

P0 **<Start Point:>**

P1 **<End Point:>**

d Equally spaced segments result from dividing a line by a certain number of points.



Line divided by **<Method: Segment Length>**

P0 **<Start Point:>**
P1 **<End Point:>**
d1 **<Seg Length:>**
d2 Remaining segment

COGO line calculation segmentation step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "32.2 Accessing COGO" to access **COGO Line Calculation Input**.	
	COGO Line Calculation Input, **Input** page **SHIFT CONF (F2)** to configure the COGO application program.	32.3
2.	**COGO Line Calculations Input**, **Input** page **<Task: Segmentation>**	32.7.1
3.	**CALC (F1)** to access **COGO Define Segmentation**.	
4.	**COGO Define Segmentation** **<Method:>** How the line is to be divided. Refer to paragraph "Diagram". Depending on the selection, the following fields are user input or output fields.	

Step	Description	Refer to chapter
	<Line Length:> Calculated line length between the selected **<Start Point:>** and **<End Point:>**. **<No. of Segs:>** For **<Method: No. of Segments>** type in the number of segments for the line. For **<Method: Segment Length>** type in the segment length for the line. A remaining segment may result from this method. **<Seg Length:>** For **<Method: No. of Segments>** this is the calculated length of each segment. For **<Method: Segment Length>** type in the required segment length. **<Last Seg Lgth:>** Available for **<Method: Segment Length>**. The length of the remaining segment. **<Start PtID:>** The point ID to be assigned to the first new point on the line. The selected point ID templates from **CONFIGURE ID Templates** are not applied. **<PtID Inc:>** **<Start PtID:>** is incremented numerically for the second, third, etc. point on the line.	
5.	**CALC (F1)** to access **COGO Segmentation Results**.	
☞	The coordinates of the new points are calculated. The heights are computed along the line assuming a linear slope between **<Start Point:>** and **<End Point:>**.	
6.	**COGO Segmentation Results**, **Result** page	

Step	Description	Refer to chapter
	<Number of Segments:> Describes the number of resulting segments for the line including the remaining segment, if it applies. **<Last Segment Lgth:>** Available for **<Method: Segment Length>**. The length of the remaining segment.	
☞	**STAKE (F5)** to access the Stakeout application program and stake out the calculated COGO point. **SHIFT QUIT (F6)** or **ESC** return to **COGO Segmentation Results**, **Result** page.	
7.	**PAGE (F1)** to access **COGO Segmentation Results**, **Plot** page The known points defining the line and those created on the line are shown in black.	30.6
8.	**CONT (F1)** returns to **COGO Line Calculations Input**.	

32.8 COGO Calculation - Arc Calculations Method

32.8.1 Arc Calculation - Arc Centre

Description

The COGO arc calculation arc centre calculates the coordinates of the centre of the arc.

Elements that must be known are

- coordinates of three points

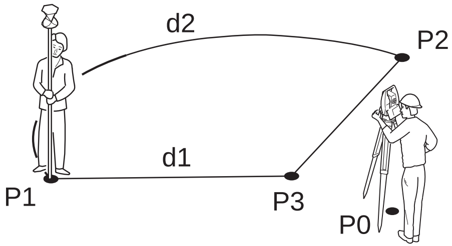
OR

- coordinates of two points
- radius to the two points

The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram



P0	Instrument station
P1	**<Start Point:>**
P2	**<End Point:>**
P3	Arc Centre
d1	**<Arc Radius:>**
d2	**<Arc Length:>**

☞ Arc management is not available for COGO arc calculations.

Access

Refer to "32.2 Accessing COGO" to access **COGO Arc Calculations Input**.

COGO Arc Calculations Input Input page

The softkeys are similar to line calculation. Refer to "32.7.1 Line Calculation - Base Point" for information on softkeys.

Description of fields

Field	Option	Description
<Task:>	**Calc Arc Center**	Calculates the coordinates of the centre of the arc.
	Calc Offset Point	Calculates the coordinates of a new point after input of station and offset values in relation to an arc.
	Calc Base Point	Calculates the base point, the station and offset of a point in relation to an arc.
	Segmentation	Calculates the coordinates of new points on an arc either equally spaced, in a defined interval or in a defined angle.
<Method:>		The method by which the arc will be defined.
	3 Points	Uses three known points to define the arc.
	2 Points/Radius	Defines the arc using two known points and a radius of the arc.

Field	Option	Description
	2 Tgnts/Radius	Defines the arc using two tangents and a radius of the arc.
	2 Tgnts/Chrd Lngt	Defines the arc using two tangents and the chord of the arc.
<Start Point:>	Choicelist	The start point of the arc. All points from **COGO Data: Job Name** can be selected. Available for **<Method: 3 Points>** and **<Method: 2 Points/Radius>**.
<Second Point:>	Choicelist	All points from **COGO Data: Job Name** can be selected. Available for **<Method: 3 Points>**. The second point of the arc.
<End Point:>	Choicelist	The end point of the arc. All points from **COGO Data: Job Name** can be selected. Available for **<Method: 3 Points>** and **<Method: 2 Points/Radius>**.
<Point 1:>	Choicelist	A point on the first tangent. Available for **<Method: 2 Tgnts/Radius>**, **<Method: 2 Tgnts/Arc Lngt>** and **<Method: 2 Tgnts/Chrd Lngt>**.

Field	Option	Description
<PI Point:>	Choicelist	The point of intersection of the two tangents. Available for **<Method: 2 Tgnts/Radius>**, **<Method: 2 Tgnts/Arc Lngt>** and **<Method: 2 Tgnts/Chrd Lngt>**.
<Point 2:>	Choicelist	A point on the second tangent. Available for **<Method: 2 Tgnts/Radius>**, **<Method: 2 Tgnts/Arc Lngt>** and **<Method: 2 Tgnts/Chrd Lngt>**.
<Radius:>	User input	The radius of the arc. Available for **<Method: 2 Points/Radius>** and **<Method: 2 Tgnts/Radius>**.
<Arc Length:>	User input	The length of the arc. Available for **<Method: 2 Tgnts/Arc Lngt>**.
<Chord Length:>	User input	The length of the chord. Available for **<Method: 2 Tgnts/Chrd Lngt>**.
<ΔArcDist-XX:>	User input	Horizontal distance along the arc from start point to base point. Available for **<Task: Calc Offset Point>**.
<ΔOffset-XX:>	User input	Offset from base point to offset point. Positive to the right and negative to the left of the arc. Available for **<Task: Calc Offset Point>**.
<Offset Point:>	Choicelist	The offset point. Available for **<Task: Calc Base Point>**.

Next step

IF	THEN
<Task: Calc Arc Center>	**CALC (F1)** accesses **COGO Center of Arc Results**. Refer to paragraph "COGO XX Results, Result page".
<Task: Calc Offset Point>	**CALC (F1)** accesses **COGO Offset Point Results**. Refer to paragraph "COGO XX Results, Result page".
<Task: Calc Base Point>	**CALC (F1)** accesses **COGO Base Point Results**. Refer to paragraph "COGO XX Results, Result page".
<Task: Segmenta-tion>	**CALC (F1)** accesses **COGO Define Segmentation**. Refer to "32.8.4 Arc Calculation - Segmentation".

COGO XX Results, Result page

Refer to paragraph "32.7.1 Line Calculation - Base Point" for information on soft-keys.

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for the COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**.
<Arc Radius:>	Output	Computed radius of arc.
<Arc Length:>	Output	Computed length of arc.
<Offs Pt Brng:>	Output	Available for **<Task: Calc Offset Point>**. Bearing of offset point from base point to offset point.

Field	Option	Description
<Offset Point:>	Output	Available for **<Task: Calc Base Point>**. Point ID of offset point.
<ΔArcDist-XX:>	Output	Available for **<Task: Calc Base Point>**. Horizontal distance along the arc from start point to base point.
<ΔOffset-XX:>	Output	Available for **<Task: Calc Base Point>**. Offset from base point to offset point. Positive to the right and negative to the left of the line.

Next step
PAGE (F6) changes to the **Code** page.

COGO XX Results, Code page

The functionality of the **Code** page is similar to **COGO Traverse Results, Code** page.

Next step
PAGE (F6) changes to the **Plot** page.

COGO XX Results, Plot page

The functionality of the **Plot** page is similar to **COGO Traverse Results, Plot** page.

Next step
STORE (F1) stores the result and accesses **COGO Arc Calculations Input, Input** page.

32.8.2 Arc Calculation - Base Point

Description

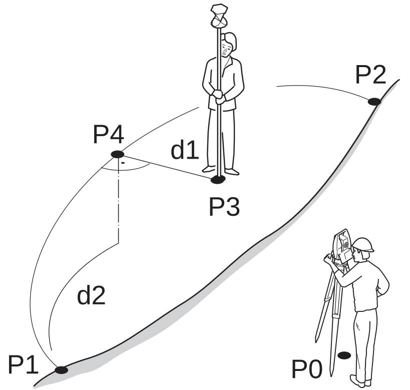
The COGO arc calculation base point calculates the coordinates of the base point, station and offset of a point in relation to an arc.

Elements that must be known are
- coordinates of three points
- coordinates of an offset point

OR
- coordinates of two points
- radius to the two points
- coordinates of an offset point

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram



P0	Instrument station
P1	**<Start Point:>**
P2	**<End Point:>**
P3	**<Offset Point:>**
P4	Base point
d1	**<ΔOffset-XX:>**
d2	**<ΔArcDist-XX:>**

☞ Arc management is not available for COGO arc calculations.

COGO arc calculation base point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "32.2 Accessing COGO" to access **COGO Arc Calculations Input, Input** page.	
☞	**COGO Arc Calculations Input, Input** page. **SHIFT CONF (F2)** to configure the COGO application program.	32.3
2.	**COGO Arc Calculations Input, Input** page. **<Task: Calc Base Point>**	32.8.1

Step	Description	Refer to chapter
3.	**CALC (F1)** calculates the results.	
4.	**COGO Base Point Results, Result** page **STORE (F1)** stores the results.	32.8.1

32.8.3 Arc Calculation - Offset Point

Description

The COGO arc calculation offset point calculates the coordinates of a new point after input of arc and offset values in relation to an arc.

Elements that must be known are
- coordinates of three points.
- offsets.

OR
- coordinates of two points.
- radius to the two points.
- offsets.

The coordinates of the known points
- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

☞ Arc management is not available for COGO arc calculations.

COGO arc calculation offset point step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "32.2 Accessing COGO" to access **COGO Arc Calculations Input**.	

Step	Description	Refer to chapter
☞	**COGO Arc Calculations Input, Input** page. **SHIFT CONF (F2)** to configure the COGO application program.	32.3
2.	**COGO Arc Calculations Input, Input** page. **<Task: Calc Offset Point>**	32.8.1
3.	**CALC (F1)** calculates the results.	
4.	**COGO Offset Point Results, Result** page **STORE (F1)** stores the results.	32.8.1

32.8.4 Arc Calculation - Segmentation

☞ The COGO arc calculation segmentation and the functionality of all screens and fields are similar to those for COGO line calculation segmentation. Refer to "32.7.3 Line Calculation - Segmentation".

Exceptions to line calculation segmentation

New field and option in COGO Define Segmentation

Field	Option	Description
<Method:>	**Delta Angle**	To divide the arc by an angular value.
<Delta Angle:>	User input	The angular value by which new points will be defined on the arc.

32.9 COGO Calculation - Shift, Rotate & Scale (Manual) Method

Description

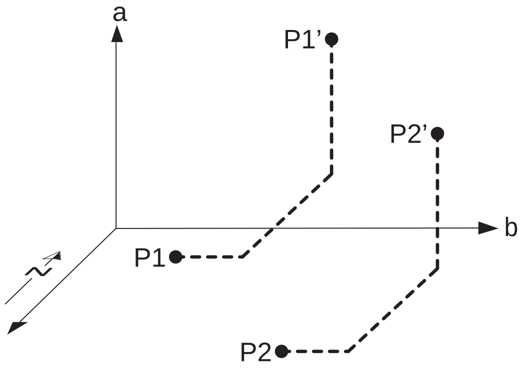
The COGO calculation shift, rotate & scale (manual) applies shifts and/or rotation and/or scale to one or several known points. The values for shifts and/or rotation and/or scale are typed in manually.

Elements that must be known are

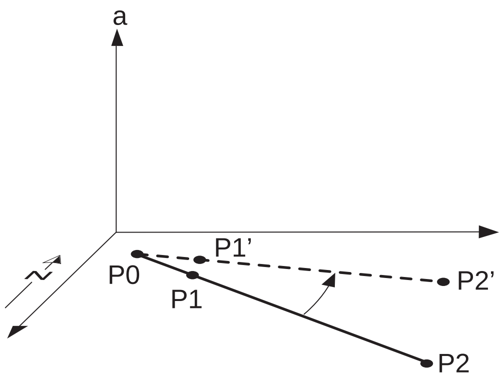
- the coordinates of the points to be shifted, rotated and/or scaled. They must be stored in the active job.
- the shift values. They can be defined as the direction of Easting, Northing and Height or as an azimuth and a grid distance or as shift from one point to another.
- the rotation value. It can be defined by a point as rotation centre plus a rotation or by an existing and new azimuth.
- the scale. It is only applied to the position.

Points with full coordinate triplets, position only points and height only points can be used.

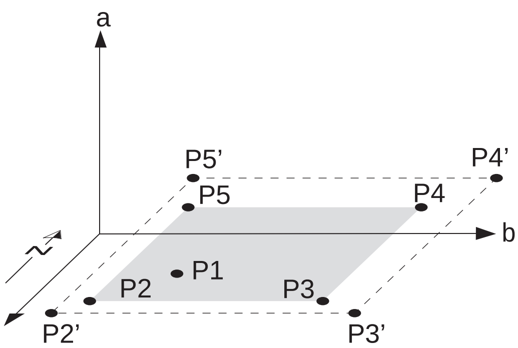
Diagram



Shift
a Height
b Easting
P1 Known point
P1' Shifted point
P2 Known point
P2' Shifted point



Rotation
a Height
b Easting
P0 **<Rotation Pt:>**
P1 Known point
P1' Rotated point
P2 Known point
P2' Rotated point



Scale

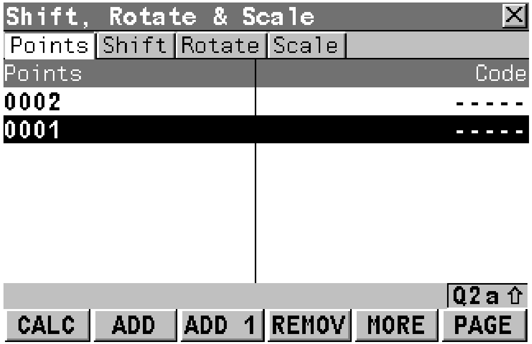
a Height
b Easting
P1 **<Rotation Pt:>**, can be held fixed, all other points are then scaled from here
P2 Known point
P2' Scaled point
P3 Known point
P3' Scaled point
P4 Known point
P4' Scaled point
P5 Known point
P5' Scaled point

Access

Refer to "32.2 Accessing COGO" to access **COGO Shift, Rotate & Scale**.

COGO Shift, Rotate & Scale, Points page

Listed are points which have been selected for shifting, rotating and/or scaling.



CALC (F1)
To perform the shift, rotation and scale calculation and to continue with the subsequent screen. Calculated COGO points are not yet stored.

ADD (F2)
To add several points from the active job to the list. Accesses **COGO Data: Job Name**. Selected sort and filter settings apply. **CONT (F1)** adds all displayed points to the list in **COGO Shift, Rotate & Scale** and returns to that screen.

ADD 1 (F3)
To add one point from the active job to the list. Accesses **COGO Data: Job Name**. Selected sort and filter settings apply. **CONT (F1)** adds the currently highlighted point to the list in **COGO Shift, Rotate & Scale** and returns to that screen.

REMOV (F4)
To remove the highlighted point from the list. The point itself is not deleted.

MORE (F5)
To display information about the codes if stored with any point, the time and the date of when the point was stored and the 3D coordinate quality and the class.

PAGE (F6)
To change to another page on this screen.

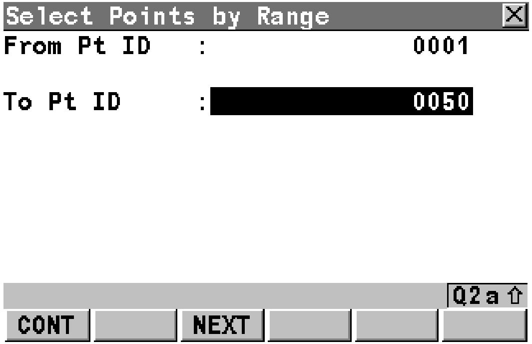
SHIFT REM A (F4)
To remove all points from the list. The points itself are not deleted.

SHIFT RANGE (F5)
To define a range of points from the active job to be added to the list. Refer to paragraph "COGO Select Points by Range".

Next step

IF	THEN
all points from **COGO Data: Job Name** are to be added	**ADD (F2)**.
one point from **COGO Data: Job Name** is to be added	**ADD 1 (F3)**.
a range of points from **COGO Data: Job Name** is to be added	**SHIFT RANGE (F5)** accesses **COGO Select Points by Range**. Refer to paragraph "COGO Select Points by Range".
all points are added	**PAGE (F1)** accesses **COGO Shift, Rotate & Scale**, **Shift** page. Refer to paragraph "COGO Shift, Rotate & Scale, Shift page".

COGO Select Points by Range



CONT (F1)
To add the points within the selected range to the list in **COGO Shift, Rotate & Scale**, **Points** page and to return to the screen from where this screen was accessed.

NEXT (F3)
To add the points within the selected range to the list in **COGO Shift, Rotate & Scale**, **Points** page without quitting this screen. Another range of point ID's can be selected.

Description of fields

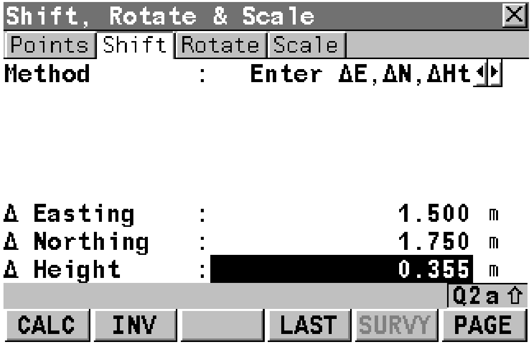
Field	Option	Description
<From Pt ID:> and **<To Pt ID:>**	User input	• Numeric point ID's in both fields: Points with numeric point ID's falling within the range are selected. Example: **<From Pt ID: 1>**, **<To Pt ID: 50>** Selected are point ID's 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.... 49, 50 as well as 001, 01, 0000045, ... Not selected are point ID's 100,200,300, ...

Field	Option	Description
		• Alphanumeric point ID's in both fields: The left most character of both entries is used as the basis for the range. The standard ASCII numerical range is used. Points with alphanumeric point ID's falling within the range are selected. Example: **<From Pt ID: a9>**, **<To Pt ID: c200>** Selected are point ID's a, b, c, aa, bb, cc, a1, b2, c3, c4, c5, a610, ... Not selected are point ID's d100, e, 200, 300, tzz ...

Next step

Step	Description
1.	**CONT (F1)** adds all points within the range to the list in **COGO Shift, Rotate & Scale** and returns to the screen from where this screen was accessed.
2.	**PAGE (F6)** accesses **COGO Shift, Rotate & Scale**, **Shift** page. Refer to "COGO Shift, Rotate & Scale, Shift page".

COGO
Shift, Rotate & Scale, Shift page



CALC (F1)

To perform the shift, rotation and scale calculation and to continue with the subsequent screen. Calculated COGO points are not yet stored.

INV (F2)

To calculate the amout of shift in Easting, Northing and height from two existing points. Available if **<Δ Easting:>**, **<Δ Northing:>** or **<Δ Height:>** is highlighted.

LAST (F4)

To select the value for the shift from previous COGO inverse calculations. Available if **<Δ Easting:>**, **<Δ Northing:>** or **<Δ Height:>** is highlighted.

SURVY (F5)

To measure a point for the COGO calculation. Available for **<Method: Use 2 Points>** if **<From:>** or **<To:>** is highlighted.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure the COGO application program. Accesses **COGO Configuration**. Refer to "32.3 Configuring COGO".

SHIFT MODIF (F4)
To mathematically modify the values. Available if **<Δ Easting:>**, **<Δ Northing:>** or **<Δ Height:>** is highlighted.

Description of fields

Field	Option	Description
<Method:>		The method by which the shift in Δ Easting, Δ Northing and Δ Height will be determined.
	Enter ΔE,ΔN,ΔHt	Defines the shift using coordinate differences.
	Enter Bng,Dst,Ht	Defines the shift using an azimuth, a distance and a height difference.
	Use 2 Points	Computes the shift from the coordinate differences between two known points.
<From:>	Choicelist	Available for **<Method: Use 2 Points>**. The point ID of the first known point for calculating the shift.
<To:>	Choicelist	Available for **<Method: Use 2 Points>**. The point ID of the second known point for calculating the shift.
<Azimuth:>	User input	Available for **<Method: Enter Bng,Dst,Ht>**. The azimuth defines the direction of the shift.

Field	Option	Description
<HDist-XX:>	User input	Available for **<Method: Enter Bng,Dst,Ht>**. The amount of shift from the original point to the calculated COGO points.
<Δ Easting:>	User input or output	The amount of shift in East direction.
<Δ Northing:>	User input or output	The amount of shift in North direction.
<Δ Height:>	User input or output	The amount of shift in height.

Next step

PAGE (F6) accesses **COGO Shift, Rotate & Scale**, **Rotate** page. Refer to "COGO Shift, Rotate & Scale, Rotate page".

COGO Shift, Rotate & Scale, Rotate page

The softkeys are the same as on the Shift page. Refer to paragraph "COGO Shift, Rotate & Scale, Shift page" for information on the keys.

Description of fields

Field	Option	Description
<Method:>		The method by which the rotation angle will be determined.
	User Entered	The rotation can be manually typed in.

Field	Option	Description
	Computed	The rotation will be calculated as **<New Azimuth:>** minus **<Existing Az:>**.
<Rotation Pt:>	Choicelist	The point around which all points will be rotated.
<Existing Az:>	User input	Available for **<Method: Computed>**. A known direction before rotating.
<New Azimuth:>	User input	Available for **<Method: Computed>**. A known direction after rotating.
<Rotation:>	User input or output	The amount by which the points will be rotated.

Next step

PAGE (F6) accesses **COGO Shift, Rotate & Scale**, **Scale** page. Refer to "COGO Shift, Rotate & Scale, Scale page".

COGO Shift, Rotate & Scale, Scale page

The softkeys are the same as on the Shift page. Refer to paragraph "COGO Shift, Rotate & Scale, Shift page" for information on the keys.

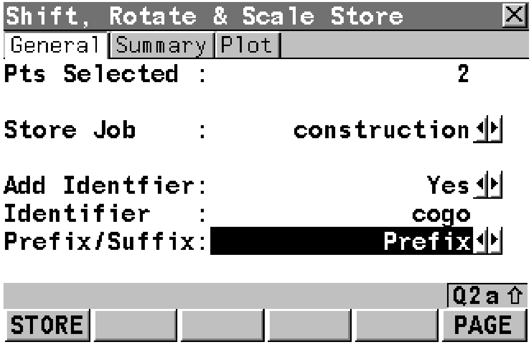
Description of fields

Field	Option	Description
<Method:>		The method by which the scale factor will be determined.

Field	Option	Description
	User Entered	The scale factor can be manually typed in.
	Computed	The scale factor will be calculated as **<New Dist:>** divided by **<Existing Dist:>**.
<Existing Dist:>	User input	Available for **<Method: Computed>**. A known distance before scaling. This value is used for calculating the scale factor.
<New Dist:>	User input	Available for **<Method: Computed>**. A known distance after scaling. This value is used for calculating the scale factor.
<Scale:>	User input or output	The scale factor used in the calculation.
<Scale From Pt:>	**No**	Scaling is performed by multiplying the original coordinates of all points by **<Scale:>**.
	Yes	**<Scale:>** is applied to the coordinate difference of all points relative to **<Rotation Pt:>** selected on the **Rotation** page. The coordinates of **<Rotation Pt:>** will not change.

Next step
CALC (F1) performs the shift, rotation and scale calculation and accesses **COGO Shift, Rotate & Scale Store**.

COGO Shift, Rotate & Scale Store, General page



STORE (F1)
To to store the results and continue with the next subsequent screen.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Pts Selected:>	Output	The number of selected points having been shifted, rotated and/or scaled.
<Store Job:>	Choicelist	The calculated COGO points will be stored in this job. All jobs from **Main Menu: Manage...\Jobs** can be selected. The original points are not copied to this job.
<Add Identi-fier:>	**Yes** or **No**	Activates the use of additional identifiers for the point ID's of the calculated COGO points.
<Identifier:>	User input	The identifier with up to four characters is added in front of or at the end of the ID of the calculated COGO points.

Field	Option	Description
<Prefix/Suffix:>	**Prefix**	Adds the setting for **<Identifier:>** in front of the original point ID's.
	Suffix	Adds the setting for **<Identifier:>** at the end of the original point ID's.

Next step

IF	THEN
the used parameters are to be viewed	**PAGE (F6)** accesses **COGO Shift, Rotate & Scale Store**, **Summary** page.
the calculated COGO points are to be viewed graphically	**PAGE (F6)** accesses **COGO Shift, Rotate & Scale Store**, **Plot** page. Original points are displayed in grey, calculated COGO points are displayed in black.
the calculated COGO points are to be stored	**STORE (F1)** accesses **COGO Shift, Rotate & Scale Results**, **Result** page. Refer to paragraph "COGO Shift, Rotate & Scale Results Result page".

COGO Shift, Rotate & Scale Results Result page

Description of fields

Field	Option	Description
<No. of New Pts:>	Output	Number of new points created.

Field	Option	Description
<No. of Skipped Pts>	Output	Number of points which were skipped either due to not being able to convert coordinates or points with identical point ID's already existed in **<Store Job:>**.

Next step

IF	THEN
the stored COGO points are to be viewed graphically	**PAGE (F6)** accesses **COGO Shift, Rotate & Scale Results**, **Plot** page. Original points are displayed in grey, calculated COGO points are displayed in black.
more points are to be shifted, rotated and/or scaled	**CONT (F1)** returns to **COGO Shift, Rotate & Scale**.
COGO is to be ended	**SHIFT QUIT (F6)**.

32.10 COGO Calculation - Shift, Rotate & Scale (Match Pts) Method

Description

The COGO calculation shift, rotate & scale (match pts) applies shifts and/or rotation and/or scale to one or several known points. The shifts and/or rotation and/or scale are calculated from selected points using a 2D Helmert tranformation.

Elements that must be known are

- the coordinates of at least two matching points for the calculation of the shifts and/or rotation and/or scale.
- the coordinates of the points to be shifted, rotated and/or scaled. They must be stored in the active job.
- the shift values. They can be defined as the direction of Easting, Northing and Height or as an azimuth and a grid distance or as shift from one point to another.
- the rotation value. It can be defined by a point as rotation centre plus a rotation or by an existing and new azimuth.
- the scale. It is only applied to the position.

Points with full coordinate triplets, position only points and height only points can be used.

Computation of shift, rotation and scale values

The number of pairs of points matched determines whether the shift, rotation and scale values are computed.

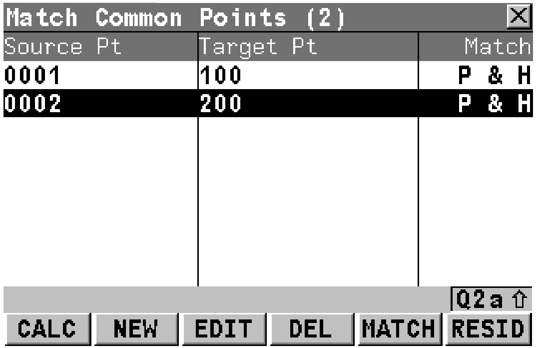
Number of pairs of points matched	Shift East	Shift North	Shift Height	Rotation	Scale
1	x	x	x	-	-
> 1	x	x	x	x	x

Access

Refer to "32.2 Accessing COGO" to access **COGO Match Common Points (n)**.

COGO Match Common Points (n)

This screen provides a list of points chosen from the active job. The points are used for the determination of the 2D Helmert transformation. The number of points matched is indicated in the title, for example **COGO Match Common Points (3)**. Unless there is no pair of matching points in the list all softkeys are available. Refer to paragraph "Match points step-by-step" for information on how to match points.



CALC (F1)
To confirm the selections, compute the transformation and continue with the subsequent screen.

NEW (F2)
To match a new pair of points. This pair is added to the list. A new point can be manually occupied. Refer to paragraph "Match points step-by-step".

EDIT (F3)
To edit the highlighted pair of matched points.

DEL (F4)
To delete the highlighted pair of matched points from the list.

MATCH (F5)
To change the type of match for a highlighted pair of matched points. Refer to "Description of columns".

RESID (F6)
To display a list of the matched points used in the transformation calculation and their associated residuals. Refer to paragraph "Fix parameters".

SHIFT PARAM (F5)
To define the parameters to be used in the 2D transformation.

Description of columns

Column	Description
Source Pt	The point ID of the points of origin for the calculation of the shifts and/or rotation and/or scale.
Target Pt	The point ID of the target points for the calculation of the shifts and/or rotation and/or scale.
Match	The type of match to be made between the points. This information is used in the transformation calculation. **P**osition **&** **H**eight, **P**osition **only**, **H**eight **only** or **None**.

Column	Description
	None removes matched common points from the transformation calculation but does not delete them from the list. This can be used to help improve residuals.

Next step

IF	THEN
the transformation is to be computed	**CALC (F1)**. The calculated shift, rotation and scale values are displayed in **COGO Shift, Rotate & Scale**. They cannot be edited. The remaining functionality of the calculation is very similar to COGO calculation shift, rotate & scale (manual). Refer to "32.9 COGO Calculation - Shift, Rotate & Scale (Manual) Method".
a pair of points is to be matched or edited	**NEW (F2)** or **EDIT (F3)**. Refer to paragraph "Match points step-by-step".
parameters for the transformation are to be fixed	**SHIFT PARAM (F5)**. Refer to paragraph "Fix parameters".

Match points step-by-step

Before calculating a transformation, it must be defined which points are to be matched. Matching new points and editing matched points is very similar.

Step	Description
1.	Refer to "32.2 Accessing COGO" to access **COGO Match Common Points**.
2.	**NEW (F2)** or **EDIT (F3)**
3.	**COGO Choose Matching Points** or **COGO Edit Matching Points** **<Source Pt:>** A point of origin for the calculation of the shifts and/or rotation and/or scale. **<Target Pt:>** A target point for the calculation of the shifts and/or rotation and/or scale. **<Match Type:>** The type of match to be made between the points selected in **<Source Pt:>** and **<Target Pt:>**. **Pos**ition **& Height**, **Pos**ition **Only**, **Height Only** or **None**. Select the points to be matched.
☞	**SURVY (F5)**. To manually occupy a point and store it in the active job.
4.	**CONT (F1)** returns to **COGO Match Common Points (n)** and adds a new line of matched points to the matched points list.

Fix parameters

The settings on this screen define the parameters to be used in the transformation.

IF the value for a field is	THEN the value for this parameter will be
-----	calculated.
any number	fixed to that value.

Description of fields

Field	Option	Description
<Δ Easting:>	User input	Shift in Easting direction.
<Δ Northing:>	User input	Shift in Northing direction.
<Δ Height:>	User input	Shift in Height direction.
<Rotation:>	User input	Rotation around the X axis.
<Scale:>	User input	Scale factor.

Next step

IF	AND	THEN
a field displays -----	the parameter needs to be fixed to a value	highlight the field. Enter the value of the parameter. **FIX (F4)**.
a field displays a value	the parameter needs to be calculated	highlight the field. **ADJST (F4)**.
all parameters are configured	-	**CONT (F1)** to return to **COGO Match Common Points (n)**.

32.11 Area Division

32.11.1 Overview

Description

The COGO calculation area division divides an area by a defined line, by percentage or by the size of a subarea.

The area division methods are listed in the table below. Elements that must be known for the calculation depend on the area division method. At least three points are required to form an area.

Divide by	Using		Elements required
Defined line	Parallel line	Through a point	• Two points defining the line • One point on the dividing line
		By a distance	• Two points defining the line • Distance
	Perpendicular line	Through a point	• Two points defining the line • One point on the dividing line
		By a distance	• Two points defining the line • Distance
Percentage	Parallel line	-	• Size of new area in percentage • Two points defining the line

Divide by	Using		Elements required
	Perpendicular line	-	• Size of new area in percentage • Two points defining the line
	Swing line	Rotation point	• Size of new area in percentage • Rotation point of the swing line
Area	Parallel line	-	• Size of new area • Two points defining the line
	Perpendicular line	-	• Size of new area • Two points defining the line
	Swing line	Rotation point	• Size of new area • Rotation point of the swing line

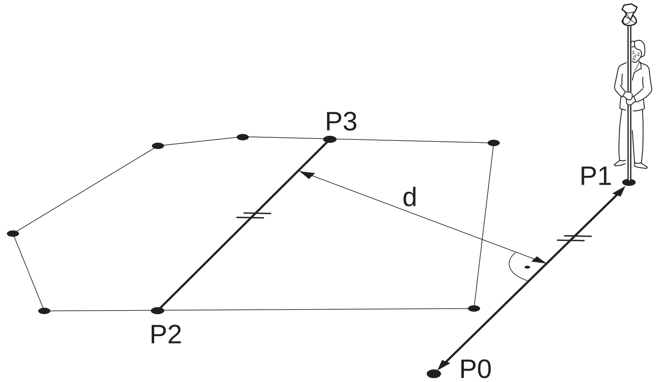
The coordinates of the known points

- may be taken from the active job.
- may be measured during the COGO calculation.
- may be entered.

Diagram

The diagrams show the area division methods. Some diagrams apply to several area division methods.

Area division method	<Divide:>	<Using:>	<Shift:>
1.	**By Defined Line**	**Parallel Line**	**By Distance**
2.	**By Percentage**	**Parallel Line**	-
3.	**By Area**	**Parallel Line**	-



P0 **<Point A:>** of defined line

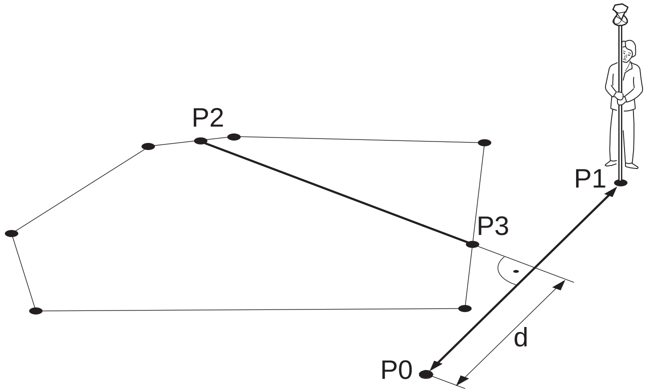
P1 **<Point B:>** of defined line

P2 First new COGO point

P3 Second new COGO point

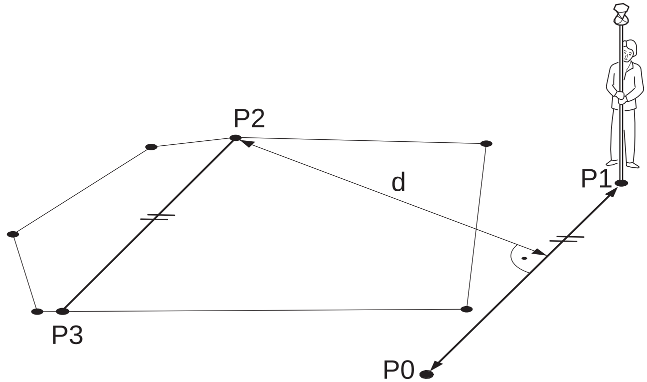
d **<HDist-XX:>**

Area division method	<Divide:>	<Using:>	<Shift:>
1.	**By Defined Line**	**Perpendic Line**	**By Distance**
2.	**By Percentage**	**Perpendic Line**	-
3.	**By Area**	**Perpendic Line**	-



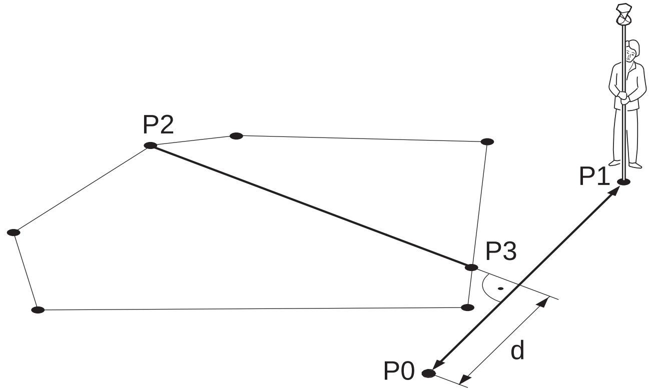
P0 **<Point A:>** of defined line
P1 **<Point B:>** of defined line
P2 First new COGO point
P3 Second new COGO point
d **<HDist-XX:>**

Area division method	<Divide:>	<Using:>	<Shift:>
1.	**By Defined Line**	**Parallel Line**	**Through Point**



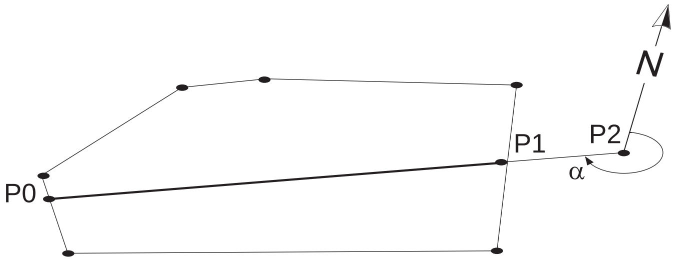
P0 **<Point A:>** of defined line
P1 **<Point B:>** of defined line
P2 **<Through Point:>**; in this case it is a known point of the existing border
P3 New COGO point
d **<HDist-XX:>**

Area division method	<Divide:>	<Using:>	<Shift:>
1.	**By Defined Line**	**Perpendic Line**	**Through Point**



P0 **<Point A:>** of defined line
P1 **<Point B:>** of defined line
P2 **<Through Point:>**; in this case it is a known point of the existing border
P3 New COGO point
d **<HDist-XX:>**

Area division method	<Divide:>	<Using:>	<Shift:>
1.	**By Percentage**	**Swing Line**	-
2.	**By Area**	**Swing Line**	-



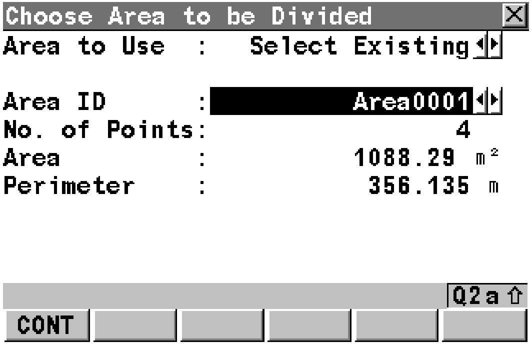
P0 First new COGO point
P1 Second new COGO point
P3 **<Rotation Pnt:>**
α **<Azimuth:>**

32.11.2 Choosing an Area to be Divided

Access

Refer to "32.2 Accessing COGO" to access **COGO Choose Area to be Divided**.

COGO Choose Area to be Divided



CONT (F1)
To accept the changes and access the subsequent screen.

Description of fields

Field	Option	Description
<Area to Use:>		The setting determines the availability of the subsequent fields and screen.
	Select Existing	To use an area from the **<Job:>** selected in **COGO COGO Begin**. The area can be edited and a new area can be created from points existing in the **<Job:>**.
	Survey New Area	To survey points that do not exist in the job yet. The points will be added to a new area.

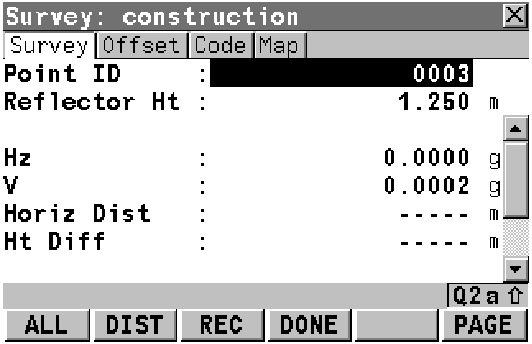
Field	Option	Description
<Area ID:>	Choicelist	For **<Area to Use: Select Existing>**. To select the area to be divided.
	User input	For **<Area to Use: Survey New Area>**. To enter a name for the new area.
<No. of Points:>	Output	Number of points forming the area.
<Area:>	Output	The size of the selected area.
<Perimeter:>	Output	The perimeter of the area.

Next step

IF	THEN
<Area to Use: Select Existing>	**CONT (F1)** accesses **COGO Define How to Divide Area**. Refer to "32.11.3 Dividing an Area".
<Area to Use: Survey New Area>	**CONT (F1)** accesses **COGO Survey: Job Name**. Refer to "COGO Survey: Job Name, Survey page".

COGO
Survey: Job Name, Survey page

Points to be added to the new area can be surveyed.



ALL (F1)
To measure and store distances and angles.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data.
If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

DONE (F4)
To end surveying an area and to access **COGO Edit Area: Area ID** where the area can be stored.

PAGE (F6)
To change to another page on this screen.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways: • To start a new sequence of point ID's type over the point ID. • For an individual point ID independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "15.1 ID Templates".
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing the Survey application program. An individual reflector height can by typed in.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Horiz Dist:>	Output	The horizontal distance after **DIST (F2)** was pressed. No distance is displayed when accessing the screen and after **REC (F3)** or **ALL (F1)**.

Field	Option	Description
<Ht Diff:>	Output	The height difference between station and measured point after **DIST (F2)**. Displays ----- when accessing the screen and after **REC (F3)** or **ALL (F1)**.

Next step

IF the task is to	THEN
change to another page on this screen	**PAGE (F6)**.
stop surveying the area and to store the area	**DONE (F4)** and then **STORE (F1)**. **COGO Define How to Divide Area** is accessed. Refer to "32.11.3 Dividing an Area".
return to **COGO Choose Area to be Divided**	**ESC**.

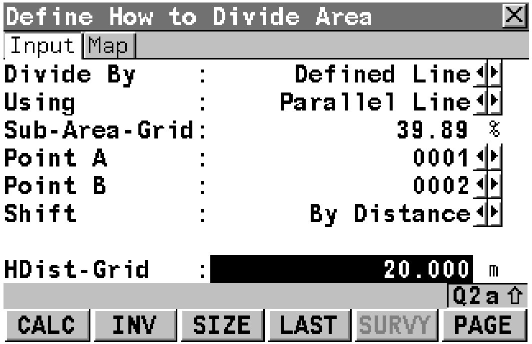
32.11.3 Dividing an Area

Access

Refer to "32.11.2 Choosing an Area to be Divided" to access **COGO Define How to Divide Area**.

COGO Define How to Divide Area, Input page

After each change of parameters in this screen, the values in the output fields are recalculated and updated.



CALC (F1)
To perform the area division and to continue with the subsequent screen. Calculated COGO points are not yet stored.

INV (F2)
To calculate the value for the distance from two existing points. Available if **<HDist-XX:>** is highlighted.

SIZE (F3) and **PERC (F3)**
To display the size and the perimeter of the sub-area.

LAST (F4)
To select the value for the distance from previous COGO inverse calculations. Available if **<HDist-XX:>** is highlighted.

SURVY (F5)
To manually occupy a point for the COGO calculation. Available if **<Point A:>**, **<Point B:>** or **<Rotation Pnt:>** is highlighted.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure the COGO application program.

SHIFT MODIF (F4)
To mathematically modify the values for the distance or angle. Available if **<HDist-XX:>** or **<Azimuth:>** is highlighted.

Description of fields

Field	Option	Description
<Divide By:>		This field defines how the size of the sub area is defined.
	Percentage	The size of the sub area is given in %.
	Area	The size of the sub area is given in m^2.
	Defined Line	The new border defining the size of the sub area is known.
<Using:>		This field defines how the new border will run.
	Parallel Line	The border will be parallel to a line defined by **<Point A:>** and **<Point B:>**.
	Perpendic Line	The border will be perpendicular to a line defined by **<Point A:>** and **<Point B:>**.

Field	Option	Description
	Swing Line	The border will be a line rotated around **<Rotation Pnt:>** by **<Azimuth:>**.
<Sub-Area-XX:>	User input	For **<Divide By: Percentage>** and **<Divide By: Area>**. The size of the sub area must be typed either in % or in m^2. When dividing the area using a parallel or perpendicular line, a reference line is defined by **<Point A:>** and **<Point B:>**. The direction of the new dividing line is always the same as the direction of the reference line. The sub area is always to the left of the new dividing line. When dividing a line using a swing line, the direction of the new dividing line is defined by the **<Rotation Pnt:>** and the **<Azimuth:>**. The sub area is always to the left of the new dividing line.
	Output	For **<Divide By: Defined Line>**. The size of the sub area is calculated in the background and displayed.
<Point A:>	Choicelist	The first point of the line which is used as the reference for a new parallel or perpendicular border. All points from **COGO Data: Job Name** can be selected.

Field	Option	Description
<Point B:>	Choicelist	The second point of the line which is used as the reference for a new parallel or perpendicular border. All points from **COGO Data: Job Name** can be selected.
<Shift:>		Available for **<Divide By: Defined Line>**.
	By Distance	The new border will run in a certain distance from the line defined by **<Point A:>** and **<Point B:>**.
	Through Point	The new border will run through a point defined in **<Through Point:>**.
<Through Point:>	Choicelist	Available for **<Shift: Through Point>**. The point through which the new border will run.
<Rotation Pnt:>	Choicelist	Available for **<Using: Swing Line>**. The point around which the new border will rotate by **<Azimuth:>**.
<Azimuth:>	Output	Available for **<Using: Swing Line>**. The angle of the new border from **<Rotation Pnt:>** to the new COGO point.
<HDist-XX:>		The distance from the line defined by **<Point A:>** and **<Point B:>** to the new border.
	User Input	For **<Divide By: Defined Line>** and **<Shift: By Distance>**.

Field	Option	Description
	Output	For **<Divide By: Percentage>** or**<Divide By: Area>** with **<Using: Parallel Line>** or **<Using: Perpendic Line>**.

Next step

PAGE (F6) changes to the **Map** page. Refer to paragraph "COGO Define How to Divide Area, Map page".

COGO Define How to Divide Area, Map page

The **Map** page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

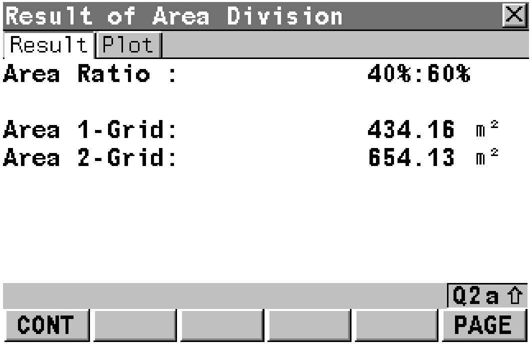
CALC (F1) performs the area division and accesses **COGO Results of Area Division**. Refer to "32.11.4 Results of the Area Division".

32.11.4 Results of the Area Division

Access

CALC (F1) in **COGO Define How to Divide Area**.

COGO
Results of Area Division,
Result page



CONT (F1)
To accept the calculation and to continue with the subsequent screen. Calculated COGO points are not yet stored.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure the COGO application program.

Description of fields

Field	Option	Description
<Area Ratio:>	Output	The ratio of the size of the two sub areas in percent.
<Area 1-XX:>	Output	The size of the first sub area in m^2.
<Area 2-XX:>	Output	The size of the second sub area in m^2.

Next step

PAGE (F6) changes to the **Plot** page.

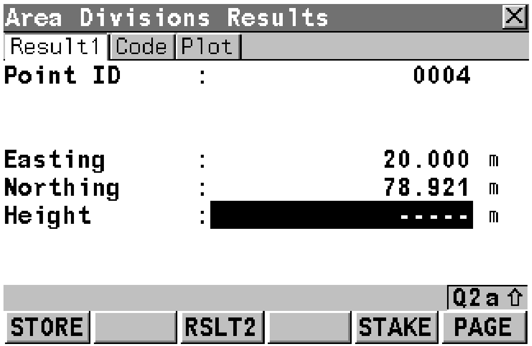
COGO
Results of Area Division,
Map page

The points defining the area and the calculated COGO points are shown in black.

Next step
CONT (F1) access **COGO Area Division Results**.

COGO
Area Division Results,
ResultX page

The coordinates of the intersection points of the new border with the original area are displayed.



STORE (F1)
To store the two results and to return to **COGO Choose Area to be Divided** once both points are stored

RSLT1 (F3) or **RSLT2 (F3)**
To view the first and second result.

STAKE (F5)
To access the Stakeout application program and stake out the calculated COGO point.

PAGE (F6)
To change to another page on this screen.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for the COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**.
<Height:>	User input	A height value to be stored with the calculated point can be typed in.

Next step
PAGE (F6) changes to the **Code** page.

COGO Area Division Results, Code page

All codes of the job can be selected. Type in a code if required.

Next step
PAGE (F6) changes to the **Plot** page.

COGO Area Division Results, Plot page

The points defining the area and the points of the new border are shown in black.

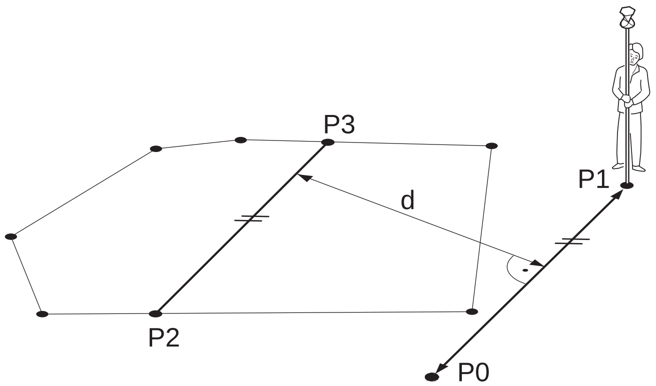
Next step
STORE (F1) stores the results and accesses **COGO Choose Area to be Divided**. For **<Write Logfile: Yes>** in **COGO Configuration**, **Logfile** page the result is written to the logfile.

32.11.5 Working Example

Description

Application:	Divide an area by a defined, parallel line. The new border has to run through a known point with the point ID 100.
Goal:	The points forming the original area are to be picked. The area division is to be calculated.

Diagram



P0 **<Point A:>** of defined line
P1 **<Point B:>** of defined line
P2 First new COGO point
P3 Second new COGO point
d **<HDist-XX:>**

Field procedure step-by-step

Step	Description
1.	**Main Menu: Programs...\COGO**
2.	**COGO COGO Begin** Select a job and a configuration set with the settings mentioned above.
☞	**CONF (F2)** to configure the COGO application program.

Step	Description
3.	**CONT (F1)** to access **COGO COGO Menu**.
4.	Highlight **Area Division**.
5.	**CONT (F1)** to access **COGO Choose Area to be Divided**.
6.	**COGO Choose Area to be Divided** **<Area to Use: Survey New Area>** **<Area ID:>** Type in an ID for the new area.
7.	**CONT (F1)** to access **COGO Survey: Job Name**.
8.	**COGO Survey: Job Name** **<Point ID:>** Type in a name for the first point of the area.
9.	**ALL (F1)** to measure and store the first point of the area.
10.	Survey all points belonging to the area. Point 100 must be part of the points.
11.	**DONE (F4)** once all points are surveyed.
12.	**COGO Edit Area: Area ID** Check the points forming the area.
13.	**STORE (F1)** to store the area and to access **COGO Define How to Divide Area**.
14.	**COGO Define How to Divide Area**, **Input** page **<Divide By: Defined Line>** **<Using: Parallel Line>**

Step	Description
	<Point A:> and **<Point B:>** Select the first and the second point of the line which is used as the reference for the new border. The new border will run parallel to this line. **<Shift: Through Point>** **<Through Point: 100>**
15.	**CALC (F1)** to access **COGO Results of Area Division**.
16.	**COGO Results of Area Division**, **Result** page The size of the two new sub areas is displayed,
17.	**CONT (F1)** to access **COGO Area Division Results**.
18.	**COGO Area Division Results**, **Result1** page **<Point ID:>** The identifier for the first COGO point depending on the point ID template configured for **<Survey Pts:>** in **CONFIGURE ID Templates**. The point ID can be changed. The calculated coordinates are displayed. Type in a point ID.
☞	**COORD (F2)** views other coordinate types.
☞	**RSLT1 (F3)** and **RSLT2 (F3)** to view the first and second result.
☞	**STAKE (F5)** to access the Stakeout application program and stake out the calculated COGO point.
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.

Step	Description
19.	**STORE (F1)** stores the first COGO point and displays the coordinates of the second COGO point.
20.	**STORE (F1)** stores the second COGO point and returns to **COGO Choose Area to be Divided**.
21.	**SHIFT QUIT (F6)** to exit the COGO application program.

32.12 Selecting a Result from Previous COGO Inverse Calculations

Description

Azimuths, distances and offsets required within the COGO traverse and intersection calculations can be selected from previously calculated inverse results.

Select a result from previous COGO inverse calculations step-by-step

Step	Description
1.	Refer to "32.2 Accessing COGO" to access **COGO Traverse Input** or **COGO Intersection Input**.
2.	**COGO XX Input**, **Input** page Highlight **<Azimuth:>**, **<HDist-XX:>** or **<Offset:>**.
3.	**LAST (F4)** to access **COGO Last Inverse Calculations**.
4.	**COGO Last Inverse Calculations** All previous COGO inverse calculations stored in the active job are displayed, sorted by time with the most recent at the top. This screen consists of three columns. • First column **From**: The point ID of the first known point for the COGO inverse calculation. • Second column **To**: The point ID of the second known point for the COGO inverse calculation.

Step	Description
	• Third column: The information displayed can vary. ----- is displayed for unavailable information, for example if a height only point is used, **Azimuth** cannot be calculated. **Azimuth**: The direction from the first to the second known point. **HDist-XX**: The horizontal distance between the two known points. **Date** and **Time** when the COGO inverse calculation was stored.
☞	**VIEW (F3)** to view all calculated values for the highlighted COGO inverse calculation. This includes the height difference, the slope distance, the grade and the coordinate differences between the two known points.
☞	**DEL (F4)** to delete the highlighted COGO inverse calculation.
☞	**MORE (F5)** to display other information in the third column.
5.	Highlight the COGO inverse calculation of which a result is to be taken over into **COGO XX Input**, **Input** page.
6.	**CONT (F1)** to return to **COGO XX Input**, **Input** page.
☞	The relevant result of the highlighted COGO inverse calculation is copied into the field which was initially highlighted in **COGO XX Input**, **Input** page.

32.13 Modifying Values for Azimuths, Distances and Offsets

Description

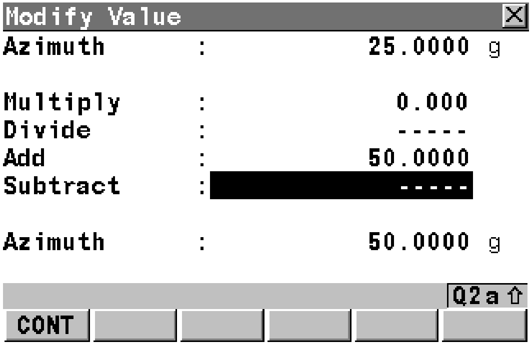
The values for the azimuth, the distance and the offset required within the COGO traverse and intersection calculation can be mathematically modified.

Access step-by-step

Step	Description
1.	Refer to "32.2 Accessing COGO" to access **COGO Traverse Input** or **COGO Intersection Input**.
2.	**COGO XX Input**, **Input** page Highlight **<Azimuth:>**, **<HDist-XX:>** or **<Offset:>**.
3.	**SHIFT MODIF (F4)** to access **COGO Modify Value**.

COGO Modify Value

On this screen numbers can be typed in for the multiplication, division, addition and subtraction with the original azimuth, distance or offset value. The standard rules of mathematical operations apply.



CONT (F1)
To accept the modified value and to return to the screen from where this screen was accessed. The modified value is copied into the field which was initially highlighted in **COGO XX Input**, **Input** page.

Description of fields

Field	Option	Description
<Azimuth:>, **<HDist-XX:>** or **<Offset:>**	Output	The name of the field and the value which was highlighted before accessing **COGO Modify Value**.
<Multiply:>	User input	The number to multiply by. • Minimum: -3000 • Maximum: 3000 • ----- performs a multiplication by 1.
<Divide:>	User input	The number to divide by. • Minimum: -3000 • Maximum: 3000 • ----- performs a division by 1.
<Add:>	User input	The number to be added. • For azimuths Minimum: 0 Maximum: Full circle • For distances and offsets Minimum: 0 m Maximum: 30000000 m • ----- performs an addition of 0.000.
<Subtract:>	User input	The number to be subtracted.

Field	Option	Description
		• For azimuths Minimum: 0 Maximum: Full circle • For distances and offsets Minimum: 0 m Maximum: 30000000 m • ----- performs a subtraction of 0.000.
<Azimuth:>, **<HDist-XX:>** or **<Offset:>**	Output	The modified value for the field in the first line. This field is updated with every mathematical operation. Angles greater than the full circle are reduced accordingly.

Next step

CONT (F1) accepts the modified value and returns to the screen from where this screen was accessed.

Example: Calculations for an azimuth

Step	User input	Value as calculated	Value as displayed
			<Azimuth: 250.0000> g
1.	**<Multiply: 2>**	500	**<Azimuth: 100.0000> g**
2.	**<Divide: 3>**	166.667	**<Azimuth: 166.6670> g**

Step	User input	Value as calculated	Value as displayed
3.	**<Add: 300>**	466.667	**<Azimuth: 66.6670> g**
4.	**<Subtract: 100>**	366.667	**<Azimuth: 366.6670> g**

Example: Calculations for a distance

The behaviour for an offset is identical.

Step	User input	Value as calculated	Value as displayed
			<HDist-Grid: 250.000> m
1.	**<Multiply: 2>**	500	**<HDist-Grid: 500.000> m**
2.	**<Divide: 3>**	166.667	**<HDist-Grid: 166.667> m**
3.	**<Add: 300>**	466.667	**<HDist-Grid: 466.667> m**
4.	**<Subtract: 100>**	366.667	**<HDist-Grid: 366.667> m**

33 Hidden Point

33.1 Overview

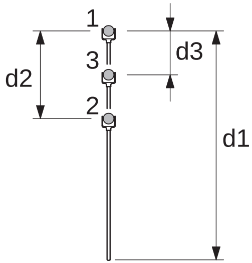
Description

Hidden points cannot be measured directly by TPS. This is because they are not directly visible.

- A hidden point can be calculated from measurements to prisms mounted on a hidden point rod with a known spacing and a known length of the hidden point rod. The hidden point rod may be held at any angle, as long as it is stationary for all measurements.
- Measurements for the hidden point are calculated as if the hidden point was observed directly. These calculated measurements can also be recorded.
- The hidden point rod can have either two or three reflectors. Refer to "33.3 Configuring Hidden Point" for information on configuring the hidden point rod.
- If three reflectors are used the average will be calculated.

Hidden point rod

The reflectors on the hidden point rod are also called auxiliary points after they have been measured.



1	Reflector 1
2	Reflector 2
3	Reflector 3
d1	Rod length
d2	Distance from reflector 1 to reflector 2
d3	Distance from reflector 1 to reflector 3

Properties of hidden points

The properties stored with the hidden point and auxiliary points are:

Type	Reflector n - auxiliary point	Hidden point
Class	**MEAS**	**MEAS**
Sub class	**COGO**	**COGO**
Source	**Hidden Point**	**Hidden point**
Instrument source	**TPS**	**TPS**

Hidden point tasks

The Hidden Point application program can be used for the following tasks:

- The hidden point program may be used to obtain accurate three dimensional coordinates for a point that is currently blocked from direct measurement by an obstruction between the point and the instrument.
- Determination of flow line locations and elevations in manholes, without measuring from the rim of the manhole to the flow line and estimating corrections for nonverticality of the measuring tape and eccentricity from the measurement on the rim to the horizontal location of the flow line;
- Determination of recesses in building corners for detailed surveys, without estimating right angle offsets, with or without taping of the dimensions;
- Measurements behind overhangs, buttresses and columns for quantity determinations in underground construction or mining, without estimating right angle offsets, with or without taping of the dimensions;
- Measurements of industrial process piping or other equipment in close quarters;
- Detailed architectural surveys for remodeling or cultural preservation or restoration work

- Any place where accurate measurements would require many more instrument setups in order to achieve line of sight from the instrument to the points being measured.

☞ TPS Hidden Point application program does not generate a logfile.

33.2 Accessing Hidden Point

Access

Select **Main Menu: Programs...\Hidden Point**.

OR

Press **PROG**. Highlight **Hidden Point**. **CONT (F1)**. Refer to "31.2 Accessing the Programs Menu" for information on the **PROG** key.

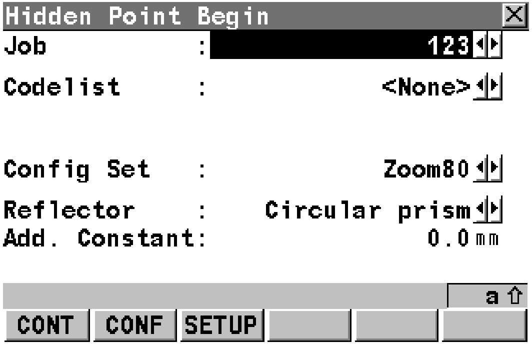
OR

Press a hot key configured to access the screen **HIDDEN PT Hidden Point Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

HIDDEN PT
Hidden Point Begin



CONT (F1)
To accept the changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure the Hidden Point application program. Refer to "33.3 Configuring Hidden Point".

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts changes and accesses **HIDDEN PT Measure Reflector 1**.

33.3 Configuring Hidden Point

Access

Select **Main Menu: Programs...\Hidden Point**. In **HIDDEN PT Hidden Point Begin** press **CONF (F2)** to access **HIDDEN PT Configuration**.

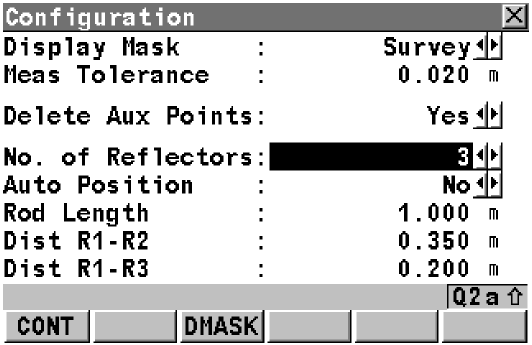
OR

Press **PROG**. Highlight **TPS HIDDEN PT**. **CONT (F1)**. In **HIDDEN PT Hidden Point Begin** press **CONF (F2)** to access **HIDDEN PT Configuration**.

OR

Press **SHIFT CONF (F2)** in **HIDDEN PT Survey Reflector 1**.

HIDDEN PT Configuration



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
To edit the display mask currently being displayed in this field. Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted. Refer to "15.2 Display Settings".

SHIFT ABOUT (F6)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask to be shown in **HIDDEN PT Measure Reflector n**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.
<Meas Toler-ance:>	User input	Limit of the difference between input and measured spacing of the reflectors. ☞ For three reflectors being used, limit for maximum deviation of the three meas-urements.
<Delete Aux Points:>	**Yes** or **No**	The auxiliary points are deleted when the hidden point is stored. The auxiliary points are reflector 1, reflector 2 and reflector 3 of the hidden point rod. The Auxiliary Points ID template is used for the auxiliary points. The Survey Points ID template is used for the computed hidden point.
<No. of Refec-tors:>	**2** or **3**	Two or three reflectors are used on the rod.
<Auto Position:>	**Yes** or **No**	Available for **<No. of Reflectors: 3>**. The third reflector is aimed at automatically.
<Rod Length:>	User input	Total length of hidden point rod.

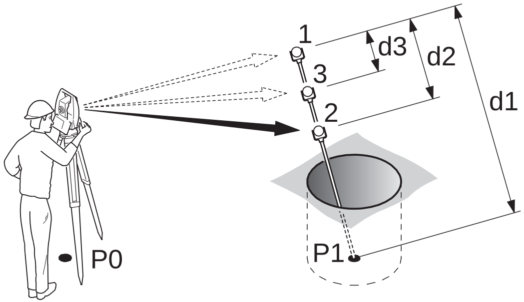
Field	Option	Description
<Dist R1-R2:>	User input	Spacing between the centres of reflector 1 and reflector 2.
<Dist R1-R3:>	User input	Available for **<No. of Reflectors: 3>**. Spacing between the centres of reflector 1 and reflector 3. Reflector 3 is situated between reflector 1 and reflector 2.

Next step

CONT (F1) returns to the screen from where this screen was accessed from.

33.4 Measuring Hidden Points

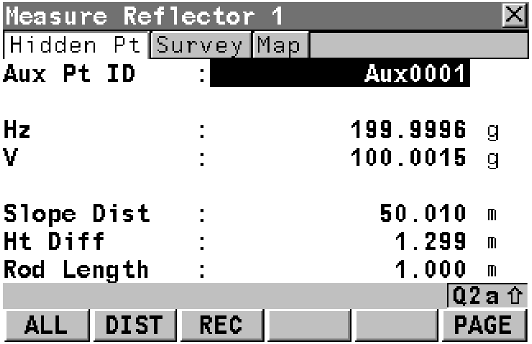
Diagram



d1 Rod length
d2 Distance from reflector 1 to reflector 2
d3 Distance from reflector 1 to reflector 3

Measuring hidden point step-by-step

Step	Description	Refer to chapter
1.	Refer to "33.2 Accessing Hidden Point" to access **HIDDEN PT Hidden Point Begin**.	
2.	**CONF (F2)** to access **HIDDEN PT Configuration**.	
3.	**HIDDEN PT Configuration** **<No. of Reflectors: 3>** Enter the values for **<Rod Length:>**, **<Dist R1-R2:>**, **<Dist R1-R3:>**	33.3
4.	**CONT (F1)** to access **HIDDEN PT Hidden Point Begin**.	
5.	**HIDDEN PT Hidden Point Begin** **CONT (F1)** to access **HIDDEN PT Measure Reflector 1**	

Step	Description	Refer to chapter
6.	**HIDDEN PT Measure Reflector 1, Hidden Pt** page  **<Aux Pt ID:>** The point ID of the auxiliary point, the reflector on the hidden point rod. The Auxiliary Points ID template is used. The horizontal angle, vertical angle, slope distance and height difference to reflector 1, the auxiliary point are displayed. **<Rod Length:>** The length of the rod can be adjusted before the hidden point result is displayed. The rod length always keeps the distances R1-R2 for 2 prisms and R1-R3 for 3 prisms into account.	
☞	**PAGE (F6)** changes to the **Map** page.	30.5

Step	Description	Refer to chapter
	SHIFT INDIV (F5) for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	15.2
7.	**ALL (F1)** measures reflector 1 and accesses **HIDDEN PT Measure Reflector 2**.	
8.	Repeat step 7. for reflector 2 and for reflector 3. After the last reflector of the hidden point rod is measured, **HIDDEN PT Hidden Point Result, Results** page is accessed.	
9.	**HIDDEN PT Hidden Point Result, Result** page **<Point ID:>** The name of the hidden point. The configured point ID template is used. **<Hz:>**, **<V:>** and **<Slope Dist:>** The calculated horizontal and vertical angle and slope distance to the computed hidden point. ----- is displayed for unavailable information. **<Ht Diff:>** The calculated height difference from instrument to computed hidden point. ----- is displayed for unavailable information. **<Easting:>**, **<Northing:>** and **<Ortho Ht:>** The calculated coordinates of the computed hidden point. ----- is displayed for unavailable information.	
	NEXT (F5) to store the hidden point and to access **HIDDEN PT Measure Reflector 1**.	

Step	Description	Refer to chapter
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.	15.2
10.	**PAGE (F6)** to change to **Code** page.	
11.	**HIDDEN PT Hidden Point Result, Code** page **<Point ID:>** The name of the hidden point. The configured point ID template is used. **<Point Code:>** The thematical code. All codes of the job can be selected. **<Atttribute n:>** The attributes for the thematical code. The behaviour of the fields depend on their definition in the codelist. Type in a code if required.	
12.	**PAGE (F6)** to change to **Plot** page.	
13.	**HIDDEN PT Hidden Point Result, Plot** page Measured distances are indicated by solid arrows.	30.6
14.	**STORE (F1)** to store the hidden point.	

Test or prove hidden points step-by-step

Step	Description	Refer to chapter
1.	Set up and orient the instrument in an open area.	

Step	Description	Refer to chapter
2.	Repeat steps 1. to 3. from paragraph "Measuring hidden point step-by-step".	
3.	Configure the hidden point rod.	33.3
4.	Position the tip of the hidden point rod on a mark that is directly visible from the instrument location.	
5.	Repeat steps 4. to 14. from paragraph "Measuring hidden point step-by-step". Make sure the hidden point rod does not move between measurements.	
6.	**PROG** to access **Zoom80 Programs**.	
7.	**Zoom80 Programs** **Stakeout** to access **STAKEOUT Stakeout Begin**	
	Make sure **<Auto Position: 3D>** is selected in **STAKEOUT Configuration, General** page.	
8.	**STAKEOUT Stakeout Begin** **CONT (F1)** to access **STAKEOUT XX Stakeout, Stake** page	
9.	**STAKEOUT XX Stakeout, Stake page** Select the hidden point.	

34 Roads - ATK

34.1 Introduction

34.1.1 Overview

Description

Alignment Tool Kit is an "add-on" component to the Road application program. It is only intended for quick and easy modification of existing alignments, or creation of new ones. Alignment Tool Kit is not an on board road planning and design application.

The Alignment Tool Kit application supports these alignment types:

- Horizontal alignments
- Vertical alignments
- X-section templates
- X-section assignments
- Chainage equations

The application is a free application program provided by GeoMax AG. If the application does not appear on your menu or you are otherwise unable to access it, please contact your GeoMax AG representative.

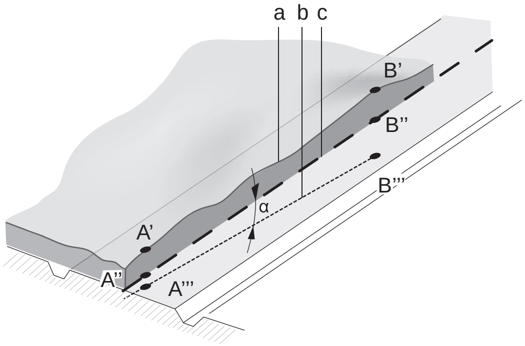
34.1.2 Basic Terms

Description

In order to make the following chapters easier to understand, the basics are introduced in this subchapter.
A road surface can be thought of three different types of design elements:

- the horizontal alignment
- the vertical alignment
- the X-section

Basic concepts



a	- Natural surface.
b	- The vertical alignment.
c	- The horizontal alignment.
A''/B''	- Points on horizontal alignment
A'/B'	- Points on real surface
A'''/B'''	- Points on vertical alignment

Any point A in a project has ENH coordinates. Each point has three different positions:

- A'' - Point on horizontal alignment
- A' - Point on real surface
- A''' - Point on vertical alignment

By adding a second point B to the project an alignment is defined. The alignment can be thought in three ways:

- Horizontal alignment (A''-B'')
- Projection of the horizontal alignment onto the real surface (A'-B')
- Vertical alignment (A'''-B''')

The angle between the horizontal and the vertical alignment is the grade (α).

Geometric elements

A road design is fitted to a base plan or map using the three basic geometric elements:

- Straight
- Curve
- Spiral

34.1.3 Design Elements

Horizontal alignment

Description

The horizontal alignment defines the road axis of a project. The constituting elements of a horizontal alignment are:

- straights (tangents)
- curves (arcs)
- spirals (clothoid or cubic parabola)
- bloss curves (element type used for railway track design)

Each constituting element is defined by individual horizontal design elements such as chainage, easting, northing, radius and parameter A.

Design elements for horizontal alignment

Design element	Description
Straight (tangent)	Straight line between two points. It's end point is identical with the beginning of a curve or spiral. The tangent is perpendicular to the radius of the curve.
Curve (arc)	Circular curve with constant radius.
Spiral	Spirals are used to connect straights and curves. A full spiral has an infinite radius at its start or end point whereas a partial has a finite radius at its start and end point. **In**. Radius at the start point is bigger than at the end point.

Design element	Description
	Out. Radius at the start point is smaller than at the end point.
Parameter A	$A^2 = R * L$ R = Radius of the connecting circular curve. L = Length of the spiral.

Vertical alignment

Description

The vertical alignment gives information about the pattern of heights of the road axis as it
is defined in the horizontal alignment.

The constituting elements of a vertical alignment are:

- tangents (straight segments)
- curves
- parabolas.

Each constituting element is defined by individual vertical design elements such as chainage,
easting, northing, radius and chainage P.

Design elements for vertical alignment

Design element	Description
Tangent	Straight line between two points. It's end point is identical with the beginning of a curve or spiral. The tangent is perpendicular to the radius of the curve.
Curve	Circular vertical curve with constant radius.

Design element	Description
Parabola	Parabolic vertical curve with constant rate of grade change.

X-Section templates

Description

A X-Section gives a profile view. It requires vertical alignment or actual elevation on each chainage.

The constituting elements are straight elements. The points are called vertices. You may optionally define slopes at the vertices most left and most right.

Points are defined by:

- ΔH and ΔV
- ΔH and slope in percentage
- ΔH and slope in ratio

X-Section assignments

Description

One X-Section is valid until a new one is defined at a chainage ahead. X-section definition can be at any chainage. The chainages need not necessarily correspond to chainages where a design element starts or ends.

Chainage equation

Description

Chainage equations define adjustments for the chainage values in the horizontal alignment. These adjustments may be necessary when the horizontal alignments has been modified by inserting or removing a constituting element and the chainage in the horizontal alignment were not recomputed. This can be the case when editing manually or with a program which does no automatic recomputation. Simply speaking, chainage equations define leaving a gap or allow an overlap at certain chainages.

The constituting elements in the equations are:

- chainage back
- chainage ahead.

34.2 Starting Alignment Tool Kit

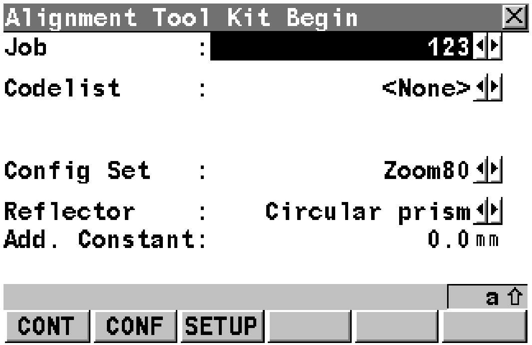
34.2.1 Accessing Alignment Editor

Access

The **Alignment Tool Kit** application can be accessed by:

- Select **Main Menu: Programs...\Alignment Tool Kit** and press **CONT (F1)**.
- Press the **PROG** key. Highlight **Alignment Tool Kit** and press **CONT (F1)**.
- Press a hot key configured to access the screen **ATK Alignment Tool Kit Begin**.
- Press the **USER** key. Highlight **Alignment Tool Kit** in the User menu (which has to be configured) and press **CONT (F1)**.

Alignment Tool Kit Begin



CONT (F1)
To accept the screen entries and continue.

SETUP (F3)
To set up chainage.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The reflector currently defined in the selected **<Config Set:>**. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constannt:>	Output	The additive constant stored with the chosen reflector.

Next step

IF	THEN
ATK is to be continued.	press **CONT (F1)** to access the **Task Selection** screen. Refer to "34.2.2 Selecting the Task".
ATK is to be configured	**CONF (F2)**. Refer to "34.2.7 Configuring Alignment Tool Kit".

34.2.2 Selecting the Task

Description

Define wether a new alignment is to be created or an existing alignment is to be modified.

Access

Refer to "34.2.1 Accessing Alignment Editor" to access **Alignment Tool Kit Begin**. Press **CONT (F1)** to access the **Task Selection** screen.

Task selection

CONT (F1)
To accept the screen entries and continue.

Description of fields

Field	Option	Description
<Task:>		Defines the task used in the ATK application. Alignments will be saved as LandXML files in the \Data\XML folder on the CompactFlash card.

Field	Option	Description
	Create Alignment	To create a new raw alignment. Refer to "34.2.3 Creating a New Raw Alignment".
	Modify Alignment	To modify an existing alignment. Refer to "34.2.4 Modify an Existing Raw Alignment".
<Raw Align- ment:>	Choicelist	The alignment to be modified. All alignments in the \Data\XML folder can be selected. Only available for **<Task: Modify Alignment>**.

Next step

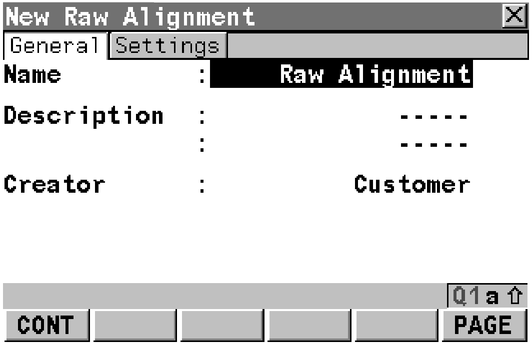
IF an alignment	THEN
is to be created	select **<Task: Create Alignment>**. Press **CONT (F1)** and access the **New Raw Alignment** screen. Refer to "34.2.3 Creating a New Raw Alignment".
is to be modified	select **<Task: Modify Alignment>** and access the **Raw Alignments** screen. Refer to "34.2.4 Modify an Existing Raw Alignment".

34.2.3 Creating a New Raw Alignment

Access

Refer to "34.2.2 Selecting the Task" to access the **Task Selection** screen. Select **<Task: Create alignment>** and press **CONT (F1)** to access the **New Raw Alignment** screen.

New Raw Alignment, General page



CONT (F1)
To accept the screen entries and continue.

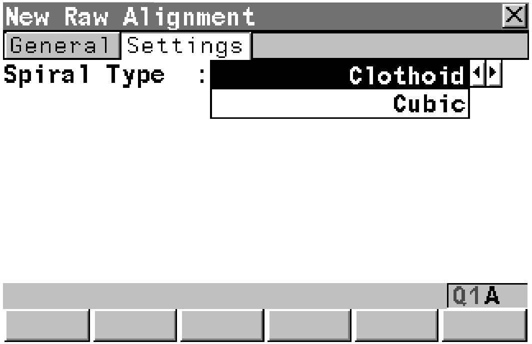
Description of fields

Field	Option	Description
<Name:>	User input	The name of the new raw alignment.
<Description:>	User input	Optional description of the new raw alignment.
<Creator:>	User input	Optional description of the Creator of this alignment.

Next step

PAGE (F6) to change to the **Settings** page.

New Raw Alignment, Settings page



CONT (F1)
To accept the screen entries and continue.

Description of fields

Field	Option	Description
<Spiral Type:>		The type of spirals to be used in the alignment definition.
	Clothoid	Uses clothoid as transition curve type.
	Cubic	Uses cubic parabola as transition curve type.

Next step

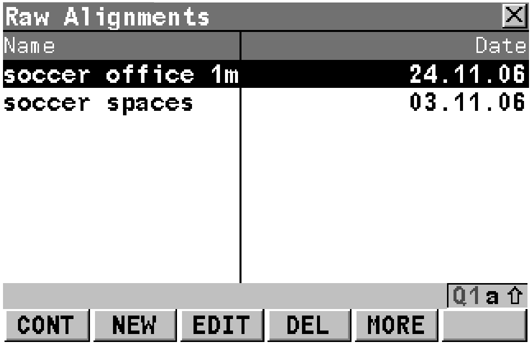
CONT (F1) accesses the **Aligment Tool Kit Menu** screen. Refer to "34.2.6 Selecting an Option".

34.2.4 Modify an Existing Raw Alignment

Access

Refer to "34.2.2 Selecting the Task" to access the **Task Selection** screen. Select **<Task: Modify Alignment>**, move the focus to **<Raw Alignment:>** and press **ENTER** to access the **Raw Alignments** screen.

Raw Alignments



CONT (F1)
To accept the screen entries and continue.

NEW (F2)
To create a new raw alignment. Refer to "34.2.3 Creating a New Raw Alignment".

EDIT (F3)
To edit an existing alignment.

DEL (F4)
To delete an existing alignment.

MORE (F5)
To switch the last column between **Date**, **Time** and **Size**.

SHIFT BCKUP (F5)
To restore a LandXML alignment file with the extension *.xmb currently stored in the \Data\XML folder.

Description of columns

Column	Description
Name	All existing LandXML alignments currently stored in the \Data\XML folder with the file extension *.xml.

Column	Description
Date	Date of creation of the alignment file.
Time	Time of creation of the alignment file.
Size	Size of the LandXML file.

Next step

IF an alignment	THEN
is to be newly created	press **NEW (F2)** and access the **New Raw Alignment** screen. Refer to "34.2.3 Creating a New Raw Alignment".
is to be edited	press **EDIT (F3)** and access the **Edit Raw Alignment** screen. Edit the alignment and press **CONT (F1)** to return to the **Raw Alignments** screen. **CONT (F1)** again to access **Alignment Tool Kit Menu**.
is to be deleted	press **DEL (F4)**, confirm or decline the process and return to the **Raw Alignments** screen. **CONT (F1)** again to access **Alignment Tool Kit Menu**.

34.2.5 Importing Alignment Data

Description

To import alignment data from different sources to an existing alignment.

Importing alignment data from the **Alignment Tool Kit Menu** screen can only be done on empty alignments.

Access

Refer to "34.2.6 Selecting an Option" to access the **Alignment Tool Kit Menu** screen. Press **IMPRT (F5)** to access the **Import Alignment** screen.

Import Alignment

CONT (F1)
To import the selected alignment data to active raw alignment.

Description of fields

Field	Option	Description
<Data Source:>		Data source from where existing alignment data should be imported.

Field	Option	Description
	Survey Job	All jobs from **Main Menu: Manage...\Jobs** can be selected.
	Road Job	
	Road+ (GSI)	Alignment data to be imported from this **Data Source** have to be stored in the \GSI folder on the CompactFlash card.
<From Job:>	Choicelist	Available for **<Data Source: Survey Job>** and **<Data Source: Road Job>**.
<Line:>	Choicelist	Line element from the selected job. Only available for **<Data Source: Survey Job>**.
<Alignment:>	Choicelist	Road alignment. Only available for **<Data Source: Road Job>**.
<ALN File:>	Choicelist	Horizontal alignment file in GSI format. Only available for **<Data Source: Road+ (GSI)>**.
<PRF File:>	Choicelist	Vertical alignment file in GSI format. Only available for **<Data Source: Road+ (GSI)>**.

Next step

CONT (F1) imports the selected alignment data and returns to the **Aligment Tool Kit Menu** screen. Refer to "34.2.6 Selecting an Option".

34.2.6 Selecting an Option

Description

All operations that can be basically performed for aligments by the ATK application.

Access

Refer to "34.2.2 Selecting the Task" to access the **Task Selection** screen. Press **CONT (F1)** to access the **Alignment Tool Kit Menu** screen.

Alignment Tool Kit Menu

CONT (F1)
To accept the screen entries and continue.

IMPRT (F5)
To import alignment data. Refer to "34.2.5 Importing Alignment Data".

Description of options

Option	Description
Edit Horizontal Alignment	To create, edit and delete elements of a horizontal alignment. Refer to "34.3 Edit Horizontal Alignments".
Edit Vertical Alignment	To create, edit and delete elements of a vertical alignment. Refer to "34.4 Edit Vertical Alignments".

Option	Description
Edit X-Section Templates	To create, edit and delete X-Section templates. Refer to "34.5 Edit X-Section Templates". Only available for **<Job Type: Road>**.
Edit X-Section Assignments	To create, edit and delete X-Section assignments. Refer to "34.6 Edit X-Section Assignments". Only available for **<Job Type: Road>**.
Edit Chainage Equation	To create, edit and delete chainage equations. Refer to "34.7 Edit Chainage Equation".
Convert to Road Job	To convert existing LandXML alignments to a Road job. Refer to "34.8 Convert to Road Job".

The available options can be performed individual or in special combinations. Possible combinations:

- 1 + 6
- 1 + 2 + 6
- 1 + 3 + 4 + 6
- 1 + 2 + 3 + 4 + 6

All listed combinations can also contain additionally the option 5 (chainage equation).

Next step

IF	THEN
an ATK method is to be started	highlight the relevant option and press **CONT (F1)**. Refer to the chapters stated above.
ATK is to be configured	**SHIFT (F2)**. Refer to "34.2.7 Configuring Alignment Tool Kit".
alignment data is to be imported	**IMPRT (F5)**. Refer to "34.2.5 Importing Alignment Data".

34.2.7 Configuring Alignment Tool Kit

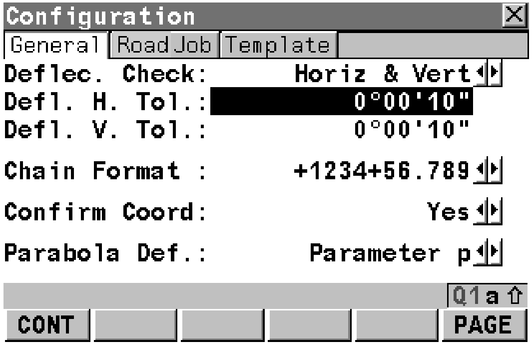
Description

The ATK configuration defines the settings to be used in the different parts of the ATK application.

Access

Refer to "34.2.1 Accessing Alignment Editor" to start the ATK application. Press **CONF (F2)** to access **Configuration**.

Configuration, General page



CONT (F1)
To accept the screen entries and continue.

PAGE (F6)
To change to another page on this screen.

Description of fields

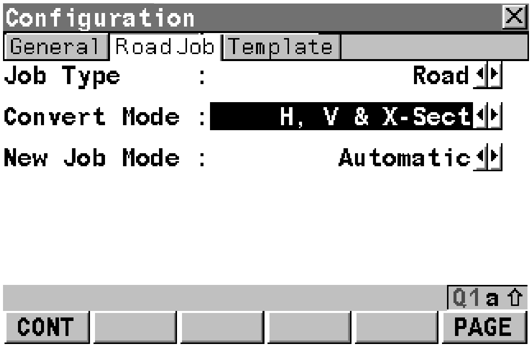
Field	Option	Description
<Deflec. Check:>		Possibility to do a deflection check for horizontal and/or vertical alignments.
	Horiz & Vert	The deflection check will be done for horizontal and vertical alignments.

Field	Option	Description
	Horizontal Only	The deflection check will only be done for horizontal alignments.
	Vertical Only	The deflection check will only be done for vertical alignments.
	None	No deflection check will be done.
<Deflec. H. Tol.:>	User input	The deflection tolerance for horizontal alignments. The tolerance value used for determining deflection errors. A deflection error occurs when the beginning curve tangent of an element does not match the ending tangent of the previous element. If the actual error in deflection is greater than this value, the error will be reported.
<Deflec. V. Tol.:>	User input	The deflection tolerance for vertical alignments.
<Chain Format:>		Selects display format for all chainage information fields.
	+123456.789	Default chainage display format.
	+123.4+56.789	Seperator between tens and hundreds with additional thousand separator.
	+123+456.789	Seperator between hundreds and thousands.

Field	Option	Description
	+1234+56.789	Seperator between tens and hundreds.
<Confirm Coord:>	Choicelist	If set to **Yes**, each time a new alignment element has been entered, a confirmation message displays the end coordinates for confirmation.
<For Parabola:>	**Parameter p** **K factor**	Parameter defining the curve. K factor = Parameter p/100.

Next step
PAGE (F6) changes to the **Road Job** page.

Configuration, Road Job page



CONT (F1)
To accept the screen entries and continue.

PAGE (F6)
To change to another page on this screen.

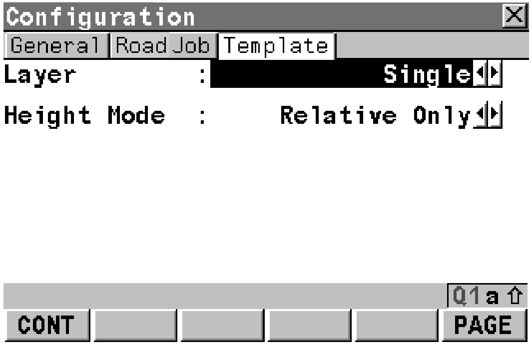
Description of fields

Field	Option	Description
<Job Type:>	Choicelist	Define the job type to be used for the conversion.
<Convert Mode:>	Choicelist	The mode used for the conversion. Refer to "34.8 Convert to Road Job" for more detailed information.
<New Job Mode:>		The job mode to be used for the conversion.
	Manual	The conversion has to be done manually. Refer to "34.8 Convert to Road Job" for more detailed information.
	Automatic	The conversion will be done automatically with the options defined for **<Convert Mode:>**.

Next step

PAGE (F6) changes to the **Template** page.

Configuration, Template page



CONT (F1)
To accept the screen entries and continue.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Layer:>		Possibility to define multiple layers per X-Section within the creation of X-Sections. This setting can not be changed for existing alignments.
	Single	A single layer can be defined per X-Section.
	Multiple	Multiple layers can be defined per X-Section.
<Height Mode:>		Define the mode for heights used in **X-Section Templates**.
	Relative Only	Heights entered for the X-Section templates are relative to the height of the vertical alignment.

Field	Option	Description
	Relative & Abs.	Within the X-Section templates definition a height can be set for the centreline.

Next step

CONT (F1) accepts the entries and returns to the screen where the **Configuration** screen was entered from.

34.3 Edit Horizontal Alignments

34.3.1 Overview

Description

Allows creating, editing and deleting of the following elements:

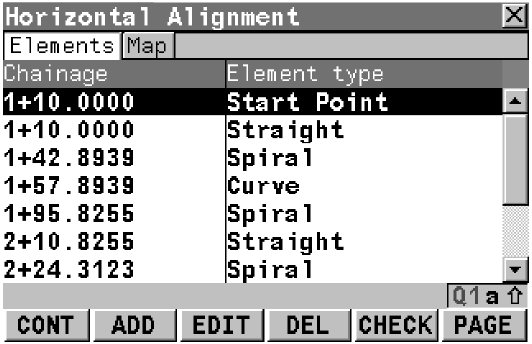
- Start Point
- Straight (Tangent)
- Curve
- Spiral
- Partial Spiral
- Bloss
- Partial Bloss

as well as checking the horizontal alignment.

Access

Refer to "34.2.6 Selecting an Option" to access the **Alignment Tool Kit Menu** screen. Hightlight **Edit Horizontal Alignments** and press **CONT (F1)** to access the **Horizontal Alignment** screen.

Horizontal Alignment



CONT (F1)
To accept the screen entries and continue.

ADD (F2)
To add a new element to the horizontal alignment.

EDIT (F3)
To edit the highlighted element of the horizontal alignment.

DEL (F4)
To delete the highlighted element of the horizontal alignment.

CHECK (F5)
To check the horizontal alignment.

PAGE (F6)
To change to another page on this screen.

SHIFT HOME (F2)
To move the focus to the start point of the horizontal alignment.

SHIFT END (F3)
To move the focus to the end point of the horizontal alignment.

Next step

IF	THEN
the start point is to be edited	highlight the Start Point and press **EDIT (F3)**. Refer to "34.3.2 Editing the Start Point".

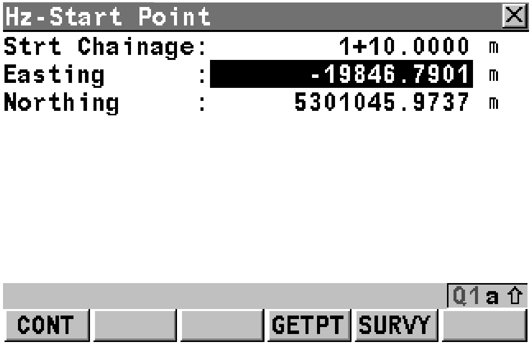
IF	THEN
an element is to be created	press **ADD (F2)** and access the **Hz-Add Element** screen. Refer to "34.3.3 Inserting/Editing an Element to/in a Horziontal Alignment".
an element is to be edited	press **EDIT (F3)**. Refer to "34.3.3 Inserting/Editing an Element to/in a Horziontal Alignment".
an element is to be deleted	press **DEL (F4)** and confirm or abort deleting. Refer to "34.3.8 Deleting an Existing Element in a Horizontal Alignment"
the horizontal alignment is to be checked	press **CHECK (F5)**. The horizontal alignment will be checked. **OK (F4)** confirms the checking and returns to the **Horizontal Alignment** screen.

34.3.2 Editing the Start Point

Access

Refer to "34.3.1 Overview" to access **Horizontal Alignment**. Highlight the **Start Point** and press **EDIT (F3)** to access the **Hz-Start Point** screen.

Hz-Start Point



CONT (F1)
To accept the screen entries and continue.

GETPT (F4)
To apply coordinates or heights from an existing point in the active job.

SURVY (F5)
To manually occupy a point.

SHIFT CONF (F2)
To access **Configuration**.

SHIFT RESET (F4)
To reset all screen entries.

Description of fields

Field	Option	Description
<Strt Chainage:>	User input	Start chainage of the horizontal alignment.
<Easting:>	User input	Easting of the start point of the horizontal alignment.
<Northing:>	User input	Northing of the start point of the horizontal alignment.

34.3.3 Inserting/Editing an Element to/in a Horziontal Alignment

Access

Refer to "34.3.1 Overview" to access **Horizontal Alignment**. Highlight an alignment element and press **ADD (F2)**/**EDIT (F3)** to create/edit a new/existing alignment element.

Creating and editing an alignment element is similar. For simplicity, only the creating of an alignment element is explained and differences are clearly outlined.

Hz-Add Element

CONT (F1)
To accept the screen entries and continue.

Description of options

Option	Description
Straight	To insert/edit a straight to/in a horizontal alignment.
Curve	To insert/edit a curve to/in a horizontal alignment.

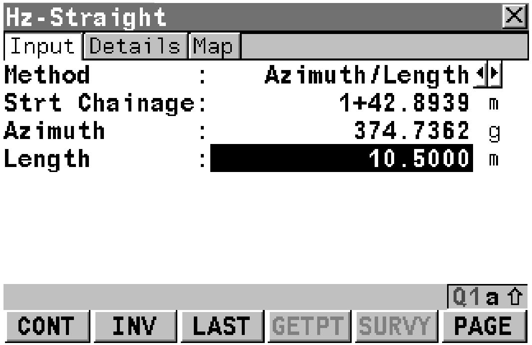
Option	Description
Spiral	To insert/edit a spiral to/in a horizontal alignment.
Partial Spiral	To insert/edit a partial spiral to/in a horizontal alignment.

34.3.4 Creating/Editing a Straight

Access

Refer to "34.3.3 Inserting/Editing an Element to/in a Horziontal Alignment" to access the **Hz-Add Element** screen. Highlight **Straight** and press **CONT (F1)** to access the **Hz-Straight** screen.

Hz-Straight



CONT (F1)
To accept the screen entries and continue.

INV (F2)
To calculate the inverse between two existing points in the active job.

LAST (F3)
To select values from the last inverse calculations.

GETPT (F4)
To apply coordinates or heights from an existing point in the active job.

SURVY (F5)
To manually occupy a point.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To access the **Configuration**.

SHIFT RESET (F4)
To reset all screen entries.

Description of fields

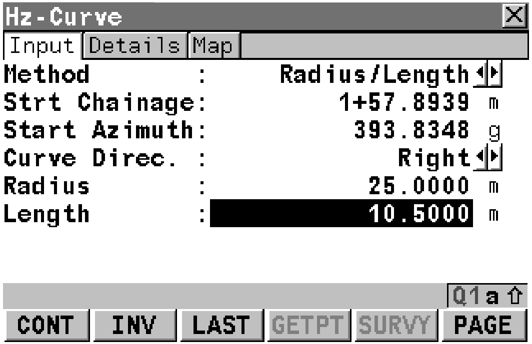
Field	Option	Description
<Method:>		The method used to define the straight.
	Azimuth/ Length	Using the azimuth and the length of the straight.
	Azimuth/ E Chain	Using the azimuth and the end chainage of the straight.
	End Coords	Using the end coordinates of the straight.
<Strt Chainage:>	Output	The end chainage of the previous element is automatically used and cannot be edited.
<Azimuth:>	User input	The azimuth displayed is from the previous element. Another value can be entered manually.
<Length:>	User input	Length of the straight element.
<End Chainage:>	User input	Chainage at the end of the element.
<End East:>	User input	Easting for the end chainage.
<End North:>	User input	Northing for the end chainage.

34.3.5 Creating/Editing a Curve

Access

Refer to "34.3.3 Inserting/Editing an Element to/in a Horziontal Alignment" to access the **Hz-Add Element** screen. Highlight **Curve** and press **CONT (F1)** to access the **Hz-Curve** screen.

Hz-Curve



CONT (F1)
To accept the screen entries and continue.

INV (F2)
To calculate the inverse between two existing points in the active job.

LAST (F3)
To select values from the last inverse calculations.

GETPT (F4)
To apply coordinates or heights from an existing point in the active job.

SURVY (F5)
To manually occupy a point.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To access **Configuration**.

SHIFT RESET (F4)
To reset all screen entries.

Description of fields

Field	Option	Description
<Method:>		The method used to define the curve.
	Radius/ Length	Using the radius of the curve and its length.
	Radius/Delta	Using the radius and the delta angle of the curve.
	Radius/ E Chain	Using the radius of the curve and the end chainage.
	Radius/ E Coords	Using the radius and the end coordinates of the curve.
	Center/ E Coords	Using the coordinates of the centre point and the end point of the curve.
	3 Points	Using three points.
<Strt Chainage:>	Output	The end chainage of the previous element is automatically used and cannot be edited.
<Start Azimuth:>	User input	The azimuth of the tangent in the start point. This is used from the previous element. The value can be edited.
<Curve Direc.:>	Choicelist	Looking in the direction of increasing chainage, the direction of the curve can be right or left.

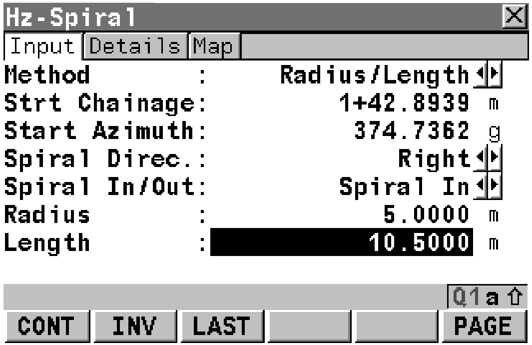
Field	Option	Description
<Radius:>	User input	Radius of the curve. The signs are set by the system depending on the curve direction defined in **<Curve Direc:>.**.
<CP East:>	User input	Easting of the centre point of the curve.
<CP North:>	User input	Northing of the centre point of the curve.
<Int. East:>	User input	Easting of the intermediate point of the **<Method: 3 Points>**.
<Int. North:>	User input	Northing of the intermediate point of the **<Method: 3 Points>**.
<Length:>	User input	Length from the start to the end point of the curve.
<Delta:>	User input	The deflection angle. Only available for **<Method: Radius/Delta>**.
<End Chainage:>	User input	The end chainage of the curve element can be typed in. Available for **<Method: Radius/E Chain>** and **<Method: Radius/Delta>**.
<End East:>	User input	Easting for the end chainage. Available for **<Method: Radius/E Coords>** and **<Method: Center/E Coords>**.
<End North:>	User input	Northing for the end chainage. Available for **<Method: Radius/E Coords>** and **<Method: Center/E Coords>**.

34.3.6 Creating/Editing a Spiral

Access

Refer to "34.3.3 Inserting/Editing an Element to/in a Horzional Alignment" to access the **Hz-Add Element** screen. Highlight **Spiral** and press **CONT (F1)** to access the **Hz-Spiral** screen.

Hz-Spiral



CONT (F1)
To accept the screen entries and continue.
INV (F2)
To calculate the inverse between two existing points in the active job.
LAST (F3)
To select values from the last inverse calculations.
PAGE (F6)
To change to another page on this screen.
SHIFT CONF (F2)
To access **Configuration**.
SHIFT RESET (F4)
To reset all screen entries.

Description of fields

Field	Option	Description
<Method:>		The method used to define the spiral.

Field	Option	Description
	Radius/ Length	Using the radius of the connecting curve and its length.
	Radius/ E Chain	Using the radius of the connecting curve and its end chainage.
	Param/Length	Using the parameter A and the length of the connecting curve.
	Param/ E Chain	Using the parameter A and the end chainage of the spiral.
<Strt Chainage:>	Output	The end chainage of the previous element is automatically used and cannot be edited.
<Start Azimuth:>	User input	The azimuth of the tangent in the start point. This is used from the previous element. The value can be edited.
<Spiral Direc.:>	Choicelist	Looking in the direction of increasing chainage, the direction of the spiral can be right or left.
<Spiral In/Out:>	Choicelist	For a spiral transition from tangent to curve select **IN**, for a spiral transition from curve to tangent select **OUT**.
<Radius:>	User input	Radius of the spiral. Available for **<Method: Radius/Length>** and **<Method: Radius/E Chain>**.

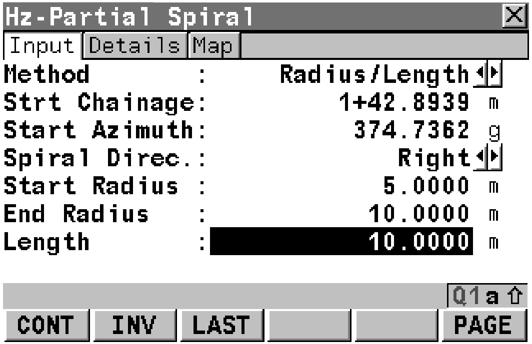
Field	Option	Description
<Parameter A:>	User input	The parameter A defining the spiral. Available for **<Method: Param/Length>** and **<Method: Param/E Chain>**.
<Length:>	User input	Length of the spiral element.
<End Chainage:>	User input	The end chainage of the curve element can be typed in. Available for **<Method: Radius/E Chain>** and **<Method: Param/E Chain>**.

34.3.7 Creating/Editing a Partial Spiral

Access

Refer to "34.3.3 Inserting/Editing an Element to/in a Horzional Alignment" to access the **Hz-Add Element** screen. Highlight **Partial Spiral** and press **CONT (F1)** to access the **Hz-Partial Spiral** screen.

Hz-Partial Spiral



CONT (F1)
To accept the screen entries and continue.

INV (F2)
To calculate the inverse between two existing points in the active job.

LAST (F3)
To select the values from the last inverse calculations.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To access **Configuration**.

SHIFT RESET (F4)
To reset all screen entries.

Description of fields

Field	Option	Description
<Method:>		The method used to define the partial spiral.

Field	Option	Description
	Radius/ Length	Using the radius and the length of the spiral.
	Radius/ E Chain	Using the radius and the end chainage of the spiral.
<Strt Chainage:>	Output	The end chainage of the previous element is automatically used and cannot be edited.
<Start Azimuth:>	User input	The azimuth of the tangent in the start point. This is used from the previous element. The value can be edited.
<Spiral Direc.:>	Choicelis	Looking in the direction of increasing chainage, the direction of the spiral can be right or left.
<Start Radius:>	User input	The entry radius of the spiral. The signs are set by the system depending on the spiral direction defined in **<Spiral Direc.:>**.
<End Radius:>	User input	The exit radius of the spiral. The signs are set by the system depending on the spiral direction defined in **<Spiral Direc.:>**.
<Length:>	User input	Length of the spiral element.
<End Chainage:>	User input	The end chainage of the curve element can be typed in. Only available for **<Radius/E Chain:>**.

34.3.8 Deleting an Existing Element in a Horizontal Alignment

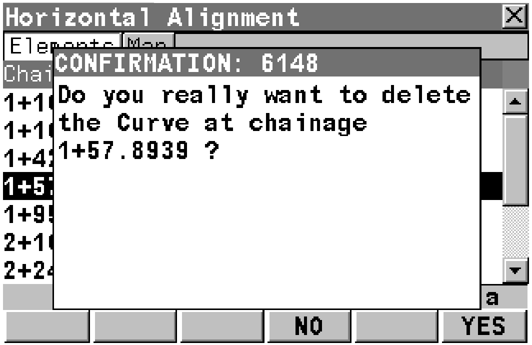
Access

Refer to "34.3.1 Overview" to access the **Horizontal Alignment** screen.

Deleting an existing element step-by-step

Step	Description
1.	**Horizontal Alignment**
2.	Select the element to be deleted and press **DEL (F4)**.
3.	Press **YES (F6)** to confirm deleting or **NO (F4)** to abort deleting the element.
4.	For **YES (F6)**, choose which elements have to be adjusted or abort the deleting. It automatically returns to the **Horizontal Alignment** screen.

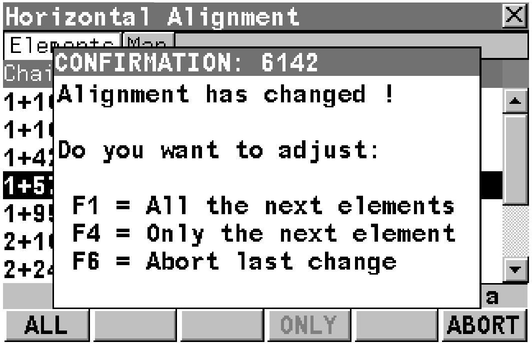
Step 3



NO (F4)
To accept the deleting and continue.

YES (F6)
To decline the deleting and return to the last screen.

Step 4



ALL (F1)
To adjust all following elements.

ONLY (F4)
To adjust only the next element.

ABORT (F6)
To abort the process without deleting an element.

34.4 Edit Vertical Alignments

34.4.1 Overview

Description

Allows creating, editing and deleting of the following elements:

- Start Point
- Straight (Tangent)
- Parabola
- Curve

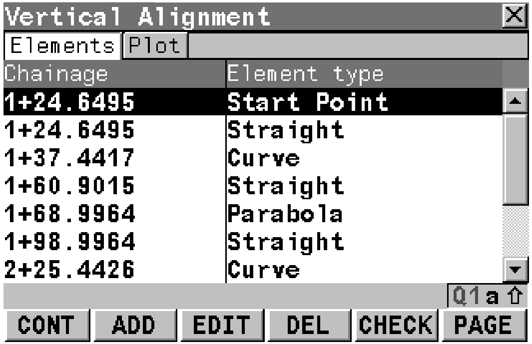
as well as checking the vertical alignment.

Throughout the whole component height and elevation is used for local orthometric height.

Access

Refer to "34.2.6 Selecting an Option" to access the **Alignment Tool Kit Menu** screen. Hightlight **Edit Vertical Alignments** and press **CONT (F1)** to access the **Vertical Alignment** screen.

Vertical Alignment



CONT (F1)
To accept the screen entries and continue.

ADD (F2)
To create a new element of the vertical alignment.

EDIT (F3)
To edit the highlighted element of the vertical alignment.

DEL (F4)
To delete the highlighted element of the vertical alignment.

CHECK (F5)
To check the vertical alignment.

PAGE (F6)
To change to another page on this screen.

SHIFT HOME (F2)
To move the focus to the start point.

SHIFT END (F3)
To move the focus to the end point.

Next step

IF an element	THEN
the start point is to be edited	highlight the start point and press **EDIT (F3)**. Refer to "34.4.2 Editing the Start Point".

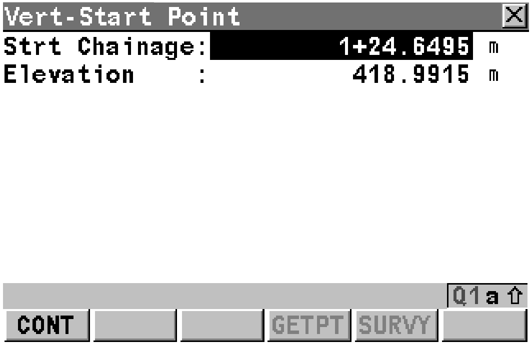
IF an element	THEN
an element is to be created	press **ADD (F2)** and access the **Vert-Add Element** screen. Refer to "34.4.3 Inserting/Editing an Element to/in a Vertical Alignment".
an element is to be edited	press **EDIT (F3)**. Refer to "34.4.3 Inserting/Editing an Element to/in a Vertical Alignment".
an element is to be deleted	press **DEL (F4)** and confirm or abort deleting. Refer to "34.4.7 Deleting an Existing Element in a Vertical Alignment"
the vertical alignment is to be checked	press **CHECK (F5)**. The vertical alignment will be checked. **OK (F4)** confirms the checking and returns to the **Vertical Alignment** screen.

34.4.2 Editing the Start Point

Access

Refer to "34.4.1 Overview" to access **Vertical Alignment**. Highlight the **Start Point** and press **EDIT (F3)** to access the **Vert-Start Point** screen.

Vert-Start Point



CONT (F1)
To accept the screen entries and continue.

GETPT (F4)
To apply coordinates or heights from an existing point in the active job.

SURVY (F5)
To manually occupy a point.

Description of fields

Field	Option	Description
<Strt Chainage:>	User input	Start chainage of the vertical alignment.
<Elevation:>	User input	Elevation at the start chainage of the vertical alignment.

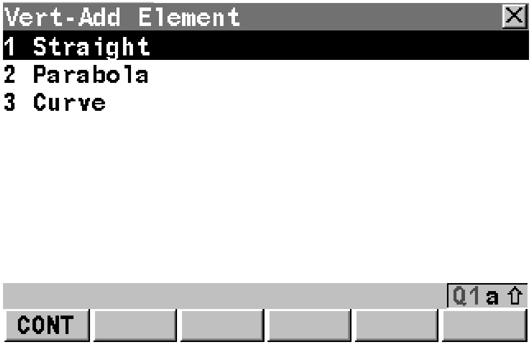
34.4.3 Inserting/Editing an Element to/in a Vertical Alignment

Access

Refer to "34.4.1 Overview" to access **Vertical Alignment**. Highlight an alignment element and press **ADD (F2)**/**EDIT (F3)** to create/edit a new/existing alignment element.

☞ Creating and editing an alignment element is similar. For simplicity, only the creating of an alignment element is explained and differences are clearly outlined.

Vert-Add Element



CONT (F1)
To accept the screen entries and continue.

Description of options

Options	Description
Straight	To insert/edit a straight to/in a vertical alignment.
Parabola	To insert/edit a parabola to/in a vertical alignment.

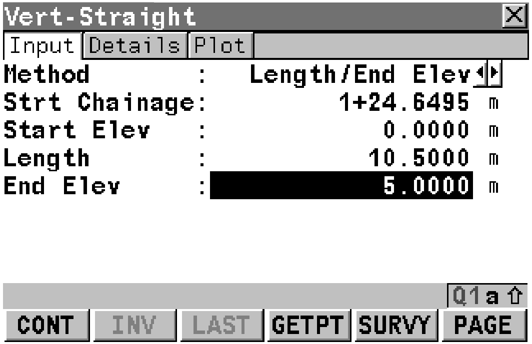
Options	Description
Curve	To insert/edit a curve to/in a vertical alignment.

34.4.4 Creating/Editing a Straight

Access

Refer to "34.4.3 Inserting/Editing an Element to/in a Vertical Alignment" to access the **Vert-Add Element** screen. Highlight **Straight** and press **CONT (F1)** to access the **Vert-Straight** screen.

Vert-Straight



CONT (F1)
To accept the screen entries and continue.

INV (F2)
To calculate the inverse between two existing points in the active job.

LAST (F3)
To select the values from the last inverse calculations.

GETPT (F4)
To apply coordinates or heights from an existing point in the active job.

SURVY (F5)
To manually occupy a point.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To access **Configuration**.

SHIFT RESET (F4)
To reset all screen entries.

SHIFT %/H:V/V:H (F5)
To switch between **hv**, **vh** and % for the S. Ratio unit.

Description of fields

Field	Option	Description
<Method:>		The method used to define the straight.
	Length/ End Elev	Using the length and the end elevation of the straight.
	End Chain & Elev	Using the end chainage and the elevation of the straight.
	Length/Grade	Using the length and the grade of the straight.
	End Chain/Grade	Using the end chainage and the grade of the straight.
<Strt Chainage:>	Output	The end chainage of the previous element is automatically used and cannot be edited.
<Start Elev:>	Output	The end height of the previous element is automatically used and cannot be edited.
<Length:>	User input	Length of the straight element as slope distance.
<End Chainage:>	User input	Chainage at the end of the element.
<Grade:>	User input	The grade of the straight element. Positive inclines have positive values, negative inclines have negative values.

Field	Option	Description
<End Elev:>	User input	Height at the end of the element. Type in manually or, alternatively, press **GETPT (F2)** when the focus is on this line to select the height from an existing point in the active job.

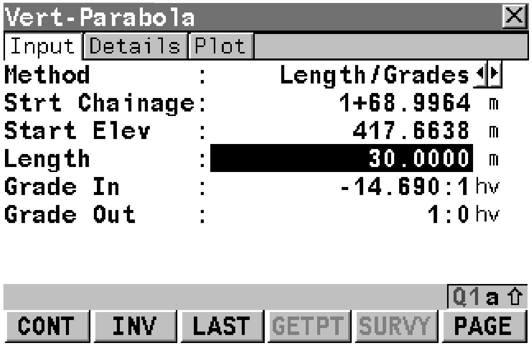
☞ For grade units the system settings are applied. To change the system setting access the **CONFIGURE Units & Formats** screen.

34.4.5 Creating/Editing a Parabola

Access

Refer to "34.4.3 Inserting/Editing an Element to/in a Vertical Alignment" to access the **Vert-Add Element** screen. Highlight **Parabola** and press **CONT (F1)** to access the **Vert-Parabola** screen.

Vert-Parabola



CONT (F1)
To accept the screen entries and continue.

INV (F2)
To calculate the inverse between two existing points in the active job.

LAST (F3)
To select the values from the last inverse calculations.

GETPT (F4)
To apply coordinates or heights from an existing point in the active job.

SURVY (F5)
To manually occupy a point.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To. access **Configuration**.

SHIFT RESET (F4)
To reset all screen entries.

SHIFT %/H:V/V:H (F5)
To switch between **hv**, **vh** and % for the S. Ratio unit.

Description of fields

Field	Option	Description
<Method:>		The method used to define the parabola.
	Length/ Grades	Using the length and the grades of the parabola.
	End Chain/Grades	Using the end chainage and the grades of the parabola.
	Param/ End Elev	Using the parameter and the end elevation of the parabola.
	3 Elevations	Using three elevations at defined chainages of the parabola.
<Strt Chainage:>	Output	The end chainage of the previous element is automatically used and cannot be edited.
<Start Elev:>	Output	The end height of the previous element is automatically used and cannot be edited.
<Length:>	User input	Length of the parabola as horizontal distance.
<End Chainage:>	User input	Chainage at the end of the element.
<Curve type:>	Choicelist	**Crest** or **Sag**.
<Parameter:>	User input	Parameter of the parabola.
<Int. Chainage:>	User input	Chainage of the second elevation.

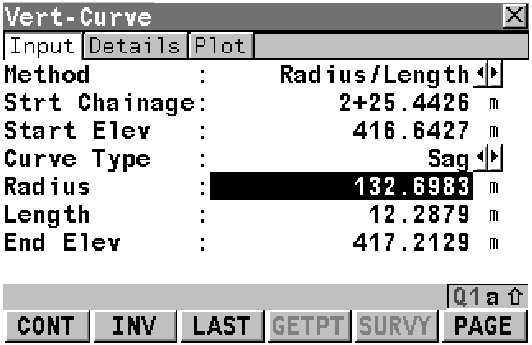
Field	Option	Description
<Int. Elev:>	User input	Second elevation. Type in manually or press **GETPT (F2)** when the focus is on this line to select the height from an existing point in the active job.
<Grade in:>	User input	The grade at the beginning of the parabola. Positive inclines have positive values, negative inclines have negative values.
<Grade out:>	User input	The grade at the end of the parabola. Positive inclines have positive values, negative inclines have negative values.
<End Elev:>	User input	Height at the end of the element. Type in manually or press **GETPT (F2)** when the focus is on this line to select the height from an existing point in the active job.

34.4.6 Creating/Editing a Curve

Access

Refer to "34.4.3 Inserting/Editing an Element to/in a Vertical Alignment" to access the **Vert-Add Element** screen. Highlight **Curve** and press **CONT (F1)** to access the **Vert-Curve** screen.

Vert-Curve



CONT (F1)
To accept the screen entries and continue.

INV (F2)
To calculate the inverse between two existing points in the active job.

LAST (F3)
To select the values from the last inverse calculations.

GETPT (F4)
To apply coordinates or heights from an existing point in the active job.

SURVY (F5)
To manually occupy a point.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To. access **Configuration**.

SHIFT RESET (F4)
To reset all screen entries.

Description of fields

Field	Option	Description
<Method:>		The method used to define the curve.
	Radius/ Length	Using the radius of the curve and its length.
	Radius/ E Chain	Using the radius and the end chainage of the curve.
<Strt Chainage:>	Output	The end chainage of the previous element is automatically used and cannot be edited.
<Start Elev:>	Output	The end height of the previous element is automatically used and cannot be edited.
<Curve type:>	Choicelist	**Crest** or **Sag**.
<Radius:>	User input	Radius of the curve.
<Length:>	User input	Length of the curve along the segment.
<End Chainage:>	User input	Chainage at the end of the element.
<End Elev:>	User input	Height at the end of the element. Type in manually or, alternatively, press **GETPT (F2)** when the focus is on this line to select the height from an existing point in the active job.

34.4.7 Deleting an Existing Element in a Vertical Alignment

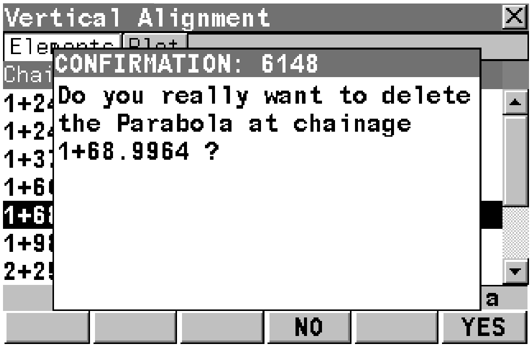
Access

Refer to "34.4.1 Overview" to access the **Vertical Alignment** screen. Highlight an alignment element and press **DEL (F4)** to delete the element.

Deleting an existing element step-by-step

Step	Description
1.	**Vertical Alignment**.
2.	Select the element to be deleted and press **DEL (F4)**.
3.	Press **YES (F6)** to confirm deleting or **NO (F4)** to abort deleting the element.
4.	For **YES (F6)**, choose which elements have to be adjusted or abort the deleting. It automatically returns to the **Vertical Alignment** screen.

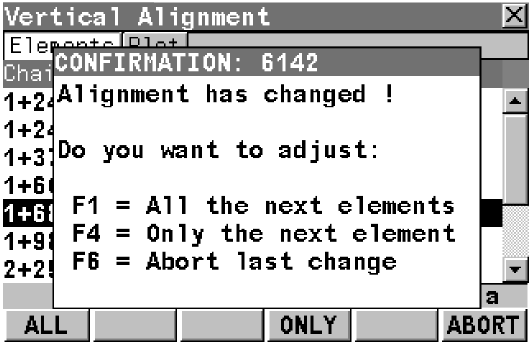
Step 3



NO (F4)
To decline deleting the element and return to the last screen.

YES (F6)
To accept deleting the element and continue.

Step 4



ALL (F1)
To adjust all following elements.

ONLY (F4)
To adjust only the next element.

ABORT (F6)
To abort the process without deleting an element.

34.5 Edit X-Section Templates

34.5.1 Overview

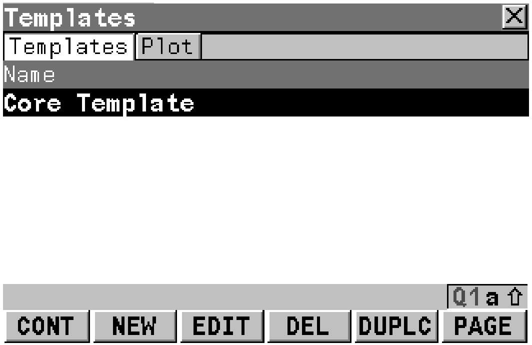
Description

Allows creating, editing, deleting and duplicating of X-Section templates.

Access

Refer to "34.2.6 Selecting an Option" to access the **Alignment Tool Kit Menu** screen. Hightlight **Edit X-Section Templates** and press **CONT (F1)** to access the **Templates** screen.

Templates



CONT (F1)
To accept the screen entries and continue.

NEW (F2)
To create a new X-Section template.

EDIT (F3)
To edit the highlighted X-Section template.

DEL (F4)
To delete the highlighted X-Section template.

DUPLC (F5)
To duplicate the highlighted template.

PAGE (F6)
To change to another page on this screen.

Next step

IF a X-Section template	THEN
is to be created	press **NEW (F2)** and access the **New Template** screen. Refer to "34.5.2 Creating/Editing a X-Section Template".
is to be edited	press **EDIT (F3)** and access the **New Template** screen. Refer to "34.5.2 Creating/Editing a X-Section Template".
is to be deleted	press **DEL (F4)**, confirm or abort deleting. Refer to "34.5.5 Deleting a X-Section Template"
is to be duplicated	press **DUPLC (F5)**. Refer to "34.5.6 Duplicating a X-Section Template"

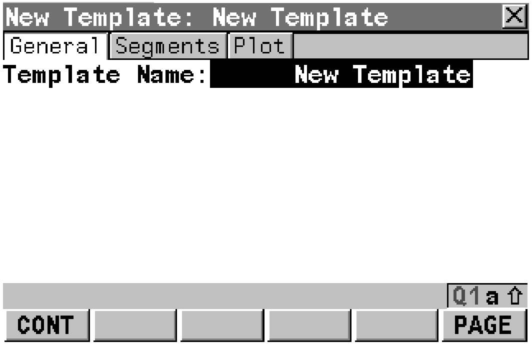
34.5.2 Creating/Editing a X-Section Template

Access

Refer to "34.5.1 Overview" to access the **Templates** screen. Press **NEW (F2)** to access the **New Template: Template Name** screen.

Creating and editing a X-Section template is similar. For simplicity, only the creating of a X-Section template is explained and differences are clearly outlined.

New Template: Template Name, General Page



CONT (F1)
To accept the screen entries and continue.

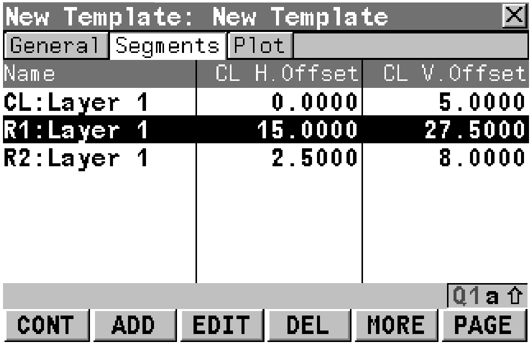
PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
Template Name	User input	Name of the X-Section template to be created/edited.

Next step
PAGE (F6) changes to the **Segments** page.

New Template: Template Name, Segments Page



CONT (F1)
To accept the screen entries and continue.

ADD (F2)
To creat and add a new segment. Refer to "34.5.3 Add/Edit a Segment".

EDIT (F3)
To edit the highlighted segment.

DEL (F4)
To delete the highlighted segment. Refer to "34.5.4 Delete a Segment".

MORE (F5)
To switch between **CL H. Offset**, **S. Dist**, **H. Dist** in the second column and between **CL V. Offset**, **S. Dist**, **H. Dist** in the third column.

PAGE (F6)
To change to another page on this screen.

SHIFT HOME (F2)
To move the focus to the begin of the list.

SHIFT END (F3)
To move the focus to the end of the list.

SHIFT MIROR (F4)
To mirror the entered segments to the other side of the X-Section.

Description of columns

Column	Description
Name	List of all segments of the X-Section template.
CL H. Offset	Horizontal centreline offset of the segment.
S. Dist	Slope distance of the segment.
H. Dist	Horizontal distance of the segment.
CL V. Offset	Vertical centreline offset of the segment.
S. Ratio	Slope ratio of the segment.

Next step

IF a segment	THEN
is to be added	press **ADD (F2)** and access the **Add Segment** screen. Refer to "34.5.3 Add/Edit a Segment".
is to be edited	press **EDIT (F3)** and access the **Edit Raw Alignment** screen. Edit the alignment and press **CONT (F1)** to return to the **Raw Alignments** screen. **CONT (F1)** again to access **Alignment Tool Kit Menu**.
is to be deleted	press **DEL (F4)**, confirm or abort the process and return to the **Raw Alignments** screen. **CONT (F1)** again to access **Alignment Tool Kit Menu**.

IF a segment	THEN
is to be mirrored	press **MIROR SHIFT (F4)** to mirror the segments from one side to the other to create a symmetric X-Section. To perform this option the second side must not have any segment.

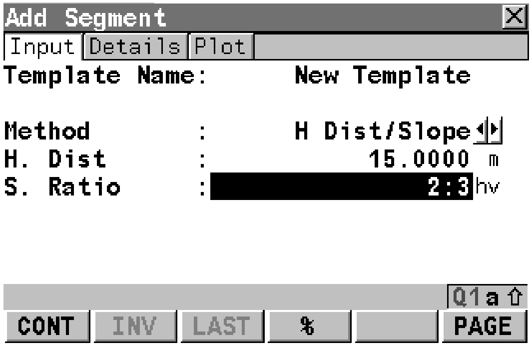
34.5.3 Add/Edit a Segment

Access

Refer to "34.5.2 Creating/Editing a X-Section Template" to access the **New Template: Template Name** screen. **PAGE (F6)** to change to the Segments page and **ADD (F2)** to access the **Add Segment** screen.

Adding and editing a segment of a X-Section template is similar. For simplicity, only the Adding of a segment is explained and differences are clearly outlined.

Add Segment



CONT (F1)
To accept the screen entries and continue.

INV (F2)
To calculate the inverse between two existing points in the active job.

LAST (F3)
To select values from the last inverse calculations.

%/H:V/V:H (F4)
To switch between **hv**, **vh** and % for the S. Ratio unit.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Template Name:>	Output	Name of the X-Section template to be edited.
<Method:>		Method to be used for defining the segment.
	H Dist/Slope	Using a horizontal distance and slope to define the segment.
	H Dist/V Dist	Using a horizontal distance and a vertical distance to define the segment.
	CL offsets	Using a horizontal and vertical offsets for the centreline.
	S Dist/Slope	Using a slope distance and slope to define the segment.
<CL H. Offset:>	User input	Horizontal centreline offset of the segment. Only available for **<Method: CL offsets>**.
<CL V. Offset:>	User input	Vertical centreline offset of the segment. Only available for **<Method: CL offsets>**.
<H. Dist:>	User input	Horizontal distance of the segment. Available for **<Method: H Dist/Slope>** and **<Method: H Dist/V Dist>**.
<S. Dist:>	User input	Slope distance of the segment. Only available for **<Method: S Dist/Slope>**.

Field	Option	Description
<S. Ratio:>	User input	Slope ratio of the segment. Available for **<Method: H Dist/Slope>** and **<Method: S Dist/Slope>**.

Next step

CONT (F1) adds segment to the X-Section template and returns to the **Segments** page.

34.5.4 Delete a Segment

Access

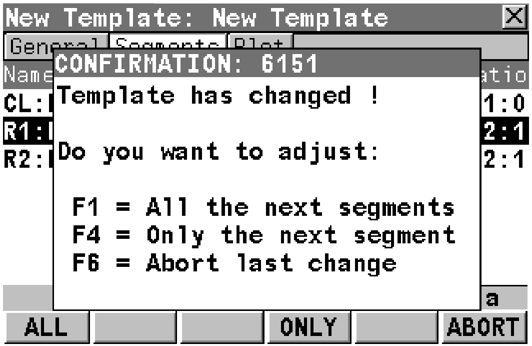
Refer to "34.5.2 Creating/Editing a X-Section Template" to access the **New Template: Template Name** screen.

Confirmation

NO (F4)
To abort deleting the X-Section segment.

YES (F6)
To confirm deleting the X-Section segment.

Confirmation



ALL (F1)
To adjust all following segments.

ONLY (F4)
To adjust only the next segment.

YES (F6)
To abort deleting.

Next step

Depending on the operation to be performed press **ALL (F1)**, **ONLY (F4)** or **ABORT (F6)** and return to **New Template: Template Name, Segments** page screen.

34.5.5 Deleting a X-Section Template

Access

Refer to "34.2.6 Selecting an Option" to access the **Alignment Tool Kit Menu** screen. Select **Edit X-Section Templates** and press **CONT (F1)** to access the **Templates** screen.

Deleting a X-Section template step-by-step

Step	Description
1.	**Templates**
2.	Highlight the template to be deleted and press **DEL (F4)**.
3.	Press **YES (F6)** to confirm or **NO (F4)** to abort deleting the template.

Confirmation

NO (F4)
To abort deleting the X-Section template.

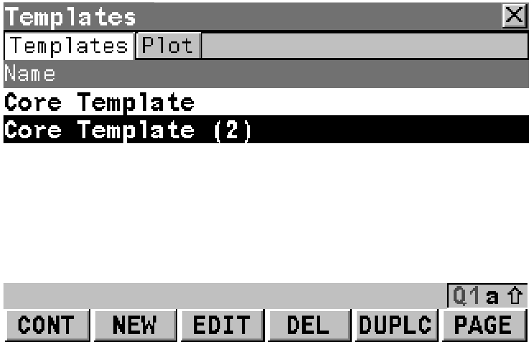
YES (F6)
To confirm deleting the X-Section template.

34.5.6 Duplicating a X-Section Template

Access

Refer to "34.2.6 Selecting an Option" to access the **Alignment Tool Kit Menu** screen. Press **CONT (F1)** to access the **Templates** screen.

Templates



CONT (F1)
To accept the screen entries and continue.

NEW (F2)
To create a new X-Section template.

EDIT (F3)
To edit the highlighted X-Section template.

DEL (F4)
To delete the highlighted X-Section template.

DUPLC (F5)
To duplicate the highlighted template.

PAGE (F6)
To change to another page on this screen.

Next step

Press **DUPLC (F5)** for duplicating the highlighted X-Section template. The duplicated X-Section template is inserted below the original template.

34.6 Edit X-Section Assignments

34.6.1 Overview

Description

Allows the creation, editing and deleting of:

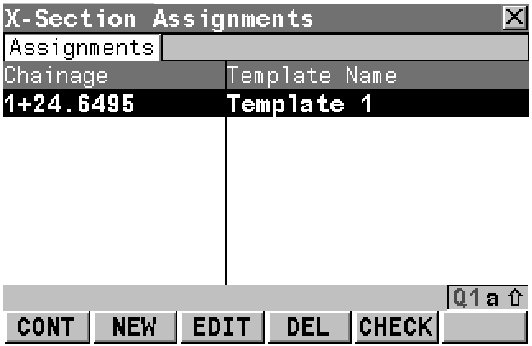
- X-Section assignments

as well as checking the X-Section assignments.
A X-Section assignment defines from which chainage on a X-section is to be used.

Access

Refer to "34.2.6 Selecting an Option" to access the **Alignment Tool Kit Menu** screen. Highlight **Edit X-Section Assignments** and press **CONT (F1)** to access the **X-Section Assignments** screen.

X-Section Assignments



CONT (F1)
To accept the screen entries and continue.
NEW (F2)
To create a new X-Section assignment.
EDIT (F3)
To edit a X-Section assignment.
DEL (F4)
To delete a X-Section assignment.
CHECK (F5)
To check the X-Section assignments.
SHIFT HOME (F2)
To move the focus to the top of the chainages list.

SHIFT END (F3)
To move the focus to the bottom of the chainages list.

Next step

IF a X-Section assignment	THEN
is to be created	press **NEW (F2)** and access the **New X-Section Assignment** screen. Refer to "34.6.2 Creating/Editing a X-Section Assignment".
is to be edited	press **EDIT (F3)** and access the **New X-Section Assignment** screen. Refer to "34.6.2 Creating/Editing a X-Section Assignment".
is to be deleted	press **DEL (F4)**, confirm or abort deleting. Refer to "34.6.3 Deleting a X-Section Assignment"
is to be checked	press **CHECK (F5)**. The X-Section assignments will be checked. **OK (F4)** confirms the checking and returns to the **X-Section Assignments** screen.

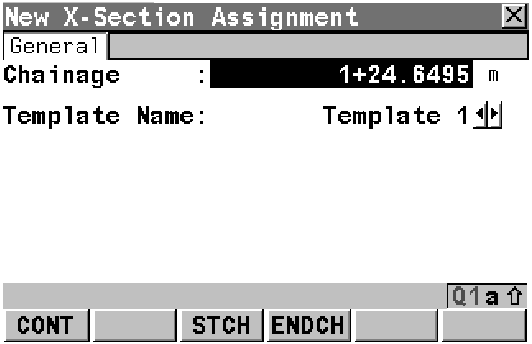
34.6.2 Creating/Editing a X-Section Assignment

Access

Refer to "34.6.1 Overview" to access the **X-Section Assignments** screen. Press **NEW (F2)** to access the **New X-Section Assignment** screen.

Creating and editing a X-Section assignment is similar. For simplicity, only the creating of a X-Section assignment is explained and differences are clearly outlined.

New X-Section Assignment



CONT (F1)
To accept the screen entries and continue.

STCH (F3)
To take the start point of the vertical alignment for **Chainage**.

ENDCH (F4)
To take the end point of the vertical alignment for **Chainage**.

SHIFT CONF (F2)
To access **Configuration**.

Description of fields

Field	Option	Description
<Chainage:>	User input	The chainage to which the X-Section template is assigned to.

Field	Option	Description
<Template Name:>	Choicelist	The X-Section template to be assigned to. All existing X-Section templates currently stored to the alignment can be selected.

Creating/Editing a X-section assignment step-by-step

Step	Description
1.	**New X-Section Assignment**
2.	Type in or edit the value for **<Chainage:>**. Alternatively press **STCH (F3)** or **ENDCH (F4)** to apply the start or end chainage of the vertical alignment.
3.	Select an existing template from the list or create a new one to be assigned to the **<Chainage:>**.
4.	Press **CONT (F1)** to create the X-Section assignment.

34.6.3 Deleting a X-Section Assignment

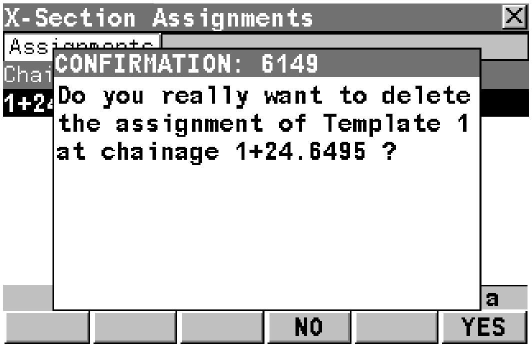
Access

Refer to "34.2.6 Selecting an Option" to access the **Alignment Tool Kit Menu** screen. Highlight **Edit X-Section Assignments** and press **CONT (F1)** to access the **X-Section assignments** screen.

Deleting a X-section assignment step-by-step

Step	Description
1.	**X-Section Assignments**
2.	Press **DEL (F4)** to delete the X-Section assignment.
3.	Press **YES (F6)** to confirm deleting or **NO (F4)** to abort deleting the X-Section assignment. It automatically returns to the **X-Section Assignments** screen.

Confirmation



NO (F4)
To abort deleting the X-Section assignment.

YES (F6)
To confirm deleting the X-Section assignment.

34.7 Edit Chainage Equation

34.7.1 Overview

Description

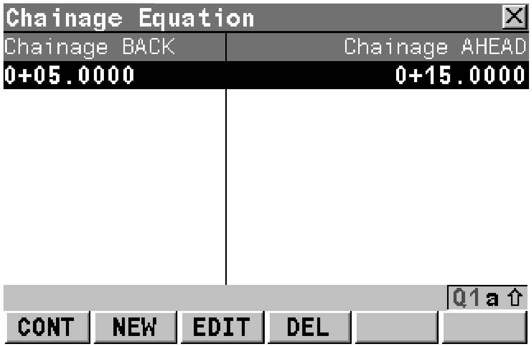
Allows creating, editing and deleting of:

- Chainage ahead
- Chainage back

Access

Refer to "34.2.6 Selecting an Option" to access the **Alignment Tool Kit Menu** screen. Highlight **Edit Chainage Equations** and press **CONT (F1)** to access the **Chainage Equation** screen.

Chainage Equation



CONT (F1)
To accept the screen entries and continue.

NEW (F2)
To create a new chainage equation.

EDIT (F3)
To edit a chainage equation.

DEL (F4)
To delete a chainage equation.

SHIFT HOME (F2)
To move the focus to the top of the chainage equations list.

SHIFT END (F3)
To move the focus to the bottom of the chainage equations list.

Next step

IF a chainage equation	THEN
is to be created	press **NEW (F2)** and access the **Chainage Equation** screen. Refer to "34.7.2 Creating/Editing a Chainage Equation".
is to be edited	press **EDIT (F3)** and access the **Chainage Equation** screen. Refer to "34.7.2 Creating/Editing a Chainage Equation".
is to be deleted	press **DEL (F4)**, confirm or abort deleting. Refer to "34.7.3 Deleting a Chainage Equation"

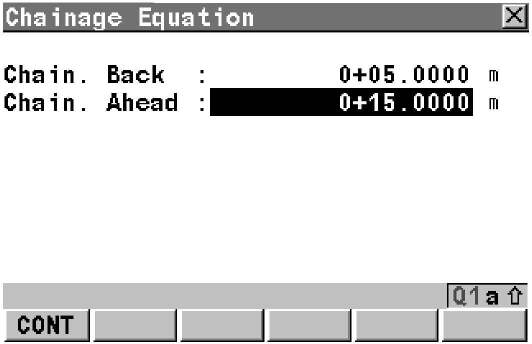
34.7.2 Creating/Editing a Chainage Equation

Access

Refer to "34.7.1 Overview" to access the **Chainage Equation** screen. Press **NEW (F2)** to access the **Chainage Equation** screen.

Creating and editing a chainage equation is similar. For simplicity, only the creating of a chainage equation is explained and differences are clearly outlined.

Creating a chainage equation



CONT (F1)
To accept the screen entries and continue.

Description of fields

Field	Option	Description
Chain. Back	User input	Chainage back.
Chain. Ahead	User input	Chainage ahead.

Creating/Editing a chainge equation step-by-step

Step	Description
1.	**Chainage Equation**

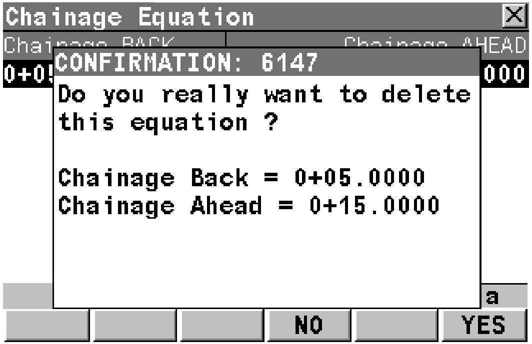
Step	Description
2.	Press **NEW (F2)** to create or **EDIT (F3)** to edit a chainage equation.
3.	Type in or edit the values for **<Chain. Back:>** and **<Chain. Ahead:>**.
4.	Press **CONT (F1)** to create the chainage equation or store the edited chainage equation.

34.7.3 Deleting a Chainage Equation

Access

Refer to "34.2.6 Selecting an Option" to access the **Alignment Tool Kit Menu** screen. Highlight **Edit Chainage Equations** and press **CONT (F1)** to access the **Chainage Equation** screen.

Confirmation



NO (F4)
To abort the deleting.

YES (F6)
To accept the deleting and continue.

Deleting a chainage equation step-by-step

Step	Description
1.	**Chainage Equation**
2.	Press **DEL (F4)** to delete a chainage equation.
3.	Press **YES (F6)** to confirm or **NO (F4)** to abort deleting the highlighted chainage equation.

34.8 Convert to Road Job

34.8.1 Overview

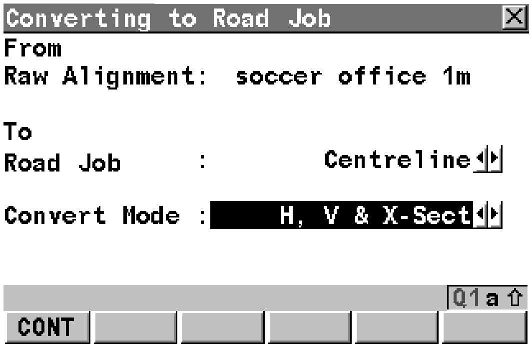
Description

Allows the onboard conversion of existing LandXML aligments including horizontal alignment, vertical alignment, X-sections and chainage equations to a Road job.

Access

Refer to "34.2.6 Selecting an Option" to access **Converting to Road Job**.

Converting to Road Job



CONT (F1)
To accept the screen entries and continue.

Description of fields

Field	Option	Description
From Raw Alignment	Output	Displays the modified or newly created alignment to be converted.

Field	Option	Description
To Road Job	Choicelist	The Road job to which the alignment will be converted.
Convert Mode		Defines the mode to be used for the conversion process.
	Horiz & Vert	Only horizontal and vertical alignment will be converted.
	Horizontal Only	Only horizontal alignment will be converted.
	H, V & X-Section	Horizontal aligment, vertical alignment and X-Sections will be converted. Only available for **<Job Type: Road>**. Refer to "34.2.7 Configuring Alignment Tool Kit" for information about supported Road job types.

34.8.2 Converting to a Road Job

Converting to a Road job step-by-step

Step	Description
1.	**Converting to Road Job**
☞	**From Raw Alignment** displays the created/edited/modified raw alignment to be converted to a Road Job.
2.	Select an existing job or create a new job for **To Road Job**.
☞	If an existing job has been selected the alignment will be stored in a new layer.
☞	If a new job with the same name as an existing job needs to be created then the existing job must be deleted first.
3.	Select the mode to be used for the onboard conversion.
4.	Press **CONT (F1)** to start the conversion.
☞	ATK creates a log file during the conversion. The file LandXml2Dbx.log can be found in the \Data\XML folder on the CompactFlash card.
5.	After the succesful conversion you have to press **OK (F4)** for returning to the **Main Menu** on the instrument.

35 Roads - Road

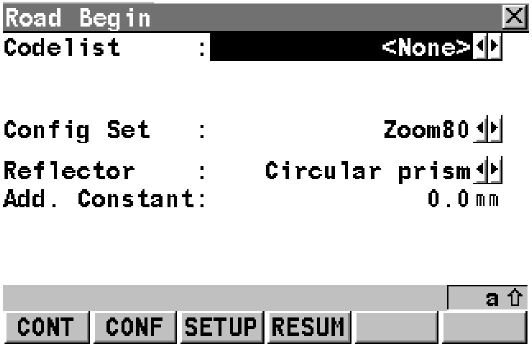
35.1 Step 1 - Road Begin

Access

Start the Road application program or press **ESC** on the **Road Setup** screen.

Positioning the TPS

To select the codelist, configuration set and reflector for the survey.



CONT (F1)
To continue to the next screen.

CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

SETUP (F3)
To set up an instrument station by determining the station coordinates and orienting the horizontal circle.

RESUM (F4)
To resume the last used and stored task. This is a recommended feature when using Advanced mode.

Description of fields

Field	Option	Description
<Codelist:>	Choicelist	The active codelist. All codelists from **Main Menu: Manage...\Codelists** can be selected.

Field	Option	Description
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from **Main Menu: Manage...\Reflectors** may be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

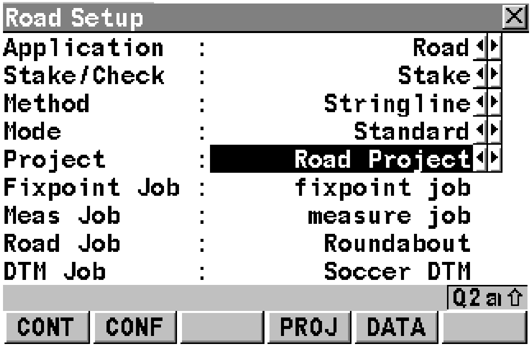
35.2 Step 2 - Road Setup

Access

Press **CONT (F1)** on the **Road Begin** screen.

Road
Road Setup

An overview of the setup information selected for the survey.



CONT (F1)
To continue to the next screen.

CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

PROJ (F4)
To edit the currently selected project. Refer to "35.7 Managing the Project".

DATA (F5)
To view/edit the road data in the road job. Refer to "35.6 Configuring".

SHIFT METHD (F2)
To show/hide the relevant stake/check methods. Choose to display only those methods which will be used for the survey. These settings can always be changed later. These settings will apply to both Stake and Check.

Description of fields

Field	Option	Description
<Application:>	Choicelist	To select the relevant application. This field lists all of the applications that have been loaded into the Road group. Ensure that **Road** is selected.
<Stake/ Check:>	Choicelist	To select either **Stake** or **Check** for the survey.
<Method:>		To select the relevant method for the survey. All stake/check methods are listed. This list can be configured, so that only the relevant methods for the survey are shown.
	Stringline	For Stake or Check. To stake/check any type of line, for example a centreline or kerb.
	Individual Stringline	For Stake or Check. Similar to the previous method when staking/checking any line of a layer. With this method, no centreline needs to be defined for the layer. The stake/check is therefore always in relation to the chainage of the line itself and not the centreline of the layer.
	X-Slope	For Stake or Check. To stake/check a X-slope defined by the road design.
	Manual Slope	For Stake or Check. To stake/check a manually defined slope relative to an existing centreline.

Field	Option	Description
	Slope	For Stake or Check. To stake/check a slope defined by the 3D road design.
	Crown	For Stake or Check. To stake/check a road crown defined by the road design.
	Layer	For Stake or Check.To stake/check a layer surface defined by the road design.
	DTM	For Check only. To check a Digital Terrain Model surface.
<Mode:>		Refer also to "Comparing the modes".
	Standard	All of the road element definitions for a survey are available in the **Define** page. The **Define** page is the page which is displayed before starting a stake/check survey in Standard mode. The layers and stringlines contained in the active Road job can be selected from this page. These elements, combined with other settings on this page can easily be changed during the survey.

Field	Option	Description
	Advanced	All of the Road element definitions for a survey are available from tasks, which are created and edited using the Selection Wizard. Tasks are an integral part of all stake/check surveys in Advanced mode. The layers and stringlines contained in the active road job are selected from tasks. A task is created for each stringline which is required for the survey. These elements, combined with other definitions can easily be changed during a survey.
<Project:>	Choicelist	To select the relevant project for the survey.
<Fixpoint Job:>	Output	The fixpoint job, as defined by the project.
<Meas Job:>	Output	The measure job, as defined by the project.
<Road Job:>	Output	The road job, as defined by the project.
<DTM Job:>	Output	The Digital Terrain Model job, as defined by the project.

Comparing the modes

Road may be operated in two modes - Standard mode and Advanced mode.

Feature	Standard	Advanced
Touch screen functionality This is supported in all screens, except in displays with graphics.	✓	✓

Feature	Standard	Advanced
Resuming a project It is possible to resume an existing project quickly and conveniently		✓
Displaying/Hiding the stake/check methods Road can be configured so that only those stake/check methods which are relevant to the user are displayed.	✓	✓
Selecting layers and stringlines during a survey Layers and stringlines can be easily and quickly selected while staking and checking.	✓	
Working with tasks User defined tasks are generated for each stringline when staking and checking. These tasks may always be edited and deleted.		✓
Shifting a stringline (related to a task) It is possible to enter horizonal and/or vertical shifts for stringlines.		✓
Entering chainage limits for a stringline (related to a task) It is possible to enter min. and max. chainages for a stringline.		✓
Staking a stringline in 2D/3D (related to a task) It is possible to stake a stringline in either 2D (X,Y) or 3D (X,Y,Z).	3D only	✓

35.3 Step 3 - Working in Standard Mode

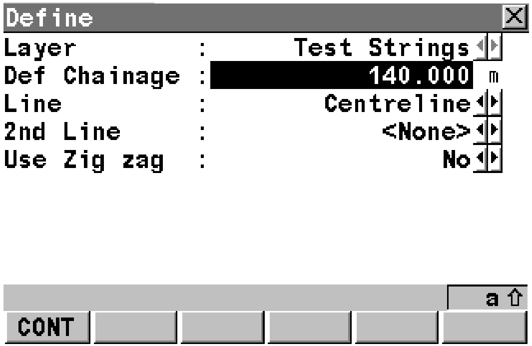
35.3.1 An Overview of the Define Page

Access

Press **CONT (F1)** on the Road Setup screen (using Standard mode).

Road Define

Layers and stringlines contained in the active road job can be selected from this page. These elements, combined with other settings on the page can easily be changed during the survey.



CONT (F1)
To continue to the next screen.

SHIFT CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

Refer to "35.2 Step 2 - Road Setup" for further details on Standard mode.

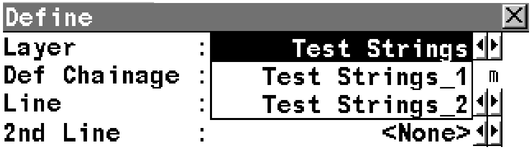
35.3.2 Selecting Layers and Stringlines/2nd Stringlines

Layers and stringlines/2nd stringlines

In Standard mode the layers and stringlines/2nd stringlines are selected from the **Define** screen.

Selecting a layer

Layers can be selected from the choicelist. The choicelist can only be opened when more than one layer is contained in the active Road job.

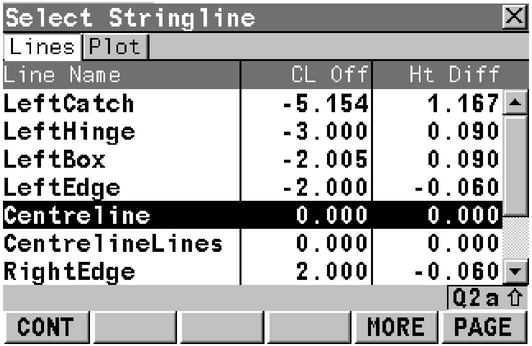


CONT (F1)
To continue to the next screen.
SHIFT CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

Selecting a stringline/2nd stringline

Click on the choicelist containing the stringlines/2nd stringlines. A line can then be selected from either the **Lines** page, or the **Plot** page.

Selection from the Lines page

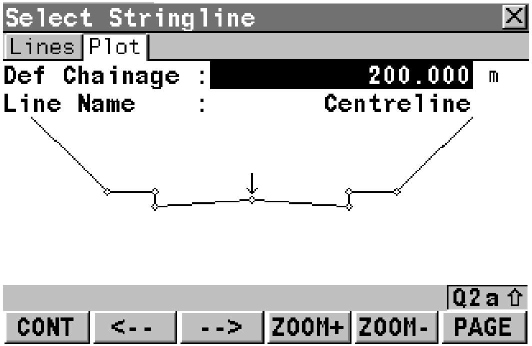


CONT (F1)
To continue to the next screen.
MORE (F5)
To display information about the height ad the height difference.

Description of columns

Column	Description
Line Name	Names of all stringlines in the selected layer.
CL Off	Offset from the centreline of the selected layer at the current chainage.
Ht Diff	(Press MORE (F5) to switch this column). Height difference of the stringline to the centreline at the current chainage.
Height	(Press MORE (F5) to switch this column) Absolute height of the stringline at the current chainage.

Selection from the Plot page



<-- (F2)
To change to the previous object.

--> (F3)
To change to the following object.

ZOOM+ (F4)
To zoom in at the highlighted object.

ZOOM- (F5)
To zoom out from the highlighted object.

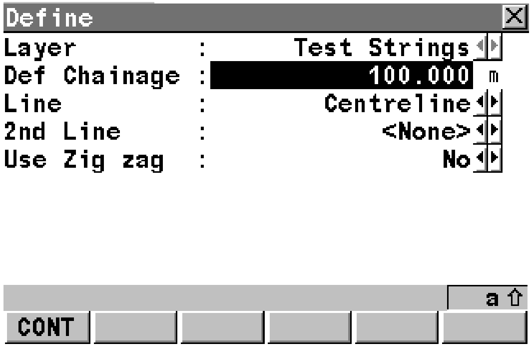
SHIFT FIT (F3)
To view the whole X-section.

SHIFT INIT (F5)
To force a re-calculation of all values.

35.3.3 The Define Page for Stringlines

Using the Define page for a Stake or Check

For this method, ensure that **<Method: Stringline>** is set in **Road Setup**.



CONT (F1)
To continue to the next screen.

SHIFT CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

Description of fields

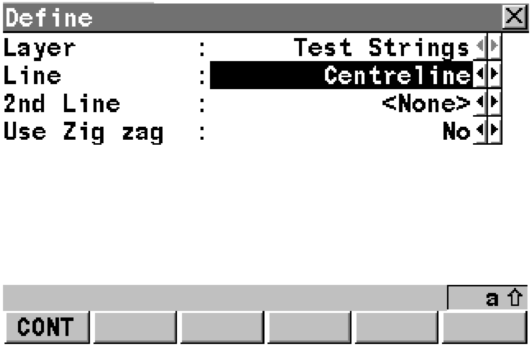
Field	Option	Description of Field
<Layer:>	Choicelist	To select a layer in the active Road job.
<Def Chainage:>	User input	To define a chainage for the stake survey. The chainage can range between the start chainage and the end chainage.
<Chainage:>	User input	To define a chainage for the check survey. The chainage can range between the start chainage and the end chainage.
<Line:>	Choicelist	To select a stringline.

Field	Option	Description of Field
<2nd Line:>	Choicelist	To select a 2nd stringline. It allows to obtain chainage, offset and height difference to any other string of the layer independent from those currently used. For example: Staking an X-Slope where the height information comes from the X-Slope but the chainage information comes from a string which is not the centreline of the current layer.
<Use Zig zag:>	**Yes** or **No**	To stake/check points on the left/right side of the centreline in one process. Refer to "35.4.11 The Zig Zag Mode" for details.

35.3.4 The Define Page for Individual Stringlines

Using the Define page for a Stake or Check

For this method, ensure that **<Method: Indiv Stringline>** is set in **Road Setup**.



CONT (F1)
To continue to the next screen.

SHIFT CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

Description of fields

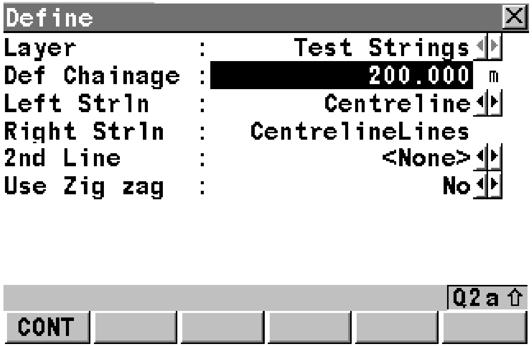
Field	Option	Description of Field
<Layer:>	Choicelist	To select a layer in the active road job.
<Line:>	Choicelist	To select a stringline.
<2nd Line:>	Choicelist	To select a 2nd stringline. Refer to "35.3.3 The Define Page for Stringlines" for details.

Field	Option	Description of Field
<Use Zig zag:>	**Yes** or **No**	To stake/check points on the left/right side of the centreline in one process. Refer to "35.4.11 The Zig Zag Mode" for details.

35.3.5 The Define Page for Cross Slopes

Using the Define page for a Stake or Check

For this method, ensure that **<Method: X-Slope>** is set in **Road Setup**.



CONT (F1)
To continue to the next screen.

SHIFT CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

Description of fields

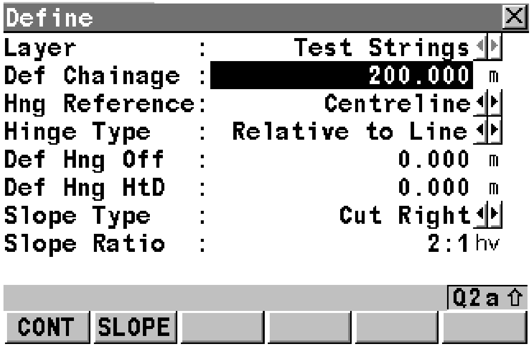
Field	Option	Description of Field
<Layer:>	Choicelist	To select a layer in the active road job.
<Def Chainage:>	User input	For Stake. The values are limited to the start chainage and end chainage.
<Chainage:>	User input	For Check. The values are limited to the start chainage and end chainage.
<Left Strln:>	Choicelist	The name of the left stringline defining the X-slope.

Field	Option	Description of Field
<Right Strln:>	Output	The name of the right stringline defining the X-slope.
<Refrence Line:>	**Left Strln** or **Right Strln**	To select one of the stringlines to be used as the reference line.
<2nd Line:>	Choicelist	To select a 2nd stringline. Refer to "35.3.3 The Define Page for String-lines" for details.
<Use Zig zag:>	**Yes** or **No**	To stake/check points on the left/right side of the centreline in one process. Refer to "35.4.11 The Zig Zag Mode" for details.

35.3.6 The Define Page for Manual Slopes

Using the Define page for a Stake or Check

For this method, ensure that **<Method: Manual Slope>** is set in **Road Setup**.



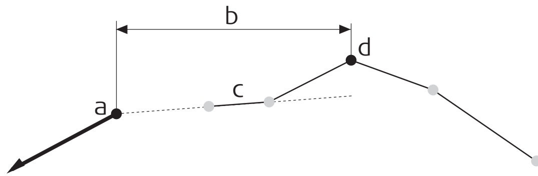
CONT (F1)
To continue to the next screen.

SLOPE (F2)
To define the slope parameters.

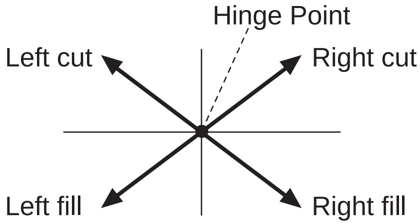
SHIFT CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

Description of fields

Field	Option	Description of Field
<Layer:>	Choicelist	To select a layer in the active road job.
<Def Chainage:>	User input	For Stake. The values are limited to the start chainage and end chainage.
<Chainage:>	User input	For Check. The values are limited to the start chainage and end chainage.
<Hng Reference:>	Choicelist	To select the hinge point of the slope.

Field	Option	Description of Field
<Hinge Type:>	Choicelist	To select the vertical offset type for the hinge point.
	Relative EndSlope	The manual slope is defined by the • Hinge offset, in most cases relative to the centreline • Hinge height, calculated by using the hinge offset on the end slope (left or right end slope, depending on hinge offset – or +)  a) Hinge point of manual slope b) Defined hinge offset (-) c) Most left cross slope of design d) Selected hinge reference
<Def Hng Off:>	User input	The horizontal offset of the hinge point from the selected hinge reference line.
<Left Strln:>	Output	The name of the left stringline. This field is visible if Hinge Type=Relative EndSlope.

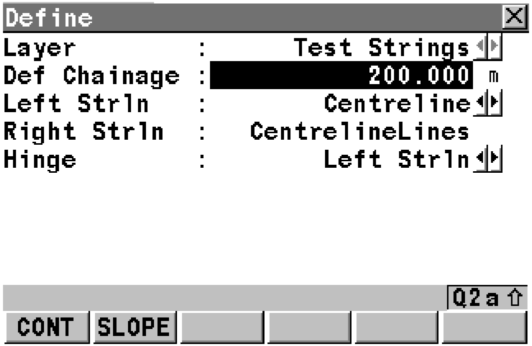
Field	Option	Description of Field
<Right Strln:>	Output	The name of the right stringline. This field is visible if Hinge Type=Relative EndSlope.
<Def Hng HtD:>	User input	If **<Hinge Type: Relative to Line>**: The height difference of the hinge point from the centreline/reference line. If **<Hinge Type: Relative EndSlope>**: Height difference of the hinge point to the calculated height on the end slope. If **<Hinge Type: Relative to DTM>**: Height difference of the hinge point height.
<Def Hng Elev:>	User input	The elevation of the hinge point (absolute height). This field is visible if **<Hinge Type: Absolute>**.

Field	Option	Description of Field
<Slope Type:>	**Cut Right**, **Cut Left**, **Fill Right** or **Fill Left**	Differentiates if the defined slope is a cut/fill and left/right. 
<Slope Ratio:>	Output	Defines the ratio of the slope. The format of **<Slope Ratio:>** depends on the settings chosen in **Road Project Configuration** for **<Slope Format:>**.

35.3.7 The Define Page for Design Slopes

Using the Define page for a Stake or Check

For this method, ensure that **<Method: Slope>** is set in **Road Setup**.



CONT (F1)
To continue to the next screen.

SLOPE (F2)
To define the slope parameters.

SHIFT CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

Description of fields

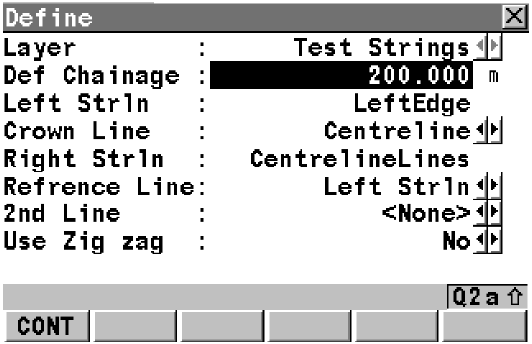
Field	Option	Description of Field
<Layer:>	Choicelist	To select a layer in the active road job.
<Def Chainage:>	User input	For Stake. The values are limited to the start chainage and end chainage.
<Chainage:>	User input	For Check. The values are limited to the start chainage and end chainage.
<Left Strln:>	Choicelist	The name of the left stringline defining the slope.

Field	Option	Description of Field
<Right Strln:>	Output	The name of the right stringline defining the slope.
<Hinge:>	**Left Strln** or **Right Strln**	To select the hinge point of the slope.

35.3.8 The Define Page for Crowns

Using the Define page for a Stake or Check

For this method, ensure that **<Method: Crown>** is set in **Road Setup**.



CONT (F1)
To continue to the next screen.

SHIFT CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

Description of fields

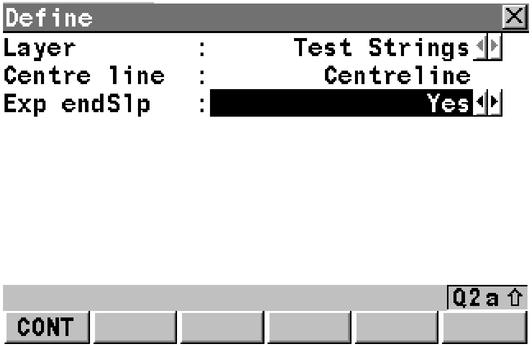
Field	Option	Description of Field
<Layer:>	Choicelist	To select a layer in the active road job.
<Def Chainage:>	User input	For Stake. The values are limited to the start chainage and end chainage.
<Chainage:>	User input	For Check. The values are limited to the start chainage and end chainage.
<Left Strln:>	Output	To select the left stringline defining the X-slope.

Field	Option	Description of Field
<Crown Line:>	Choicelist	To select the common stringline between the left X-slope and right X-slope.
<Right Strln:>	Output	To select the right stringline defining the X-slope.
<Refrence Line:>	**Left Strln** or **Right Strln**	To select one of the stringlines to be used as the reference line.
<2nd Line:>	Choicelist	To select a 2nd stringline. Refer to "35.3.3 The Define Page for Stringlines" for details.
<Use Zig zag:>	**Yes** or **No**	To stake/check points on the left/right side of the centreline in one process. Refer to "35.4.11 The Zig Zag Mode" for details.

35.3.9 The Define Page for Layers

Using the Define page for a Stake or Check

For this method, ensure that **<Method: Layer>** is set in **Road Setup**.



CONT (F1)
To continue to the next screen.

SHIFT CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

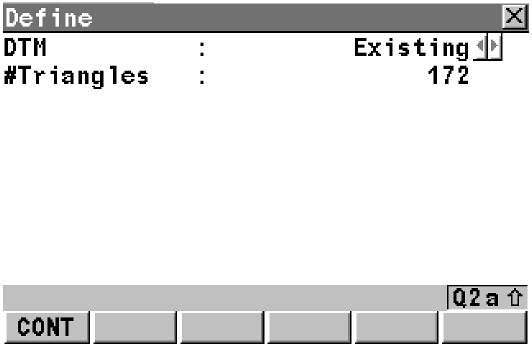
Description of fields

Field	Option	Description of Field
<Layer:>	Choicelist	To select a layer in the active road job.
<Centre line:>	Output	Active centreline of the selected layer.
<Exp endSlp:>	**Yes** or **No**	To expand the left most and right most end slopes of the design.

35.3.10 The Define Page for Digital Terrain Models (DTM)

Using the Define page for a check survey (only applicable to Check)

For this method, ensure that **<Method: DTM>** is set in **Road Setup**.



CONT (F1)
To continue to the next screen.

SHIFT CONF (F2)
To access the configuration settings. Refer to "35.6 Configuring".

Description of fields

Field	Option	Description of Field
<DTM:>	Choicelist	A list of all DTM surfaces available in the selected DTM job.
<#Triangles:>	Output	Number of triangles the selected DTM consists of.

35.4 Step 3 - Working in Advanced mode

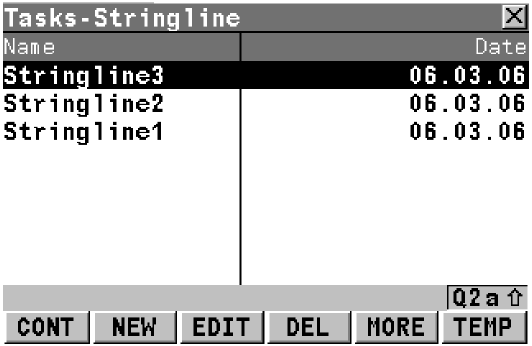
35.4.1 An Overview of Tasks

Access

Press **CONT (F1)** on the **Road Setup** screen using Advanced mode.

Task management

In order to stake/check a road, a task needs to be created or selected. A task is created by using the Selection Wizard. A task is selected from Task Management. The task defines which road is to be staked/checked and defines any shifts that are to be used during the survey. This screen shows a list of all existing tasks stored with the selected project.



CONT (F1)
To continue to the next screen.

NEW (F2)
To create a new task with the Selection Wizard.

EDIT (F3)
To edit an existing task with the Selection Wizard.

DEL (F4)
To delete an existing task.

MORE (F5)
To toggle between the task date and task time.

TEMP (F6)
To create a temporary task with the Selection Wizard. This task is identical to any other task but is not stored for later use.

SHIFT HOME (F2)
To go to the top of the list.
SHIFT END (F3)
To go to the end of the list.
SHIFT TIME/NAME (F5)
To sort the list by time or name.

Description of columns

Column	Description
Name	The name of the working task.
Date	The creation date of the working task.
Time	The creation time of the working task.

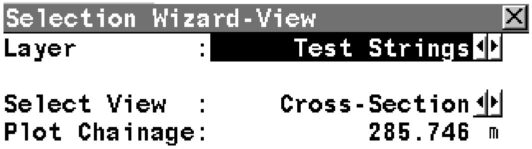
☞ Refer to "35.2 Step 2 - Road Setup" for further details on Advanced mode.

35.4.2 Selecting Layers and Stringlines

Layers and stringlines

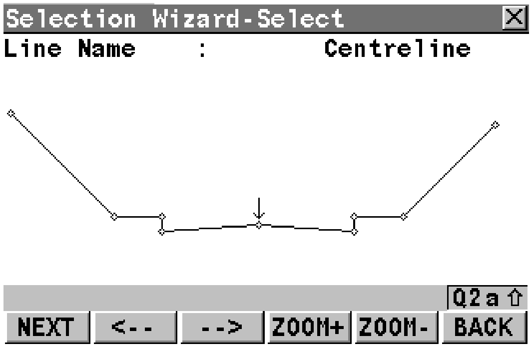
In Advanced mode a task is created, edited or selected in order to stake/check elements of a road. The task defines which road is to be staked/checked, including which layers and stringlines are to be used.

Selecting a layer



Layers can be selected from the choicelist in the View screen of the Selection Wizard. The choicelist can only be opened when more then one layer is contained in the active road job.

Selecting a stringline



Stringlines can be selected from the Select screen of the Selection Wizard.

35.4.3 Creating/Editing Tasks with the Selection Wizard

General

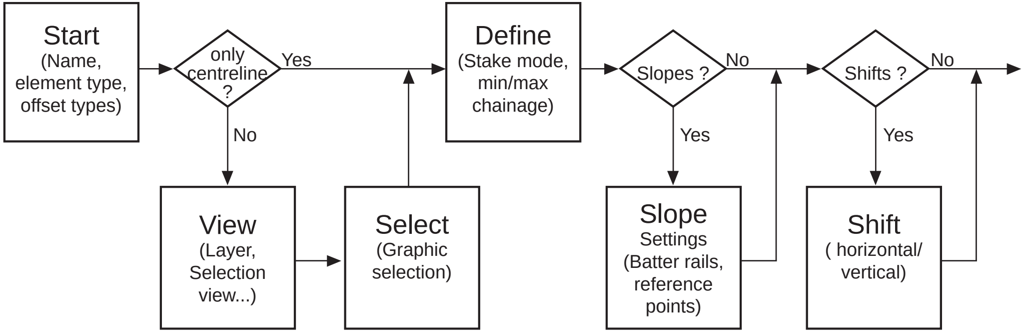
The element to stake out or check is selected at the start of the stake out and check process. This selection is made at the same time as the definition of the parameters for the stake out/check.The selection wizard guides you through the process of selecting and defining the elements to stake out or check. The selected element to stake out/check and all the parameters defined are stored as a new working task. Tasks created with the selection wizard are stored as part of the project and may be called up again.

Two types of tasks

- Road distinguishes between two types of tasks:
    - Persisted tasks, these tasks are stored as part of the project and can be recalled. Persisted tasks should be created if you will have to come back to complete this stake/check survey.
    - Temporary tasks, these tasks are not persisted. They are used if you have to stake/check only a few points.
- Temporary tasks will not show up in Task Management and cannot be recalled.

Description

The basic steps and dialogs are common for every selection although, depending on the chosen settings, certain screens of the wizard are skipped.



IF the task is to	THEN
step from one screen of the wizard to the next one	**NEXT (F1)**.
to return to the previous wizard screen	**BACK (F2)**.
exits the wizard on the last screen of the wizard	**FINSH (F1)**.

Road Selection Wizard - Start Screen

Description

Selection Wizard-Start is the first screen accessed by the selection wizard.

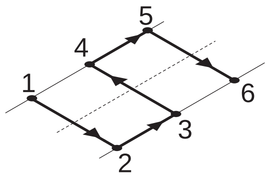
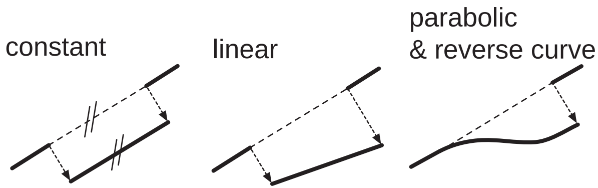
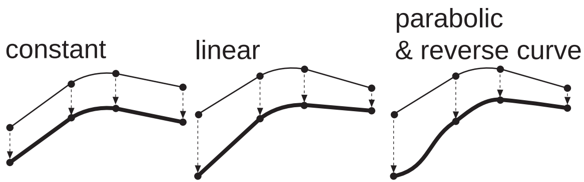
Selection Wizard-Start

NEXT (F1)
To move to the next screen of the selection.

Description of fields

Field	Option	Description of Field
<Task Type:>		The task type to select. Options will vary depending upon from which stake out/check method the selection wizard is accessed.
	Centreline	Selection of a stringline to be used as centreline.
	Stringline	Selection of a stringline part of a layer with defined centreline.

Field	Option	Description of Field
	Indiv Stringline	Selection of a stringline within a layer, independent if a centreline is defined.
	Slope	Selection of a slope.
	Manual Slope	Selection of the centreline for a manual slope.
	X-Slope	Selection of a X-slope.
	Crown	Selection of a road crown.
	Layer	Selection of a design layer.
	DTM	Selection of a DTM/TIN surface. ☞ The list of stake out and check methods is not identical with the available task types. For example, **<Task Type: Stringline>** uses centreline and stringline.
<Task Name:>	User input	The name of the task to be stored.
<Use Zig zag:>	**Yes** or **No**	The zig zag mode is used to stake out points on the left and right hand side of the centreline in one process. Refer to "35.4.11 The Zig Zag Mode" for more information on the zig zag mode. The zig zag mode is available for stakeout/check methods **Stringline**, **Indiv Stringline**, **X-Slope** and **Crown**.

Field	Option	Description of Field
		
<Shift Horiztl:>	**None**, **Linear**, **Constant**, **Parabolic** or **Reverse Curve**	Type of horizontal shift applied to the object. 
<Shift Verticl:>	**None**, **Linear**, **Constant**, **Parabolic** or **Reverse Curve**	Type of vertical shift applied to the object. 

Next step

NEXT (F1) to move to the next step of the selection wizard.

Road Selection Wizard - View Screen

Description

Selection Wizard-View defines the layer and its graphic appearance for the selection.

Selection Wizard-View

NEXT (F1)
To move to the next screen of the selection.

DEFLT (F5)
To reset the **<Plot Chainage:>** to the start chainage of the layer centreline.

BACK (F6)
To move back to the previous screen of the wizard.

Description of fields

Field	Option	Description of Field
<Layer:>	Choicelist	The layer the object to select belongs to.
<Select View:>		The selection view used for picking the objects.
	Cross-Section	Cross section view of the design data. The cross section view is available for all working methods.

Field	Option	Description of Field
	Plan	2D plan view of the design data. The plan view is only available for the working methods **Stringline** and **Indiv Stringline**.
<Plot Chainage:>	User input	With **<Select View: Cross-Section>**, it defines the chainage at which the cross section for the graphical selection is created. With **<Select View: Plan>**, it defines the chainage which is to be marked and displayed by a triangle. This allows easier user orientation within a project. **<Plot Chainage:>** is only used for **<Select View: Cross Section>** and the working method **Indiv Stringline**.
<Plot Step:>	User input	To define a chainage increment. This is the amount by which the **<Plot Chainage:>** is to be incremented and updated on the screen display. **<Plot Step:>** is only used for **<Select View: Cross Section>** and the working method **Indiv Stringline**.

Next step
NEXT (F1) to move to the next step of the selection.

Road Selection Wizard-DTM

Unlike all other objects, DTM's are selected by name.

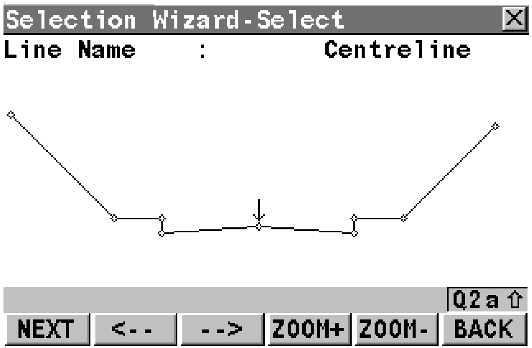
Road Selection Wizard - Select Screen

Description

This screen allows the object to be used for the chosen task to be selected. Depending on the chosen **<Selection View:>** on the previous screen, this screen shows either a plan or a cross section view.

Selection Wizard-Select cross section view

The graphic shown is a cross section view of the layer selected in the previous step of the selection wizard. The name of the stringline/s defining the highlighted element are shown at the top of the screen.



NEXT (F1)
To move to the next screen of the selection.

<-- (F2)
To change to the previous object.

--> (F3)
To change to the following object.

ZOOM+ (F4)
To zoom in at the position of the current highlighted object.

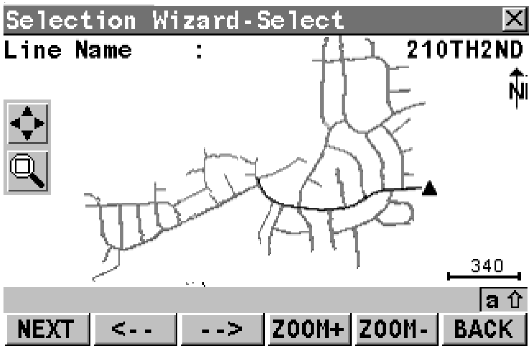
ZOOM- (F5)
To zoom out at the position of the current highlighted object.

BACK (F6)
To move back to the previous screen of the wizard.

SHIFT FIT (F3)
To view the whole X-section.

Selection Wizard-Select plan view

The graphic shown is a plan view of the layer selected in the previous step of the Selection Wizard. The name of the stringline/s defining the highlighted element are shown at the top of the screen. For easier orientation within a project, the plan view includes a triangle which represents the **<Plot Chainage:>**, as selected in the previous screen of the Selection Wizard. This selection method is available for the individual stringline work method. The desired line can be selected by clicking at the graphic.



NEXT (F1)
To move to the next screen of the selection.

<-- (F2)
To change to the previous object.

--> (F3)
To change to the following object.

ZOOM+ (F4)
To zoom in at the position of the current highlighted object.

ZOOM- (F5)
To zoom out at the position of the current highlighted object.

BACK (F6)
To move back to the previous screen of the wizard.

SHIFT CH+ (F2)
To increment.the **<Plot Chainage:>** by the **<Plot Step:>**.

SHIFT FIT (F3)
To view the whole alignment.

SHIFT CENTR (F4)
To centre the plot at the selected element.

SHIFT LIST (F5)
To list the plot at the selected element.

Next step

NEXT (F1) to move to the next step of the selection wizard.

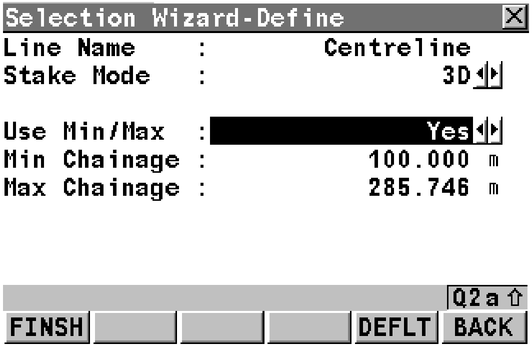
Road Selection Wizard - Define Screen

Description

Selection Wizard-Define allows parameters relevant to the task to be defined.

Selection Wizard-Define varies for each of the following elements: Stringlines and centrelines, X-slopes and road crowns, slopes, layers.

For stringlines and individual stringlines



NEXT (F1)
To move to the next screen of the selection.

DEFLT (F5)
To reset the **<Min Chainage:>** and **<Max Chainage:>** to the start/end chainage of the layer centreline.

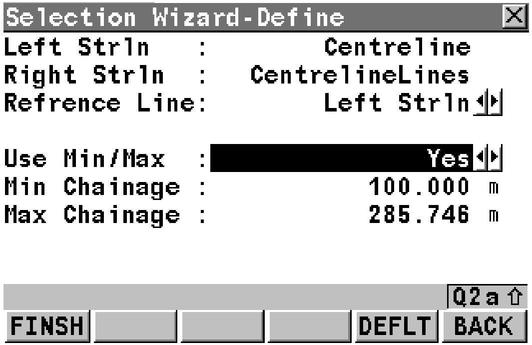
BACK (F6)
To move back to the previous screen of the wizard.

Description of fields

Field	Option	Description of Field
<Line Name:>	Output	The name of the selected stringline.
<Stake Mode:>		The stake out mode used for the selected object.
	3D	Full 3D stake out or check of the selected object.
	2D	Stake out or check of the selected object in position only.
<Use Min/Max:>	**Yes** or **No**	Define a maximum and minimum working chainage. Refer to "35.4.12 Chainage Range" for more information.

Field	Option	Description of Field
<Min Chainage:>	User input	Minimum chainage of the chainage range. Refer to "35.4.12 Chainage Range" for more information.
<Max Chainage:>	User input	Maximum chainage of the chainage range. Refer to "35.4.12 Chainage Range" for more information.

For X-slopes



NEXT (F1)
To move to the next screen of the selection.

DEFLT (F1)
To reset the **<Min Chainage:>** and **<Max Chainage:>** to the start/end chainage of the layer centreline.

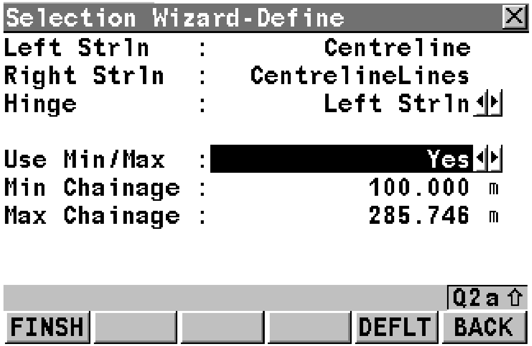
BACK (F6)
To move back to the previous screen of the wizard.

Description of fields

Field	Option	Description of Field
<Left Strgl:>	Output	The name of the left stringline defining the X-slope.

Field	Option	Description of Field
<Right Strgl:>	Output	The name of the right stringline defining the X-slope.
<Refrence Line:>	**Left Strgl** or **Right Strgl**	The stringline the stake out of the X-slope is relative to.
<Use Min/Max:>	**Yes** or **No**	Define a maximum and minimum working chainage. Refer to "35.4.12 Chainage Range" for more information.
<Min Chainage:>	User input	Minimum chainage of the chainage range. Refer to "35.4.12 Chainage Range" for more information.
<Max Chainage:>	User input	Maximum chainage of the chainage range. Refer to "35.4.12 Chainage Range" for more information.

For slopes



NEXT (F1)
To move to the next screen of the selection.

DEFLT (F5)
To reset the **<Min Chainage:>** and **<Max Chainage:>** to the start/end chainage of the layer centreline.

BACK (F6)
To move back to the previous screen of the wizard.

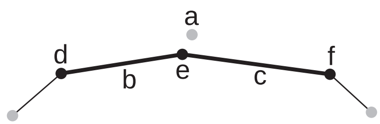
Description of fields

Field	Option	Description of Field
<Left Strgl:>	Output	Name of the slopes left stringline.
<Right Strgl:>	Output	Name of the slopes right stringline.
<Hinge:>	**Left Strgl** or **Right Strgl**	The stringline of the slope on which the hinge point lies.
<Use Min/Max:>	**Yes** or **No**	Define a maximum and minimum working chainage. Refer to "35.4.12 Chainage Range" for more information.
<Min Chainage:>	User input	Minimum chainage of the chainage range. Refer to "35.4.12 Chainage Range" for more information.

Field	Option	Description of Field
<Max Chainage:>	User input	Maximum chainage of the chainage range. Refer to "35.4.12 Chainage Range" for more information.

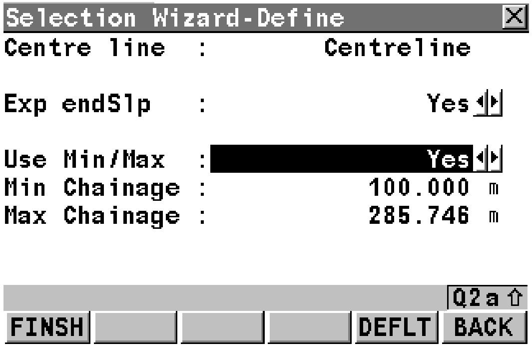
For crowns

Selection Wizard-Define of the selection wizard for crowns is identical to **Selection Wizard-Define** for X-slopes, the difference being the behavior of the reference line. The left most and right most line of the two X-slopes may be chosen as the reference line. The stake offsets and stake height difference applied to the road crown are relative to this reference line. For the second X-slope of the road crown, stake offsets/height difference are added symmetrically.



a) Centreline
b) Left X-slope of the road crown
c) Right X-slope of the road crown
d) **<Left Strgl:>**, left most stringline
e) **<Mid Strgl:>**, mid stringline
f) **<Right Strgl:>**, right most stringline

For layers



NEXT (F1)
To move to the next screen of the selection.

DEFLT (F5)
To reset the **<Min Chainage:>** and **<Max Chainage:>** to the start/end chainage of the layer centreline.

BACK (F6)
To move back to the previous screen of the wizard.

Description of fields

Field	Option	Description of Field
<Centre line:>	Output	Active centreline of the selected layer.
<Exp endSlp:>		To expand the left most and right most end slopes of the design.
	Yes	Prolong end slopes of the layer.
	No	End-slopes will not be prolonged.
<Use Min/Max:>	**Yes** or **No**	Define a maximum and minimum working chainage. Refer to "35.4.12 Chainage Range" for more information.

Field	Option	Description of Field
<Min Chainage:>	User input	Minimum chainage of the chainage range. Refer to "35.4.12 Chainage Range" for more information.
<Max Chainage:>	User input	Maximum chainage of the chainage range. Refer to "35.4.12 Chainage Range" for more information.

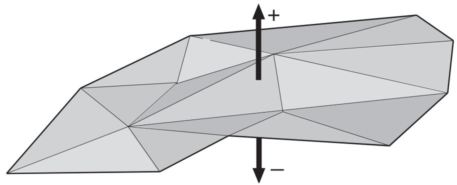
For DTM's

NEXT (F1)
To move to the next screen of the selection.

BACK (F6)
To move back to the previous screen of the wizard.

Description of fields

Field	Option	Description of Field
<DTM:>	Choicelist	A list of all DTM surfaces available in the selected DTM job.

Field	Option	Description of Field
<#Triangles:>	Output	Number of triangles the selected DTM consists of.
<Shift Verticl:>	User input	Vertical shift for the DTM. A positive shift moves the DTM up. A negative shift moves it down. 

Next step

IF the task is to	THEN
move to the next step of the selection wizard	**NEXT (F1)**.
to confirm all steps of the selection wizard and exit it, if it is the last screen of the selection wizard	**FINSH (F1)**.

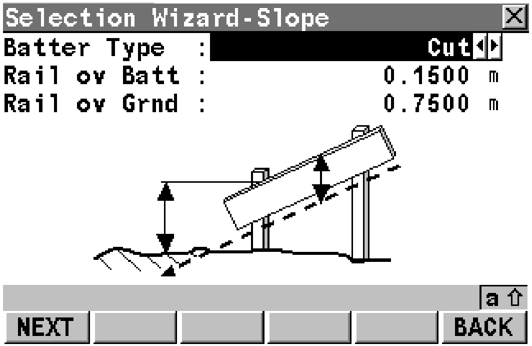
Road Selection Wizard - Slope Screen

Description

Depending on the **<Slope method:>** chosen in **Configuration**, **General** page the following screens appear.

IF the slope methd is	THEN
None or Ref. Point Surf	No screen for slope stake definition is available.
Batter rail	The screen to define batter rails for cut and fill slopes is used. Refer to "For batter rail" for information on defining the batter rail.
Reference Point	The screen to define the reference point is used. Refer to "For reference peg" for information on defining the reference peg.
Reference Batter	The screen to define the reference batter is used. Refer to "For reference batter" for information on defining the batter rail.

For batter rail



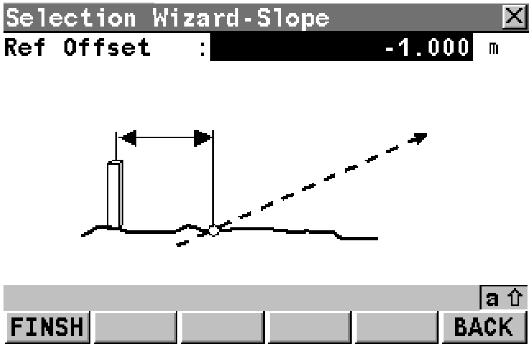
NEXT (F1)
To confirm all steps of the wizard and exit the selection wizard.

BACK (F6)
To move back to the previous screen of the wizard.

Description of fields

Field	Option	Description of Field
<Batter Type:>	**Cut** or **Fill**	Toggle between the definition for cut and fill batter rails.
<Rail ov Batt:>	User input	The height of the rail over the slope. Represents the traveller height if working with travellers.
<Rail ov Grnd:>	User input	The height of the rail over ground. Used to make sure that the stake used is long enough.

For reference peg



NEXT (F1)
To confirm all steps of the wizard and exit the selection wizard.

BACK (F6)
To move back to the previous screen of the wizard.

Description of fields

Field	Option	Description of Field
<Ref Offset:>	User input	The horizontal offset of the reference point from the catch point. ☞ The sign depends on the side of the centreline. In the direction of increasing chainage the offset is negative for the left side. In the direction of increasing chainage the offset is postive for the right side.

For reference batter

NEXT (F1)
To confirm all steps of the wizard and exit the selection wizard.

BACK (F6)
To move back to the previous screen of the wizard.

Description of fields

Field	Option	Description of Field
<Ref Offset:>	User input	The horizontal offset of the reference point from the catch point.
<Traveller Ht:>	User input	The traveller height. Height of the rail above the slope.

Next step

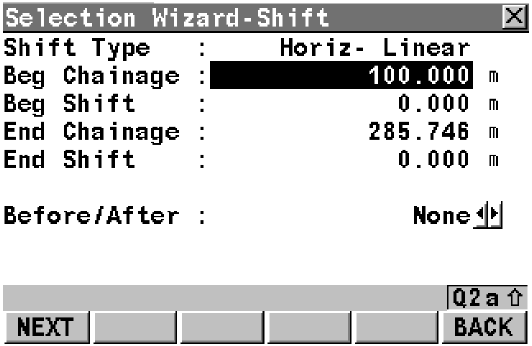
IF the task is to	THEN
move to the next step of the selection wizard	**NEXT (F1)**.
to confirm all steps of the selection wizard and exit it, if it is the last screen of the selection wizard	**FINSH (F1)**.

Road Selection Wizard - Shift Screen

Description

Horizontal and vertical shifts can be applied to the selected element. By using these shifts the design can be lifted/lowered and moved horizontally.

These screens of the selection wizard are only accessed if in the first step of the selection wizard in **Selection Wizard-Start** the selections are different to **<Shift Horiztl: None>** or **<Shift Verticl: None>**. The screen is accessed as part of the selection wizard.

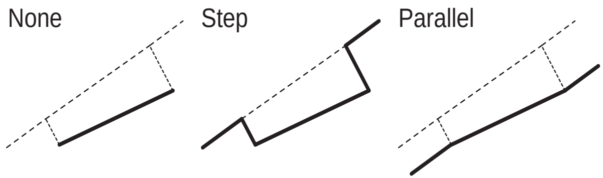


NEXT (F1)
To move to the next screen of the selection.

BACK (F6)
To move back to the previous screen of the wizard.

Description of fields

Field	Option	Description of Field
<Shift Type:>	Output	Type of shift selected for the object on the first screen of the wizard. Refer to "35.12.2 Horizontal and Vertical Shifts" for more information on shifts.
<Beg Chainage:>	User input	Chainage from which on the shift is added.
<Beg Shift:>	User input	Shift of the object at **<Beg Chainage:>**.
<End Chainage:>	User input	Chainage till which the shift is added.
<End Shift:>	User input	Shift of the object at **<End Chainage:>**.

Field	Option	Description of Field
<Before/ After:>		Defines the object outside of the defined shift range.
	None	The object only exists within the defined shift range.
	Steps	Before/after the defined shift range no shift is added.
	Parallel	The **<Beg Shift:>**/**<End Shift:>** are continued parallel.
		

Next step

IF the task is to	THEN
move to the next step of the selection wizard	**NEXT (F1)**.
to confirm all steps of the selection wizard and exit it, if it is the last screen of the selection wizard	**FINSH (F1)**.

Define horizontal and/or vertical shift step-by-step

Step	Description
☞	**Selection Wizard-Shift** is accessed as part of the selection wizard.
1.	Depending on the selection for **<Shift Horiztl:>** for the stringline in **Selection Wizard-Start** the next steps vary. • Unless **<Shift Horiztl: None>**, continue with step 2. • If **<Shift Horiztl: None>**, continue with step 3.
2.	**Selection Wizard-Shift** Define the horizontal shift.
3.	Depending on the selection for **<Shift Verticl:>** for the stringline in **Selection Wizard-Start** the next steps vary. • Unless **<Shift Verticl: None>**, continue with step 4. • If **<Shift Verticl: None>**, continue with step 6.
4.	Press **NEXT (F1)**
5.	**Selection Wizard-Shift** Define the vertical shift.
6.	Continue with the next step of the selection.

35.4.4 Selecting Stringlines, Individual Stringlines or Centrelines

Description

Stringlines are always defined relative to the centreline of the layer. Refer to "35.11.3 Basic Elements for Road Stake and Check Measurements" for information on stringlines.

Stringline selection step-by-step

Step	Description
1.	**Selection Wizard-Start** Choose **<Task Type: Stringline>** or **<Task Type: Centreline>** If the road job consists of no other stringlines than one centreline then **<Task Type: Centreline>** is fixed. Define **<Task Name:>**, **<Use Zig zag:>** and select the type of shifts to add **<Shift Horiztl:>** and **<Shift Verticl:>**.
2.	Press **NEXT (F1)**
3.	**Selection Wizard-View** Define **<Select View:>**, **<Plot Chainage:>** and select the **<Layer:>**.
4.	Press **NEXT (F1)**
5.	**Selection Wizard-Select** **<-- (F2)** and **--> (F3)** to select the stringline by moving right and left or click at a line. If **<Task Type: Centreline>** the selection is fixed to the centreline of the layer.
6.	Press **NEXT (F1)**
7.	**Selection Wizard-Define**

Step	Description
	Define **<Stake Mode:>**, **<Use Min/Max:>**, **<Min Chainage:>** and **<Max Chainage:>**
8.	Depending on the selection for **<Shift Horiztl:>** and **<Shift Verticl:>** the next steps vary. • If **<Shift Horiztl: None>**, **<Shift Verticl: None>** continue with step 9. • Else press **NEXT (F1)** to define the shifts and then continue with step 9.
9.	Press **FINSH (F1)** to confirm all wizard steps and exit the wizard.

35.4.5 Selecting X-Slopes

Description

X-slopes consist of two stringlines representing their left and right edge. Refer to "35.11.3 Basic Elements for Road Stake and Check Measurements" for information on X-slopes.

X-slope selection step-by-step

Step	Description
1.	**Selection Wizard-Start**
	Choose **<Task Type: X-Slope>**.
	Define **<Task Name:>, <Use Zig zag:>** and select the type of shifts to add **<Shift Horiztl:>** and **<Shift Verticl:>**.
2.	Press **NEXT (F1)**
3.	**Selection Wizard-View** Select the **<Layer:>** and **<Plot Chainage:>**. **<Select View: Cross-Section>** is fixed.
4.	Press **NEXT (F1)**
5.	**Selection Wizard-Select** **<-- (F2)** and **--> (F3)** to select the X-slope by moving right and left.
6.	Press **NEXT (F1)**
7.	**Selection Wizard-Define** Define **<Refrence Line:>**, **<Use Min/Max:>**, **<Min Chainage:>** and **<Max Chainage:>**.

Step	Description
8.	Depending on the selection for **<Shift Horiztl:>** and **<Shift Verticl:>** the next steps vary. • If **<Shift Horiztl: None>**, **<Shift Verticl: None>** continue with step 9. • Else press **NEXT (F1)** to define the shifts and then continue with step 9.
9.	Press **FINSH (F1)** to confirm all wizard steps and exit the wizard.

35.4.6 Selecting Slopes

Description

Slopes consist of two stringlines, the hinge point lies on one of the stringlines.

☞ To avoid errors and minimise the number of keystrokes, the vertex of the slope closer to the centreline is chosen as default for the hinge point during the definition in the Selection Wizard.

Slope selection step-by-step

Step	Description
1.	**Selection Wizard-Start** Choose **<Task Type: Slope>**.
	Define **<Task Name:>** and select the type of shifts to add **<Shift Horiztl:>** and **<ShiftVerticl:>**. Zig zag mode can not be used with slopes.
2.	Press **NEXT (F1)**
3.	**Selection Wizard-View** Choose the **<Layer:>** and **<Plot Chainage:>**. **<Select View: Cross-Section>** is fixed.
4.	Press **NEXT (F1)**
5.	**Selection Wizard-Select** **<-- (F2)** and **--> (F3)** to select the slope by moving right and left.
6.	Press **NEXT (F1)**
7.	**Selection Wizard-Define**

Step	Description
	Define **<Hinge:>**, **<Use Min/Max:>**, **<Min Chainage:>** and **<Max Chainage:>**.
8.	Press **NEXT (F1)**
9.	Depending on **<Slope method:>** chosen in **Project Configuration**, **General** the next steps vary. • If **<Slope method: None>**, continue with step 10. • If **<Slope method: Batter rails>**, continue with paragraph "Batter rail definition step-by-step". • If **<Slope method: Ref Point>**, continue with paragraph "Reference point definition step-by-step". • If **<Slope method: Ref Point Surf>**, continue with paragraph "Reference point surface definition step-by-step". • If **<Slope method: Ref Batter>**, continue with paragraph "Reference point definition step-by-step".
10.	Depending on the selection for **<Shift Horiztl:>** and **<Shift Verticl:>** the next steps vary. • If **<Shift Horiztl: None>**, **<Shift Verticl: None>** continue with step 11. • Else press **NEXT (F1)** to define the shifts and then continue with step 11.
11.	Press **FINSH (F1)** to confirm all wizard steps and exit the wizard.

Batter rail definition step-by-step

Step	Description
1.	Press **NEXT (F1)**
2.	**Selection Wizard-Slope** Define **<Rail ov Batt:>** and **<Rail ov Grnd:>**.
3.	Press **NEXT (F1)**
4.	Depending on the selection for **<Shift Horiztl:>** and **<Shift Verticl:>** the next steps vary. • If **<Shift Horiztl: None>**, **<Shift Verticl: None>** continue with step 5. • Else press **NEXT (F1)** to define the shifts and then continue with step 5.
5.	Press **FINSH (F1)** to confirm all wizard steps and exit the wizard.

Reference point definition step-by-step

Step	Description
1.	Press **NEXT (F1)**
2.	**Selection Wizard-Slope** Define **<Ref Offset:>**.
3.	Press **NEXT (F1)**
4.	Depending on the selection for **<Shift Horiztl:>** and **<Shift Verticl:>** the next steps vary. • If **<Shift Horiztl: None>**, **<Shift Verticl: None>** continue with step 5.

Step	Description
	• Else press **NEXT (F1)** to define the shifts and then continue with step 5.
5.	Press **FINSH (F1)** to confirm all wizard steps and exit the wizard.

Reference point surface definition step-by-step

Step	Description
1.	Press **NEXT (F1)**
2.	Depending on the selection for **<Shift Horiztl:>** and **<Shift Verticl:>** the next steps vary. • If **<Shift Horiztl: None>**, **<Shift Verticl: None>** continue with step 3. • Else press **NEXT (F1)** to define the shifts and then continue with step 3.
3.	Press **FINSH (F1)** to confirm all wizard steps and exit the wizard.

Reference batter definition step-by-step

Step	Description
1.	Press **NEXT (F1)**
2.	**Selection Wizard-Slope** Define **<Ref Offset:>** and **<Traveller Height:>**.
3.	Press **NEXT (F1)**
4.	Depending on the selected **<Shift Horiztl:>** and **<Shift Verticl:>** the next steps will vary.

Step	Description
	• If **<Shift Horiztl: None>**, **<Shift Verticl: None>** continue with step 5. • Else press **NEXT (F1)** to define the shifts and then continue with step 5.
5.	Press **FINSH (F1)** to confirm all wizard steps and exit the wizard.

35.4.7 Selecting Manual Slopes

Description

Manual slopes are defined relative to a stringline. The creation of the task is therefore quite similar to the one of a stringline.

Manual slope selection step-by-step

Step	Description
1.	**Selection Wizard-Start** Choose **<Task Type: Manual Slope>**.
2.	Define **<Task Name:>** and select the type of shifts to add **<Shift Horiztl:>** and **<Shift Verticl:>**. Zig zag mode can not be used with manual slopes.
3.	Press **NEXT (F1)**
4.	**Selection Wizard-View** Define **<Select View:>**, **<Plot Chainage:>** and select the **<Layer:>**.
5.	Press **NEXT (F1)**
6.	**Selection Wizard-Select** **<-- (F2)** and **--> (F3)** to select the stringline by moving right and left or click at a line. If **<Task Type: Centreline>** the selection is fixed to the centreline of the layer.
7.	Press **NEXT (F1)**
8.	**Selection Wizard-Define** Define **<Use Min/Max:>**, **<Min Chainag:>** and **<Max Chainage:>** **<Stake Mode: 3D>** is fixed.

Step	Description
9.	Depending on the selection for **<Shift Horiztl:>** and **<Shifts Verticl:>** the next steps vary. • If **<Shift Horiztl: None>**, **<Shift Verticl: None>** continue with step 10. • Else press **NEXT (F1)** to define the shifts and then continue with step 10.
10.	Press **FINSH (F1)** to confirm all wizard steps and exit the wizard.

35.4.8 Selecting Layers

Description

Layers consist of a various number of stringlines representing the layer surface, for example, one centreline and the right and left edge of the road. Refer to "35.11.3 Basic Elements for Road Stake and Check Measurements" for information on layers.

Slope selection step-by-step

Step	Description
1.	**Selection Wizard-Start** Choose **<Task Type: Layer>**.
2.	Define **<Task Name:>** and select the type of shifts to add **<Shift Verticl:>**. No horizontal **<Shift Horiztl:>** can be added to a layer. Zig zag mode can not be used with slopes.
3.	Press **NEXT (F1)**
4.	**Selection Wizard-View** Choose the **<Layer:>** and **<Plot Chainage:>**. **<Select View: Cross-Section>** is fixed.
5.	Press **NEXT (F1)**
6.	**Selection Wizard-Select** Graphical representation of the selected layer at the defined **<Plot Chainage:>**.
7.	Press **NEXT (F1)**

Step	Description
8.	**Selection Wizard-Define** Define **<Exp endSlp:>**, **<Use Min/Max:>**, **<Min Chainage:>** and **<Max Chainage:>**
9.	Depending on the selection for **<Shift Horiztl:>** and **<Shift Verticl:>** the next steps vary. • If **<Shift Horiztl: None>**, **<Shift Verticl: None>** continue with step 10. • Else press **NEXT (F1)** to define the shifts and then continue with step 10.
10.	Press **FINSH (F1)** to confirm all wizard steps and exit the wizard.

35.4.9 Selecting Digital Terrain Models (DTM)

Description

Unlike all other objects DTM's are not related to a centreline. Therefore it is not necessary to define chainage related settings, and hence, some steps of the selection wizard are skipped. Refer to "35.11.3 Basic Elements for Road Stake and Check Measurements" for information on DTM's.

DTM selection step-by-step

Step	Description
1.	**Selection Wizard-Start** Choose **<Task Type: DTM>**. Define **<Task Name:>**.
2.	Press **NEXT (F1)**.
3.	**Selection Wizard** Select the **<DTM:>** and define the vertical shift **<Shift Verticl:>**.
4.	Press **FINSH (F1)** to confirm all wizard steps and exit the selection wizard.

35.4.10 Selecting Road Crowns

Description

Road crowns consist of two X-slopes. They are a combined stake out of two X-slopes at once. Refer to "35.11.3 Basic Elements for Road Stake and Check Measurements" for information on road crowns.

Road crown step-by-step

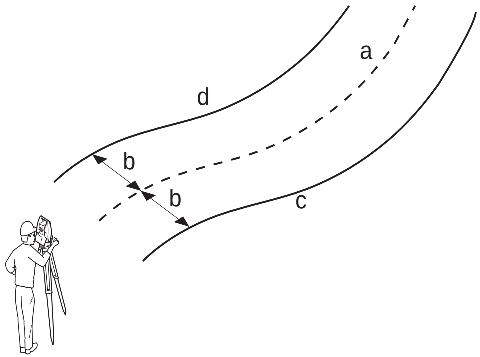
Step	Description
1.	**Selection Wizard-Start** **<Choose Task Type: Crown>**
2.	Define **<Task Name:>** and select the type of shifts to add **<Shift Horiztl:>** and **<ShiftVerticl:>**. The horizontal shift is added along the X-slope for the defined reference line.
3.	Press **NEXT (F1)**
4.	**Selection Wizard-View** Choose the **<Layer:>** and define the **<Plot Chainage:>**. **<Select View: Cross-Section>** is fixed.
5.	Press **NEXT (F1)**
6.	**Selection Wizard-Select** **<-- (F2)** and **--> (F3)** to select the crown.
7.	Press **NEXT (F1)**
8.	**Selection Wizard-Select**

Step	Description
9.	Define **<Refrence Line:>**, **<Use Min/Max:>**, **<Min Chainage:>** and **<Max Chainage:>**. Only the left most and right most stringline of the crown may be selected as reference line. Stake offsets / height differences are relative to the reference line and symmetric to the middle stringline of the road crown.
10.	Depending on the selection for **<Shift Horiztl:>** and **<Shift Verticl:>** the next steps vary. • If **<Shift Horiztl: None>**, **<Shift Verticl: None>** continue with step 10. • Else press **NEXT (F1)** to define the shifts and then continue with step 10.
11.	Press **FINSH (F1)** to confirm all wizard steps and exit the wizard.

35.4.11 The Zig Zag Mode

Description

If staking out a street that is defined as a centreline with offsets of 2.5 m left and right, the zig zag mode allows you to toggle between the two lines to stake out.



a) Centreline
b) Defined **<Stake Offset:>**
c) Parallel right stringline
d) Parallel left stringline

The zig zag mode is available for the following stake out/check methods:

Type	Description
Stringline	Toggle between parallel stringline left and right.
X-slope	Toggle between left and right stringline of the X-slope.
Crown	Toggle between left and right X-slope

Road automatically detects which side of the centreline is being used and selects the appropriate stringline as a reference.

Auto position with zig zag

When pressing auto position **SHIFT POSIT (F4)** a message box comes up prompting you if either the left or right side should be staked out/checked.

35.4.12 Chainage Range

Description

The chainage range is chosen during task creation with the selection wizard. By defining a chainage range it is possible to limit which part of the design will be stake out or checked. If the defined chainage range is exceeded during stake out/check a warning appears.

Chainage range fields

The following fields are used for the chainage range definition:

Field	Option	Description
<Use Min/Max:>		To define the used chainage range.
	No	No chainage range is applied. The whole length of the stringline is used.
	Yes	A chainage range is applied. If the defined range is acceded a warning appears. ☞ **DEFLT (F5)** to use the start/end chainage of the centreline as **<Min Chainage:>** / **<Max Chainage:>**.
<Min Chainage:>	User input	Minimum chainage of the chainage range.
<Max Chainage:>	User input	Maximum chainage of the chainage range.

35.5 Step 4 - Measuring

35.5.1 Staking/Checking the Road - An Overview of the Pages

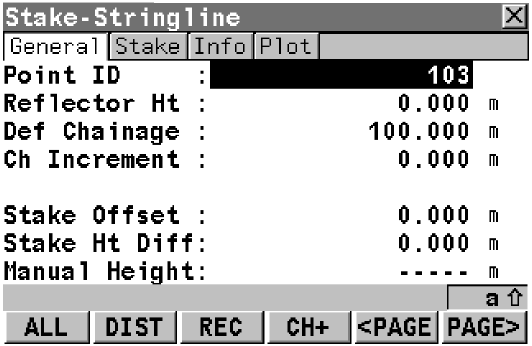
The pages

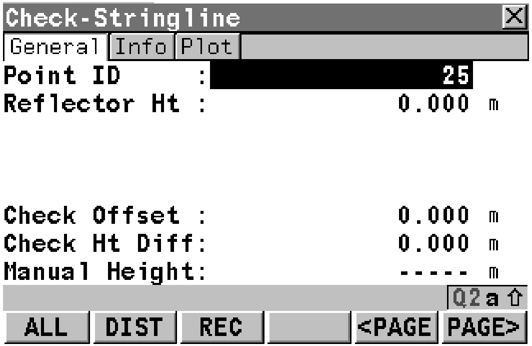
For Stake	For Check
Stake-Stringline General | Stake | Info | Plot	Check-Stringline General | Info | Plot
The General page Stake out settings for the point to stake out, for example, point ID or reflector height.	
The Stake page Displays the differences between the measured points and stake out points (delta values). If these values are zero, the measured point coincides with the stake out point.	-
The Info page A user definable page displaying values relevant to the measured point.	
The Plot page A graphical representation of the current design in relation to the measured point.	

35.5.2 The General Page

Road Stake/Check - Stringline, General page

This page defines the point to be staked.





CH+ (F4)
Available for Stake. To increase **<Def Chainage:>** by the **<Ch Increment:>**.

SHIFT CONF (F2)
To access configuration settings. Refer to "35.6 Configuring".

SHIFT POSIT (F4)
Available for Stake. To enable automatic instrument positioning. Refer to " Road Configuration, Posit page".

SHIFT EXTRA (F5)
To access the Extras Menu. Refer to "35.10 Working with the Extras Menu".

Description of fields

The following fields are always shown in all Stake and Check methods, unless **<Offset Direc.: Perp to Align>** in **Configuration**, **General** page.

Field	Option	Description
<Point ID:>	User input	Name of the next point to be stored. The ioint ID will be incremented/decremented whenever a point gets stored with **ALL (F1)** or **REC (F3)**. Refer to the "15.1 ID Templates" for information on defining the point increment and point ID.
<Reflector Ht:>	User input	Height of the reflector.

The following fields are always shown in all Stake methods, unless **<Offset Direc.: Perp to Align>** in **Configuration**, **General** page.

Field	Option	Description
<Def Chainage:>	User input	Nominal chainage of the point to be staked out. If staking out random chainages and no nominal chainage is defined, for example **<Def Chainage: ----->**, no value for **<ΔChainage:>** will be displayed on the **Stake** page. All values will be displayed relative to the current chainage.

Field	Option	Description
<Ch Incre-ment:>	User input	Chainage increment. Value by which the nominal chainage **<Def Chainage:>** increases/decreases when pressing **CH+ (F4)**. When working with random chainages, for example **<Def Chainage: ----->**, this line is disabled.

The following fields are shown in the Stake methods.

Field	Option	Description
<Stake Offset:>	User input	Horizontal offset from the reference string-line (as defined by the chosen method) of the point to stake.
<Stake Ht Diff:>	User input	Vertical offset from the reference stringline or surface (as defined by the chosen method) of the point to stake.

The following fields may be shown in the Check methods, unless **<Offset Direc.: Perp to Align>** in **Configuration**, **General** page.

Field	Option	Description
<Check Offset:>	User input	Horizontal offset for stringlines defined by manual offset. Refer to "Stake offset / height difference working example" for more information on stake offsets.
<Check Ht Diff:>	User input	Vertical offset for stringlines defined by manual height difference. Refer to "Stake offset / height difference working example" for more information on stake height differences.

The following fields are shown in the Stringline, Individual Stringline, X-Slope and Crown methods with a selection for **<2nd Line:>** in the Define screen.

Field	Option	Description
<2nd Line Off:>	User input	Horizontal stake/check offset for 2nd string
<2nd Line HtD:>	User input	Vertical stake/check height difference for 2nd string

The following field is shown in the Stake and Check methods except for the Slope and Manual Slope, unless **<Offset Direc.: Perp to Align>** in **Configuration**, **General** page.

Field	Option	Description
<Manual Height:>	User input	A height which is entered manually by the user. The value typed in is used instead of design height or DTM height. If no value is typed in, the height from design is used.

The following field is shown for the Stake methods Stringline, Individual Stringline and Manual Slope, with **<Offset Direc.: Angle to Align>** in **Configuration**, **General** page.

Field	Option	Description
<Angle to Alig:>	User input	The value in clockwise direction in relation to the element tangent.

Understanding priorities of various heights

Type of height	Overrules	**<Stake Height Diff:>**
Manually entered OR Obtained from individual point	All other heights	Considered
From height layer of DTM	Design height	Considered
From design	No other heights	Considered
2nd height from info layer of DTM	No influence on priorities For additional info only	-

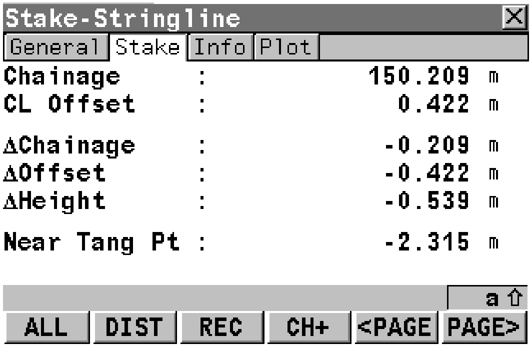
35.5.3 The Stake Page

Press ◀/▶ to de-/increase the chainage by the chainage increment.

Road Stake - Stringline, Stake page (only applicable to stake surveys)

The values on this page guide you to the position to stake out. All stake out methods share a common Stake page. However the values shown differ, being related to different elements for each stake out method. Variations to the following definitions are indicated in the relevant chapters for each stake out method.

Depending on the **<Orientation:>** and **<Guidance:>,** as selected in **Configuration**, **General** page, the appearance of this page may vary.



CH+ (F4)
To increase **<Chainage:>** by the chainage increment.

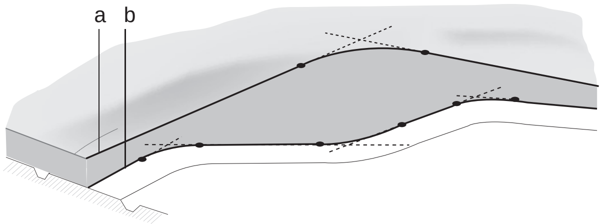
SHIFT CONF (F2)
To access configuration settings. Refer to "35.6 Configuring".

SHIFT POSIT (F4)
To enable automatic instrument positioning. Refer to " Road Configuration, Posit page".

SHIFT EXTRA (F5)
To access the Extras Menu. Refer to "35.10 Working with the Extras Menu".

Description of fields

Field	Option	Description
<Chainage:> or **<Ch:>**	Output	The current chainage.
<CL Offset:> or **<CL O:>**	Output	Perpendicular horizontal offset from the centreline.
<ΔChainage:> or **<ΔCh:>**	Output	Difference between the defined chainage **<Def Chainage:>** on the **General** page and the current chainage **<Chainage:>** of the **Stake** page. If no defined chainage exists, for example if staking out random chainages or checking, this field shows **-----**.
<ΔOffset:> or **<ΔOff:>**	Output	Horizontal offset between the defined position and the current position. The **<Stake Offset:>** defined on the **General** page is taken into account.
<ΔHeight:> or **<ΔHt:>**	Output	Vertical offset between the defined position and the current position. The **<Stake Ht Diff:>** defined on the **General** page is taken into account.
<Near Tang Pt:> or **<NrTP:>**	Output	Chainage difference between the measured point and the nearest tangent point (start/end point of a road segment) of the design.

Field	Option	Description
		 a) Vertical alignment b) Horizontal alignment Only tangent points (start/end point of a road segment) are detected.

35.5.4 The Info Page

Description

A user defineable Info page exists for each of the stake methods and check methods. Refer to "35.6.4 Stake Out Info Page and Check Info Page" for information on all available items for the Info page and how to select them.

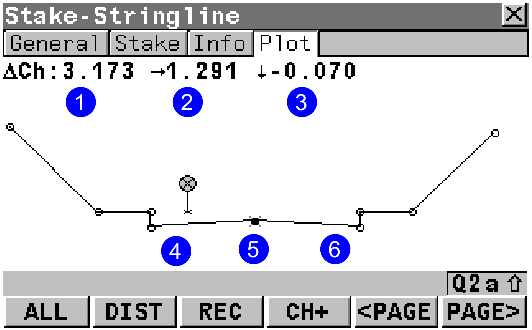
35.5.5 The Plot Page

Road Stake/Check - Stringline, Plot page

The **Plot** page for Stake shows information about the measured point relative to the design (as defined by the selected layer and stringline, and the values entered on the **General** page).

The information at the top of the plot corresponds with the information on the **Stake** page, only when **<Orientation: To Alignment>** is set in **Configuration**, **General** page.

The **Plot** page for Check is similar to Stake. The only difference is that the current chainage is always shown, as shown on the **Info** page.



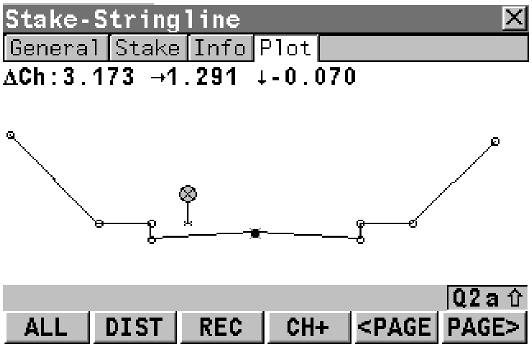
1. For Stake: Chainage difference between the measured point and the defined chainage. When working with random chainages (that is, when no defined chainage has been entered on the General page), **<ΔCh:>** changes to **<Ch:>** (the current chainage as shown on the Stake page).
   For Check: Current chainage as shown on the **Info** page.
2. Horizontal distance (left/right arrow) to the design.
3. Vertical distance (up/down arrow) to the design.
4. The measured point.

5. The element to stake is shown in bold. The position to stake is marked with a cross.
6. The plot can be shown as a cross plot, plan view or profile view (as defined by **<Plot Type:>** in **Configuration**, **Info** page).

Refer to "35.11.4" and "35.11.5" for details on plots with shifts and stake offsets/height differences.

The cross plot view

zoom in ● ± zoom out ● .



CH+ (F4)
Available for Stake. To increase **<Def Chainage:>** by the chainage increment.

SHIFT CONF (F2)
To access configuration settings. Refer to "35.6 Configuring".

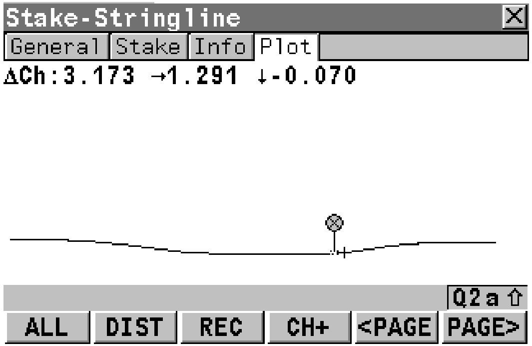
SHIFT FIT (F3)
To fit all data into the screen area.

SHIFT CENTR (F4)
To centre the plot at the selected element.

SHIFT EXTRA (F5)
To access the Extras Menu. Refer to "35.10 Working with the Extras Menu".

The profile view

zoom in ●± zoom out ●.



CH+ (F4)
: Available for Stake. To increase **<Def Chainage:>** by the chainage increment.

SHIFT CONF (F2)
: To access configuration settings. Refer to "35.6 Configuring".

SHIFT FIT (F3)
: To fit all data into the screen area.

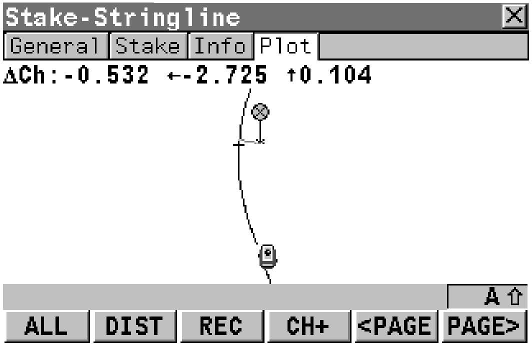
SHIFT CENTR (F4)
: To centre the plot at the selected element.

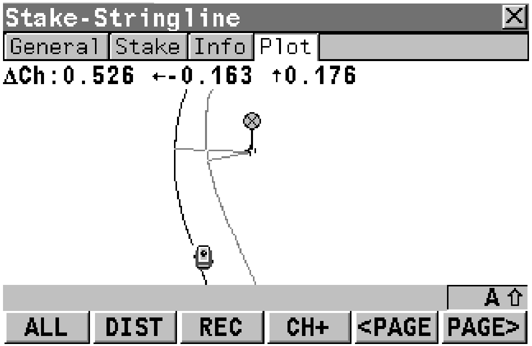
SHIFT EXTRA (F5)
: To access the Extras Menu. Refer to "35.10 Working with the Extras Menu".

The plan view

For **<Stake/Check: Check>** and **<Method: DTM>** in **Road Setup**, a **Plot** page is added to the measurement screen if a DTM layer has been selected for display. The page shows the DTM and the centreline of the alignment - always in plan view. At the top of the page chainage, DTM height and ΔHeight are shown.

zoom in ●± zoom out ●.





CH+ (F4)
: Available for Stake. To increase **<Def Chainage:>** by the chainage increment.

SHIFT CONF (F2)
: To access configuration settings. Refer to "35.6 Configuring".

SHIFT FIT (F3)
: To fit all data into the screen area.

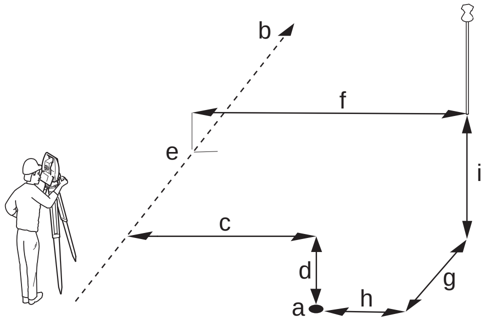
SHIFT CENTR (F4)
: To centre the plot at the selected element.

SHIFT EXTRA (F5)
: To access the Extras Menu. Refer to "35.10 Working with the Extras Menu".

35.5.6 Measuring Points by Chainage and Offset

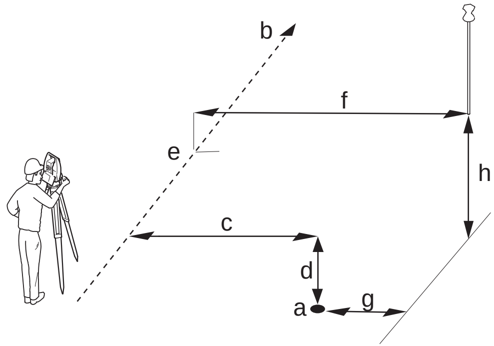
Graphical overview

Stake



a) Position to stake out, defined by chainage, stake offset and, optionally, stake height difference
b) Centreline/stringline the position is defined relative to
c) <Stake Offset:>
d) <Stake Ht Diff:>
e) <Chainage:>
f) <CL Offset:>
g) <ΔChainage:>
h) <ΔOffset:>
i) <ΔHeight:>

Check



a) Position to check, defined by check offset and, optionally, check height difference
b) Centreline/stringline the position is defined relative to
c) <Check Offset:>
d) <Check Ht Diff:>
e) <Chainage:>
f) <CL Offset:>
g) <Strgl Offset:>
h) <Strgl Ht Diff:>

Description

- When staking points, these are points that have been defined manually by chainage and offset relative to an existing 2D or 3D centreline or stringline.

- When checking points, these are points that have been defined manually by chainage and offset relative to an existing 2D or 3D centreline or stringline.

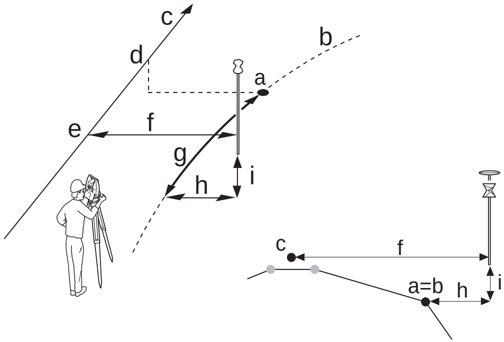
Required elements

- For **<Method: 2D:>** a horizontal centreline is required.
- For **<Method: 3D:>** a 3D centreline is required.

35.5.7 Measuring Stringlines Relative to a Centreline

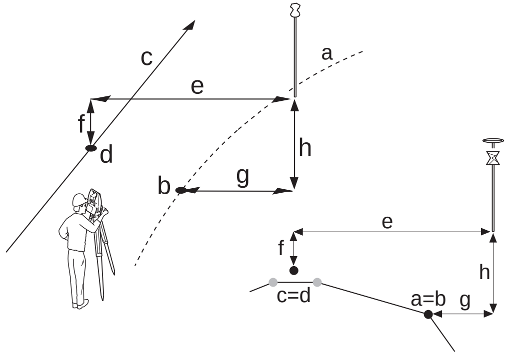
Graphical overview

Stake



a) Position to stake out
b) Stringline to stake out
c) Centreline
d) <Def Chainage:>
e) <Chainage:>
f) <CL Offset:>
g) <ΔChainage:>
h) <ΔOffset:>
i) <ΔHeight:>

Check



a) Stringline to check
b) Projected point on stringline
c) Centreline
d) <Chainage:>
e) <CL Offset:>
f) <CL Ht Diff:>
g) <Strgl Offset:>
h) <Strgl Ht Diff:>

Description

- Stringlines define various elements, including:
  - Centreline of the design.
  - Change in slope ratio, for example, the edge of a carriage way.
  - Gutter, cable, pipeline or any other type of alignment element.

- Refer to "35.11.3 Basic Elements for Road Stake and Check Measurements" for information on the usage of stringlines.

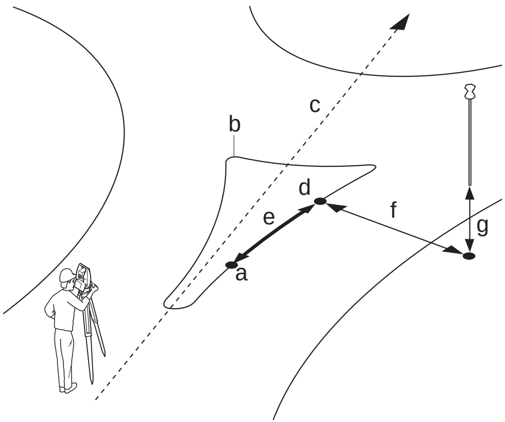
Required elements

- For **<Method: 2D>** at least a 2D stringline and a 2D centreline are required.
- For **<Method: 3D>** a 3D stringline and a 3D centreline are required.

35.5.8 Measuring Individual Stringlines without Centrelines

Graphical overview

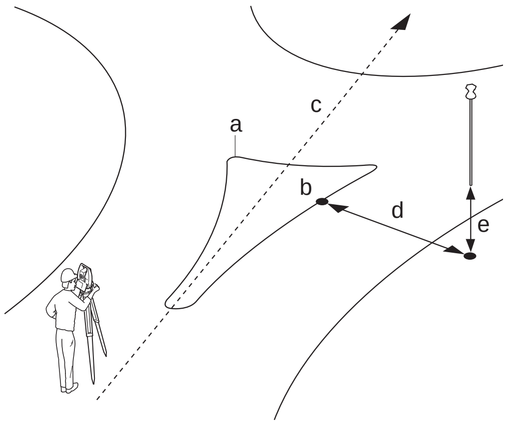
Stake



Stake Out of Roundabout

a) Position to stake out
b) Stringline to stake out
c) Centreline of the layer - is not used for the individual stringline
d) **<Chainage:>**
e) **<ΔChainage:>**
f) **<ΔOffset:>**
g) **<ΔHeight:>**

Check



Checking a Roundabout

a) Stringline to check
b) **<Chainage:>**
c) Centreline of the layer - is not used for the individual stringline
d) **<Strgl Offset:>**
e) **<Strgl Ht Diff:>**

Description

Different to stringlines, where the stake/check is always relative to the centreline defined for the layer, individual stringlines have no longer a relation to an overall centreline. Individual stringlines are used to check roundabouts, parking bays, subdivision works and any other type of lines. The different stringlines to stake/check can be stored within one layer, which does not require a defined centreline. This is different to the stake/check of any other type which always require a centreline.

Required elements

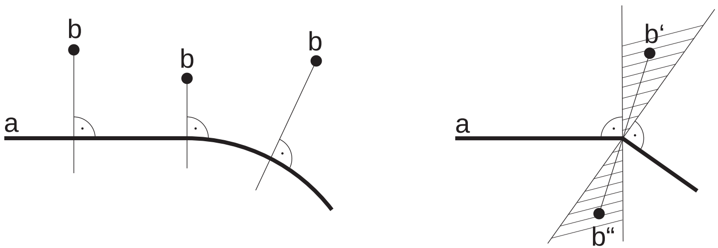
A 2D or 3D design of the line to stake/check is required.

Indefinite triangle

Description

In almost all situations, a measured position is shown relative to the individual stringline by the stringline chainage and a square offset to the stringline. However, situations may arise where a road design has extreme changes in the deflection angle of tangent points. In these cases it is not always possible to show a measured position by the nominal chainage and offset. An indefinite triangle is a region in which these situations arise. Points measured within an indefinite triangle are shown relative to the tangent point.

Graphic



Road Design A

a) Individual stringline

b) Measured position (displayed relative to the stringline by chainage and square offset)

Road Design B

a) Individual stringline with extreme changes in the deflection angle of tangent points

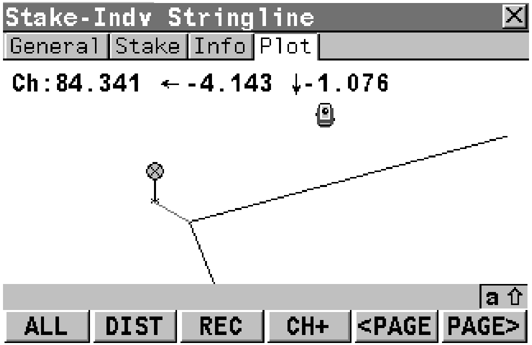
b) Measured position within indefinite triangle

This position **cannot** be shown in the usual manner and is displayed relative to the tangent point

b") Measured position within indefinite traingle

This position **can** be shown in the usual manner and is displayed by chainage and square offset

Screen

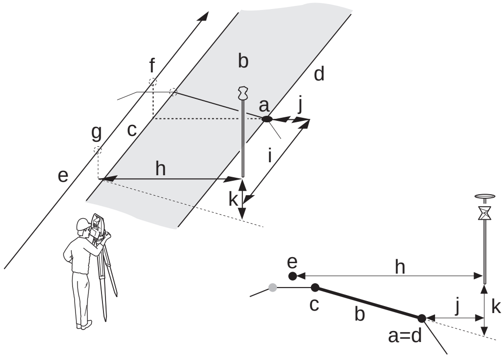


Points measured within an indefinite triangle are always shown relative to the tangent point.

35.5.9 Measuring Cross Slopes

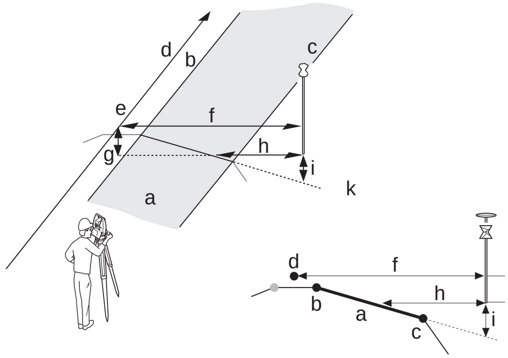
Graphical overview

Stake



a) Position to stake out
b) X-slope to stake out
c) Left stringline
d) Right stringline
e) Centreline
f) **<Def Chainage:>**
g) **<Chainage:>**
h) **<CL Offset:>**
i) **<ΔChainage:>**
j) **<ΔOffset:>**
k) **<ΔHeight:>**

Check



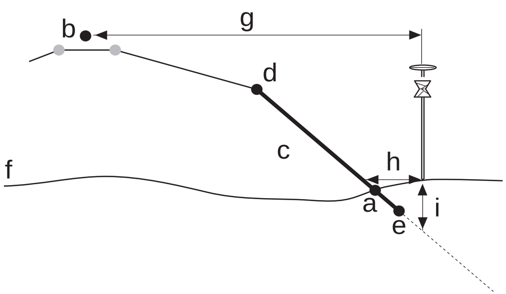
a) X-slope to check
b) Left stringline
c) Right stringline
d) Centreline
e) **<Chainage:>**
f) **<CL Offset:>**
g) **<CL Ht Diff:>**
h) **<X-Slp Offset:>**
i) **<X-Slp Ht Diff:>**

Description	• Surfaces such as the final carriage way, are often staked/checked using X-slopes. A X-slope consists of a combination of two stringlines. Refer to "35.11.3 Basic Elements for Road Stake and Check Measurements" for information on the usage of X-slopes.
Required elements	A 3D design of the road is required.

35.5.10 Measuring Manual Slopes and Design Slopes

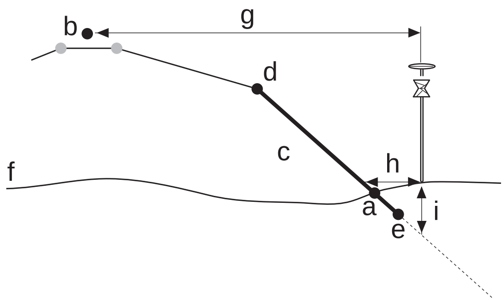
Graphical overview

Stake



a) Catch point
b) Centreline
c) Slope to stake out
d) Hinge point = left stringline
e) Second / right stringline
f) Natural surface
g) **<CL Offset:>**
h) **<ΔOffset:>**
i) **<ΔHeight:>**

Check



a) Catch point
b) Centreline
c) Slope to check
d) Hinge point
e) Second stringline of the slope
f) Natural surface
g) **<CL Offset:>**
h) **<Slope Offset:>**
i) <Slope Ht Diff:>

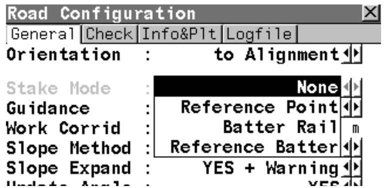
Description

- Surfaces, such as the end slopes of a cut or fill, are staked/checked using slope methods.
- Slopes are defined by two stringlines. Refer to "35.11.3 Basic Elements for Road Stake and Check Measurements" for information on the usage of slopes.
- For manual slopes, the slope is defined manually relative to an existing centre-line.

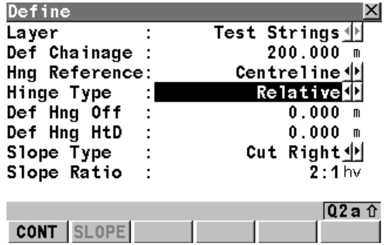
- For design slopes, a 3D representation of the slope is required.
- When staking slopes, the point of interest is the intersection of the defined slope with the natural surface (= catch point). Refer to "35.11.7 Methods for Slope Staking" for information on the slope staking methods supported by Road.
- When checking slopes, the slope check is independent of the **<Slope Method:>** chosen in Road Configuration.

Defining the Slope Type - Using no Slope

Configuring the slope

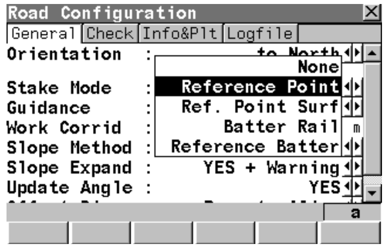
Step	Description	
1.	Select **Road Config**. Press **CONT (F1)** to continue to the next screen.	
2. 2	When no slope type is required, set **<Slope Method: None>**.	

Entering the values (Standard Mode)

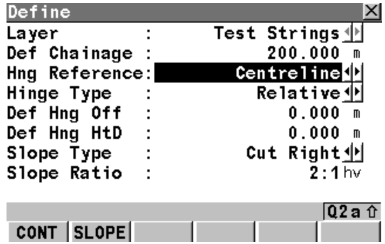
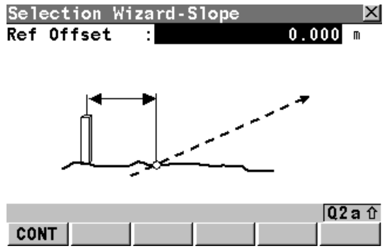
Step	Description
1.	After setting **<Slope Method: None>**, the **SLOPE (F2)** key in the **Define** screen is disabled and no slope values can be entered. 

Defining the Slope Type - Using a Reference Point

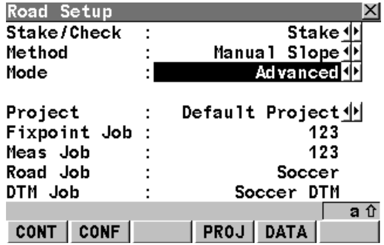
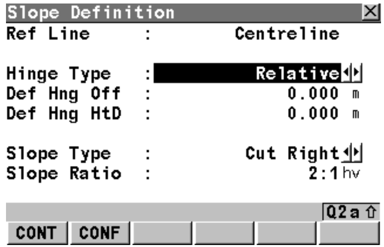
Configuring the slope

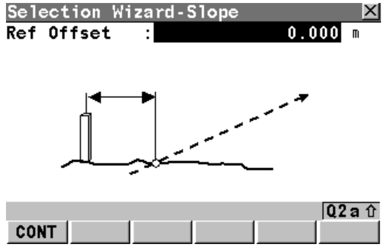
Step	Description
1.	Select **Road Config**. Press **CONT (F1)** to continue to the next screen. 
2.	When a reference point is required, set **<Slope Method: Reference Point>**. 

Entering the values (Standard Mode)

Step	Description
1.	After setting **<Slope Method: Reference Point>** in the configuration screen, the **SLOPE (F2)** key in the **Define** screen is enabled and slope values for the reference point can be entered. Press **SLOPE (F2)** to continue to the next screen. 
2.	It is now possible to stake out a reference point with a defined offset from the catch point. Enter the appropriate values. 

Entering the values (Advanced Mode)

Step	Description
1.	After setting **<Slope Method: Reference Point>** in the configuration screen, a task is created or selected and then the instrument is positioned and oriented. Press **CONT (F1)** to go to Task Management. 
2.	Enter appropriate values for the slope definition. Refer to "35.10.7 Extras for Slope" for details of the fields in this screen. Refer to "Slope staking using a reference point" for further details on using a reference point. Press **CONT (F1)** to continue to the next screen. 

Step	Description
3.	It is now possible to stake out a reference point with a defined offset from the catch point. Enter the appropriate values. Refer to " Road Selection Wizard - Slope Screen" for further details on using the Task selection wizard. 

Workflow

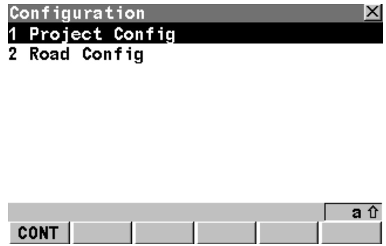
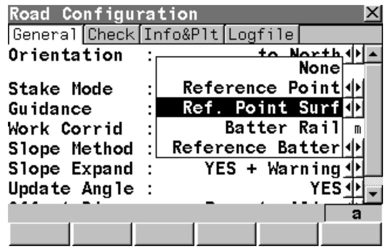
- Refer to "Slope staking using a reference point" for more information on the reference point method.
- The first position to stake out is the catch point.

Step	Description
1.	Stake out the position of the catch point by using **<ΔOffset:>** and/or **<ΔHeight:>**. When **<ΔOffset:>** and **<ΔHeight:>** are equal to zero, the catch point has been located.
2.	**SHIFT EXTRA (F5)** to access **Extras- Slope**.
3.	Select **<Place Reference Point:>** to access the stake out screen for the reference peg **Stake - Refpoint**. The measured position from step 1. is used as the catch point for the stake out of the reference point.

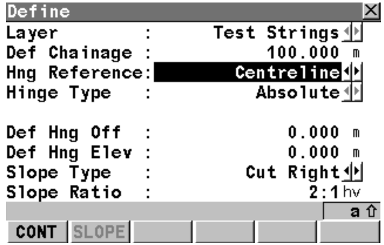
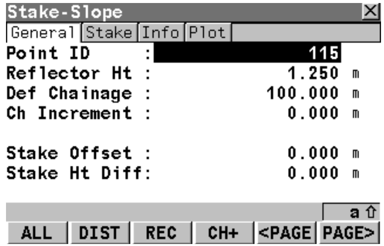
Step	Description
4.	Stake out the reference point using **<ΔOffset:>**. When **<ΔOffset:>** is equal to zero the reference peg position has been found. **<ΔHeight:>** shows the height difference relative to the catch point. Note that all values shown on the **Info** page are relative to the original slope.
5.	**ESC** to return to **Stake Slope**. Stake out the next catch point from this screen.

Defining the Slope Type - Using a Ref. Point Surface

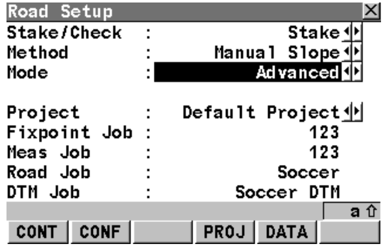
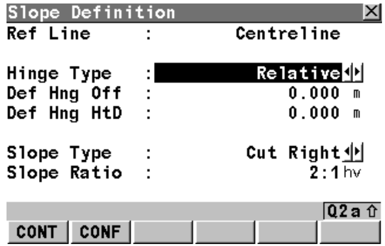
Configuring the slope

Step	Description
1.	Select **Road Config**. Press **CONT (F1)** to continue to the next screen. 
2.	When a reference point at the slope surface is required: Set **<Slope Method: Ref. Point Surf>**. 

Entering the values (Standard Mode)

Step	Description
1.	After setting **<Slope Method: Ref. Point Surface>** in the configuration screen, the **SLOPE (F2)** key in the **Define** screen is disabled. Slope values for the reference point can not be entered. Press **CONT (F1)** to continue to the next screen. 
2.	It is now possible to stake out. Enter the appropriate values. 

Entering the values (Advanced Mode)

Step	Description
1.	After setting **<Slope Method: Ref. Point Surf:>** in the configuration screen, a task is created or selected and then the instrument is positioned and oriented. Press **CONT (F1)** to go to Task Management. 
2.	Enter appropriate values for the slope definition. Refer to "Road Selection Wizard - Slope Screen" for further details on using the Task selection wizard. Refer to "35.10.7 Extras for Slope" for details of the fields in this screen. Refer to "Slope staking using a reference point surface" for further details on using a reference point. Press **CONT (F1)** to continue to the next screen. 

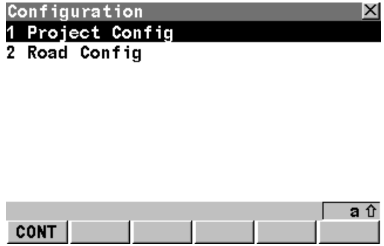
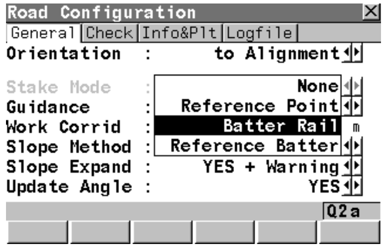
Workflow

- Refer to "Slope staking using a reference point surface" for more information on the reference point surface method.
- The first position to find is the catch point.

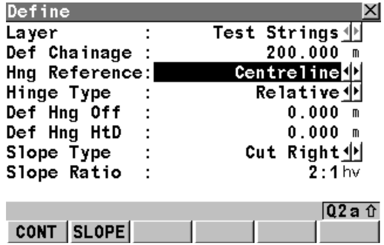
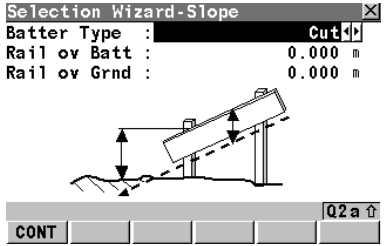
Step	Description
1.	Stake out the position of the catch point by using **<ΔOffset:>** and/or **<ΔHeight:>**. When **<ΔOffset:>** and **<ΔHeight:>** are equal to zero, the catch point has been located.
2.	**SHIFT EXTRA (F5)** to access **Extras- Slope**.
3.	Select **<Place Surface Reference Peg:>** to access the define screen for the reference peg field. The measured position from step 1. is used as the catch point for the stake out of the reference point. **<Act Hinge Height Diff:>** displays the hinge height difference value from **Stake- Slope**, **Info** page. Type in the appropriate value for **<Def Hinge Ht Diff:>**.
4.	Stake out the surface reference peg relative to the projected catch point. You are guided to the position. Values in **Stake Slope Ref. Point Surf**, **Stake** page guide you to the position to place the peg. The defined hinge height difference is taken into account.
5.	**ESC** to return to **Stake Slope**. Stake out the next catch point from this screen.

Defining the Slope Type - Using a Batter Rail

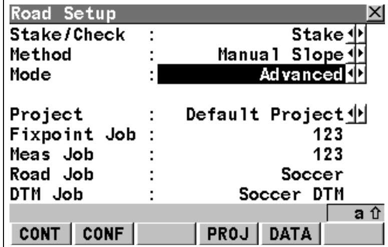
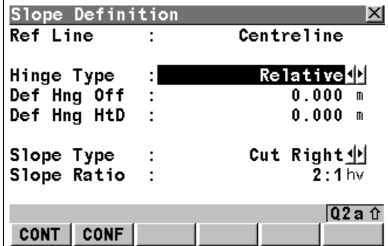
Configuring the slope

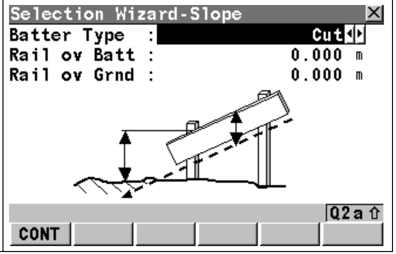
Step	Description
1.	Select **Road Config**. Press **CONT (F1)** to continue to the next screen. 
2.	When a batter rail is required, set **<Slope Method: Batter Rail>**. 

Entering the values (Standard Mode)

Step	Description
1.	After setting **<Slope Method: Batter Rail>** in the configuration screen, the **SLOPE (F2)** key in the Define screen is enabled and slope values for the batter rail can be entered. Press **SLOPE (F2)** to continue to the next screen. 
2. 2	It is now possible to stake out a batter rail with a defined peg height. Enter the appropriate values. 

Entering the values (Advanced Mode)

Step	Description	Screen
1.	After setting **<Slope Method: Batter Rail>** in the configuration screen, a task is created or selected and then the instrument is positioned and oriented. Press **CONT (F1)** to continue to the next screen.	
2.	Enter appropriate values for the slope definition. Refer to "35.10.7 Extras for Slope" for details of the fields in this screen. Refer to " Slope staking with batter rails" for further details on using a batter rail. Press **CONT (F1)** to continue to the next screen.	

Step	Description	Screen
3.	It is now possible to stake out a batter rail with a defined peg height. Enter the appropriate values. Refer to "Road Selection Wizard - Slope Screen" for further details on using the Task selection wizard.	

Workflow

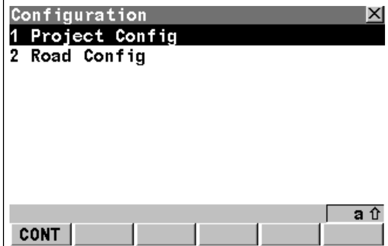
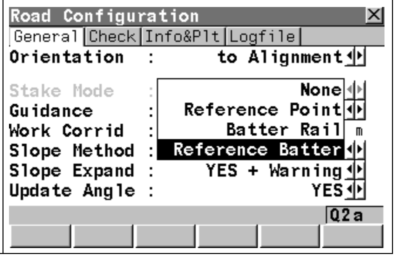
- Refer to "Slope staking with batter rails" for more information on the batter rail method.
- The first peg to stake out is always the peg closest to the hinge point.

Step	Description
1.	Stake out the position of the first peg of the batter by using **<ΔOffset:>**. The height of the rail over ground **<Rail over Grd:>** is taken into account for **<ΔOffset:>**. This means that when **<ΔOffset:>** is equal to zero the first peg is in the correct position.
2.	Place the pole on top of the first peg. The value for **<ΔHeight:>** indicates how far below the top of the peg the batter has to be placed.

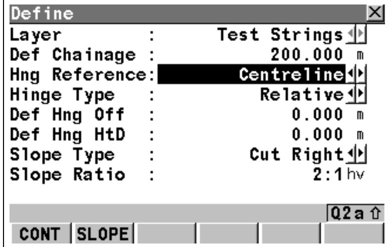
Step	Description
3.	Stake out the second peg of the batter rail by using **<ΔChainage:>** and place the peg.
4.	Place the pole on the position of the batter rail to be used as a reference for the slope values to mark on the batter rail. **<ΔHeight:>** should read now zero. Note that all values shown under the **Info** page are relative to the original slope.

Defining the Slope Type - Using a Reference Batter

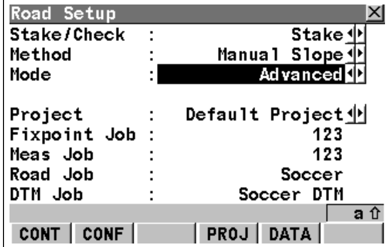
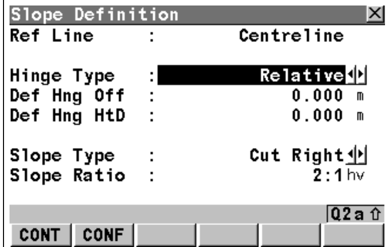
Configuring the slope

Step	Description	Screen
1.	Select **Road Config**. Press **CONT (F1)** to continue to the next screen.	
2.	When a reference batter is required, set **<Slope Method: Reference Batter>**.	

Entering the values (Standard Mode)

Step	Description	Screen
1.	After setting **<Slope Method: Batter Rail>** in the configuration screen, the **SLOPE (F2)** key in the **Define** screen is enabled and slope values for the batter rail can be entered. Press **SLOPE (F2)** to continue to the next screen.	
2.	It is now possible to stake out a batter rail with a defined offset from the catch point. Enter the appropriate values.	

Entering the values (Advanced Mode)

Step	Description	Screen
1.	After setting **<Slope Method: Batter Rail>** in the configuration screen, a task is created or selected and then the instrument is positioned and oriented. Press **CONT (F1)** to continue to the next screen.	
2.	Enter appropriate values for the slope definition. Refer to "35.10.7 Extras for Slope" for details of the fields in this screen. Refer to " Staking batter rails using a reference point" for further details on using a batter rail. Press **CONT (F1)** to continue to the next screen.	
3.	It is now possible to stake out a batter rail with a defined offset from the catch point. Enter the appropriate values. Refer to "Road Selection Wizard - Slope Screen" for further details on using the Task selection wizard.	

Workflow

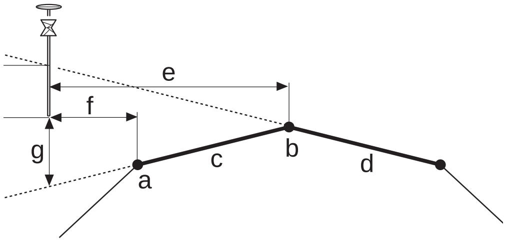
- Refer to "Staking batter rails using a reference point" for more information on the reference batter rail method.
- The first position to stake out is the catch point.

Step	Description
1.	Stake out the position of the catch point by using **<ΔOffset:>** and/or **<ΔHeight:>**. When **<ΔOffset:>** and **<ΔHeight:>** are equal to zero, the catch point has been located.
2.	**SHIFT EXTRA (F5)** to access **Extras- Slope**. The measured position is used as the catch point for the stake out of the reference point.
3.	Select **<Place Reference Point:>** to access the stake out screen for the reference peg **Stake - Refpoint**.
4.	Stake out the reference point using **<ΔOffset:>**. When **<ΔOffset:>** is equal to zero the reference peg position has been found.
5.	Place the pole on top of the reference peg. The value for **<ΔHeight:>** indicates how far below the top of the peg the batter has to be placed.
6.	Place the pole on the position of the batter rail to be used as a reference for the slope values to mark on the batter rail. **<ΔHeight:>** should now read zero. Note that all values shown under the **Info** page are relative to the original slope.
7.	**ESC** to return to **Stake Slope**. Stake out the next catch point from this screen.

35.5.11 Measuring Road Crowns

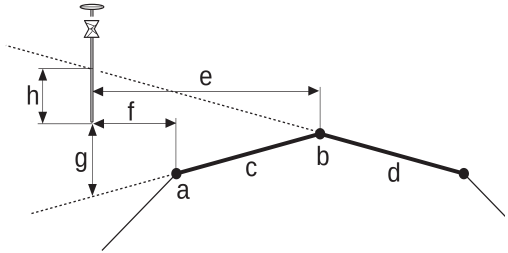
Graphical overview

Stake



a) Position to stake out, in this case the left stringline of the crown
b) Middle stringline of the crown, in this case also the centreline
c) Left X-slope to stake out
d) Right X-slope to stake out
e) **<CL Offset:>**
f) **<ΔOffset:>**
g) **<ΔHt Left:>**
h) **<ΔHt Right:>**

Check



a) Left stringline of the crown
b) Middle stringline of the crown, common for both X-slopes
c) Left X-slope to check
d) Right X-slope to check
e) **<CL Offset:>**
f) **<ΔOffset:>**
g) **<ΔHt Left:>**
h) **<ΔHt Right:>**

Description

- When staking road crowns, it allows the stake out of two X-slopes at the same time. If the zig zag mode is selected, Road automatically switches between the right and left X-slope as the reference for **<ΔOffset:>** depending on whether the measured position is to the left or right of the middle stringline.
- When checking road crowns, it allows the check of two X-slopes at the same time. The information for both X-slopes is shown at the same time.

Required elements A 3D design of the road is required.

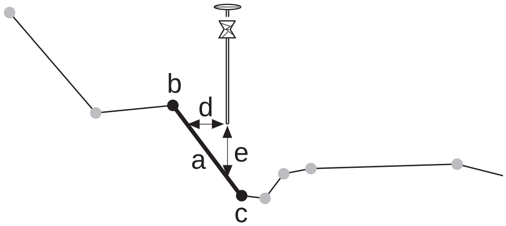
Specific fields The following fields vary from the description used in "35.5.2 The General Page":

Field	Option	Description
<ΔHt Left>, <**ΔHt Right:>**, **<ΔHt L:>** or **<ΔHt R:>**	Output	Vertical offset to the left/right X-slope defining the road crown.

35.5.12 Measuring Road Layers

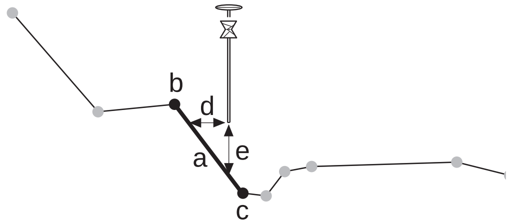
Graphical overview

Stake



a) Relevant part of the layer for the current position
b) Left stringline **<Left Name:>**
c) Right stringline **<Right Name:>**
d) **<ΔOffset:>**
e) **<ΔHeight:>**

Check



a) Relevant part of the layer for the current position
b) Left stringline **<Left Name:>**
c) Right stringline **<Right Name:>**
d) **<Slope Offset:>**
e) **<Layer Ht Diff:>**

Description

All stringlines are grouped in layers. Such a layer describes a surface of the road. When staking/checking out a layer, Road automatically detects the stringline left and right of the measured position.

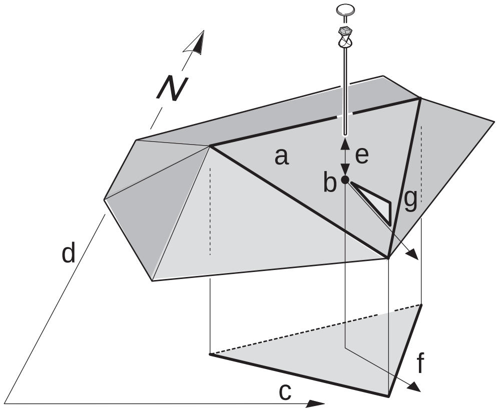
Required elements

A 3D design of the road is required.

35.5.13 Measuring Digital Terrain Models (DTM)

Graphical overview

Check



a) Relevant triangle of the DTM
b) Projected point on DTM
c) Easting
d) Northing
e) **<DTM Ht Diff:>**
f) **<Flow Directn:>**
g) **<Flow Ratio:>**

Description

A DTM check returns the height difference between the current height and the height the DTM at the measured position.

Required elements

A DTM job is required.

35.6 Configuring

35.6.1 Overview of all Configuration Settings

Accessing the screens

Press **CONF (F2)** on the **Road Begin** screen or **Road Setup** screen.

OR

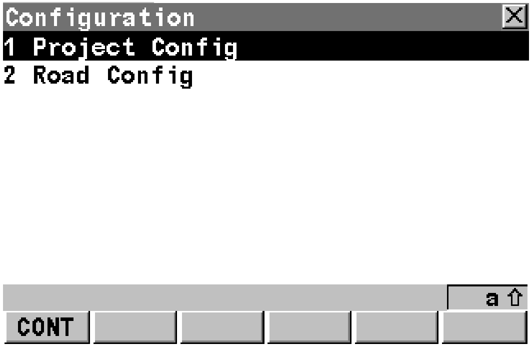
Press **SHIFT CONF (F2)** on the **Define** page and on any page of the measurement screen.

Description

The Road configurations are separated in three different groups:

Type	Description
System configuration	General parameters, for example, angle and distance units.
Project configuration	Project parameters, for example, the display format used for chainages.
Road configuration	Road parameters, for example, the vertical exaggeration of cross section plots.

Configuration



CONT (F1)
To access the highlighted configuration type.

Description of options

Option	Description
Project Config	These configuration settings refer to general parameters. They define the appearance and behaviour common for all parts of the Road program.
Road Config	These configuration settings refer to parameters that apply only to Road projects.

35.6.2 Configuration Settings for the Project - Project Config

Road Configuration, General page

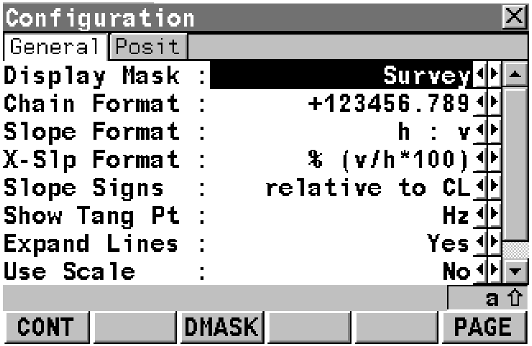
Access

Select **Project Config** on the **Road Configuration** screen and press **CONT (F1)**.

Description

This defines the appearance/behaviour common to all parts of the Road program.

Screen



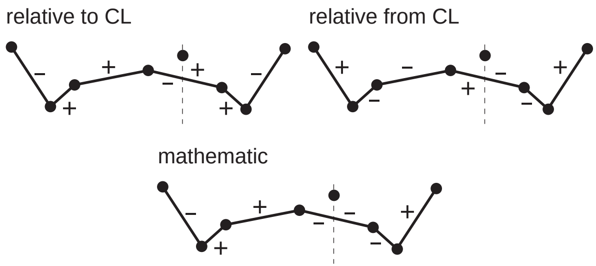
CONT (F1)
To confirm the changes and move to the previous screen.

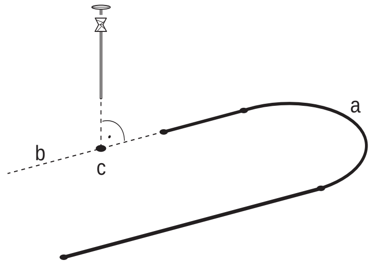
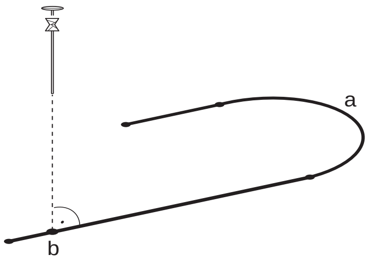
DMASK (F3)
To configure the selected display mask. Refer to "15.2 Display Settings".

Description of fields

Field	Option	Description
<Display Mask:>	Choicelist	Selects the user defined display mask shown in the application for all Stake and Check methods. All display masks of the active configuration set can be selected.
<Chain Format:>		Selects display format for all chainage information fields.
	+123456.789	Default chainage display form.
	+123.4+56.789	Separator between tens and hundreds with additional decimal point.
	+123+456.789	Separator between hundreds and thousands.
	+1234+56.789	Separators between tens and hundreds.
		The distance units **Int Ft/Inch (fi)**, **US Ft/Inch (ft)**, **Kilometres (km)** and **US Miles (mi)** are only supported by the first chainage format. All other chainage formats are restricted to the base units **Metre (m)**, **Int Ft (fi)** and **US Ft (ft)**.
	Peg Nº+10.000	In this format, a peg distance is used to calculate a peg number and determine what additional value is shown next to it.

Field	Option	Description
		For example, at chainage of 100 m and a peg distance of 20 m, the peg number equals 5 (100/20 = 5). Chainage 100 m = 5 + 0.000 Chainage 110 m = 5 + 10.000 Chainage -100 m = -5 - 0.000 Chainage -90 m = -4 -10.000
<Slope Format:>		Selects the display format for all slope values.
	h:v	Horizontal:Vertical; for example 5:2.
	v:h	Vertical:Horizontal; for example 2:5.
	% (v/h * 100)	For example 40%.
	Elev Angle	Angle, format depends upon system configuration. For example 21.8014 deg, 21°48'05'', 24.2238 gon. Refer to "17.1 Units & Formats" for information on available angle formats.
<X-Slp Format:>	**h:v**, **v:h**, **% (v/h * 100)** or **Elev Angle**	Same as **<Slope Format:>**. Refer to "**<Slope Format:>**" above.
<Slope Signs:>		Selects sign definition method for slopes and X-slopes.

Field	Option	Description
	mathematical	All slopes sign defines from left to right, independent of whether left or right of the centreline.
	relative to CL / relative from CL	Slope signs defined relative to/from the centreline. 
<Show Tang Pt:>		To define if a message box should be shown when a tangent point has been detected within the chainage increment range. This tangent point can be selected for stakeout. Refer to "35.5.3 The Stake Page" for further details.
	None	No tangent points will be indicated.
	Hz	Indicate tangent points of the horiz. alignment only.
	Vt	Indicate tangent points of the vert. alignment only.

Field	Option	Description
	Hz and Vt	Indicate all tangent points.
<Expand Lines:>		Expand each stringline at its beginning and end with a tangent. The extension is used for projecting a point to the stringline and for intersecting the stringline.
	Yes	 a) Centreline b) Extended centreline c) Projected point on extended centreline ☞ Intersection points on extended string-lines are not shown in cross-sections and can't be staked out.
	No	 a) Centreline b) Projected point on centreline

Field	Option	Description
		☞ It is recommended to use **Expand Lines: No** when working with closed alignments (for example roundabout, slip road, motorway exit).
<Use Scale:>	**No**	No scale factor is applied to length values. Length values are displayed in the grid format.
	Yes	A defined scale factor is applied to length values. All distance values (chainages, chainage increments, offsets, Δ chainage, Δ offset, Δ height, ...) are displayed in ground using the **<Scale factor:>**. ☞ The Road job data is still in grid format. ☞ All data is saved to the database in ground format. Only ground data is written to the log file.
<Scale Factor:>	User input	To apply an appropriate geodetic map projection to scale over the ground.

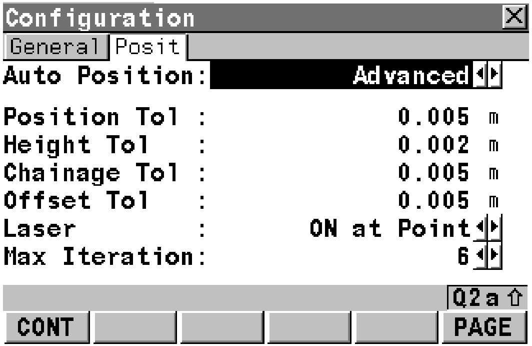
Next step
PAGE (F6) changes to the **Posit** page.

Road Configuration, Posit page

Description

This allows the instrument to aim at the position to stake/check. Refer to "35.6.5 Auto Positioning" for information on the different positioning types. This functionality is only available for motorised instruments.

Screen



CONT (F1)
To confirm the changes and move to the previous screen.

Description of fields

Field	Option	Description
<Auto Position:>		Type of automatic positioning used.
	None	No auto position.
	2D (Hz)	Instrument positions horizontally.
	3D (Hz & V)	Instrument positions horizontally and vertically.

Field	Option	Description
	2D + Meas	Instrument positions horizontally and finds the height by iterative distance measurements. Refer to " Auto Position 2D + Measure".
	Advanced	Allows to keep certain values of the current position to remain constant. Refer to " Auto Position Advanced". ☞ The following lines will only be enabled for **<Auto Position: 2D + Meas>** or **<Auto Position: Advanced>**.
<Position Tol:>	From **0.001** to **10**	2D distance tolerance to the position to stake out.
<Height Tol:>	From **0.001** to **10**	Height tolerance of the position to stake out.
<Chainage Tol:>	From **0.001** to **10**	Chainage tolerance of the position to stake out.
<Offset Tol:>	From **0.001** to **10**	Offset tolerance of the position to stake out.
<Laser:>		Defines when the red laser is turned on during the automatic search of the position.
	Always off	Visible red laser is turned off.
	On at Point	Visible red laser is turned on as soon as the point is found.

Field	Option	Description
	Always on	Visible red laser is turned on during the whole search. ☞ The laser can also be permanently turned on by using the instrument settings.
<Max Itera-tion:>	From **2** to **10**	Maximum number of iterations for the distance measurement before stopping.

Next step

CONT (F1) to accept the changes and continue.

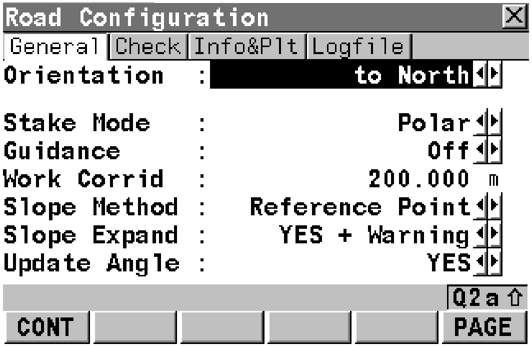
35.6.3 Configuration Settings for the Program - Road Config

Road Configuration, General page

Access

Select **Road Config** on the **Road Configuration** screen and press **CONT (F1)**.

Screen



CONT (F1)

To confirm the changes and move to the previous screen.

Description of fields

Field	Option	Description
<Orientation:>		The reference direction used to stake out points. The stake out elements and the graphics displayed are based on this selection.

Field	Option	Description
	to Align-ment	The stake out is relative to the alignment. When the stake out mode **<Stake Mode: Chain&Offset>** is chosen, this method is selected automatically.
	to North	The north direction is used as the reference direction.
	to Arrow	The direction of the orientation is from the current position to the position to stake out. The graphic displays a moving arrow pointing in the direction of the position to stake out.
	from Station	The reference direction is from the station to the current position.
	to Station	The reference direction is from the current position to the station.
<Stake Mode:>		Selects the stake out method. Defines the displayed type for the point to stake out.
	Polar	The angular difference from the orientation direction, the horizontal distance and the cut/fill is displayed.
	Orthogonal	The distance forwards/backwards and right/left to the point and the cut/fill is displayed.

Field	Option	Description
	Chain&Offset	Difference in chainage and offset to the stake out position. Only available for **<Orientate: To Alignment>**.
<Guidance:>	**Off**	Turns off the bulls-eye view on all stake out screens.
	Arrows	Height differences are shown using arrows up and down. Horizontal differences are represented with arrows left and right.
	Graphics	Bulls-eye view is turned on for all stake out screens.
	Arrows & Graphics	Horizontal and height differences are shown using arrows up/down and left/right. The bulls-eye view on all stake out screens is turned on.
<Work Corrid:>	User input	Useful for receiving warnings when you are located outside a defined working corridor and to clearly display a cross section in the plot page when working with irregular alignments, for example traffic islands and parking lots. Refer to "35.11.9 Working Corridor" for more information on the working corridor.

Field	Option	Description
<Slope Method:>	**None**, **Reference Point**, **Ref. Point Surf**, **Batter Rail** or **Reference Batter**	Selects the working method used for slope staking. Refer to "35.11.7 Methods for Slope Staking" for information on the different methods of slope staking.
<Slope Expand:>		To configure the warning handling for slope stake-out. This allows the workflow of slope stake-out to be optimised. Three methods are available.
	YES + Warning	The slope is expanded beyond and above or below the hinge point. A warning is shown as soon as leaving the defined area.
	YES	The slope is expanded beyond and above or below the hinge point. No warning is when leaving the defined area.
	NO	The slope is not expanded beyond and above or below the hinge point.
<Update Angle:>	**YES**	Angles are updated with telescope movement after a distance was measured.

Field	Option	Description
	NO	Angles and stake out values are updated after a distance measurement. All values are then frozen until the next distance is taken. When **<Automation: Track360>** is selected and the instrument is locked onto a target the angular values do not change.
<Offset Direc:>	**Perp to Align**	The offset angle is handled perpendicular to the alignment.
	Angle to Align	The offset angle is handled in relation to the tangent direction of the segment at the defined chainage, in clockwise direction. This option is taken into account for stakeout/check methods: • Stringline • Indiv Stringline • Manual Slope

Next step

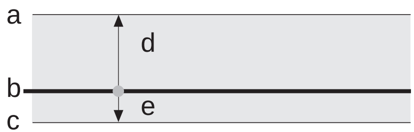
PAGE (F6) changes to the **Check** page.

Road Configuration, Check page

Description

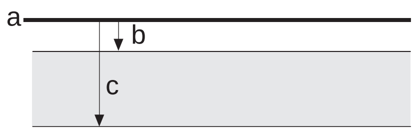
Especially when checking points in an as-built control it is useful to enable the Quality Check criteria available under Configuration. For every point stored the chosen parameters are checked and if the check limits are exceeded a warning is shown. This guarantees a higher productivity as it is no longer necessary to check the values for every shot taken. When checking layers of a road a too thick layer results in higher costs as more material is used, a too thin layer can lead to problems and might cause serious damage. Therefore Road enables you to define different check limits for above and below the design.

Graphic



a) Layer is too thick
b) Design surface
c) Layer is too thin
d) Height tolerance ↑
e) Height tolerance ↓

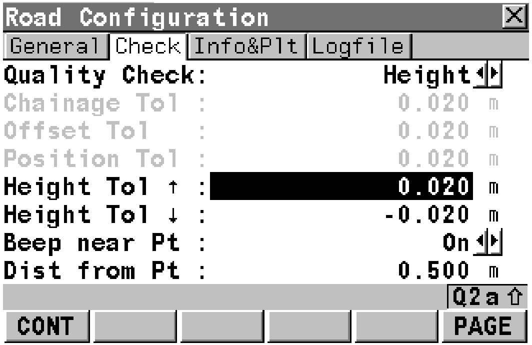
Be aware that height tolerances below the design surface are entered as negative values (for example, the **<Height Tol ↓:>** with -10 mm from above). By using the signs of the height tolerances it is also possible to cover situations like the one shown below with a valid range between -10 to -50 mm below the design surface.



a) Design surface
b) Height tolerance ↑
c) Height tolerance ↓

Like all configurations the settings for **<Height Tol ↓:>** and **<Height Tol ↑:>** are stored as part of the configuration set.

Screen



CONT (F1)
To confirm the changes and move to the previous screen.

Description of fields

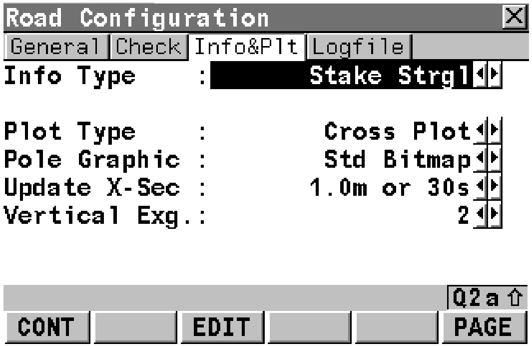
Field	Option	Description
<Quality Check:>		Activates a position check when storing a staked or checked point. When the defined tolerance is exceeded, the stake out/check can be repeated, skipped or stored.
	None	No quality check during stake out/check of points.
	Ch&Off&Ht	Check for chainage, horizontal offset and height.
	Ch&Off	Check for chainage and horizontal offset.
	Pos&Ht	Check for 2D position and height.

Field	Option	Description
	Position	Check for 2D position.
	Height	Check for height. ☞ Depending on this selection the lines below are enabled/disabled.
<Chainage Tol:>	From **0.001** to **100**	Maximum difference in chainage.
<Offset Tol:>	From **0.001** to **100**	Maximum horizontal offset from defined position.
<Position Tol:>	From **0.001** to **100**	Maximum radial horizontal distance.
<Height Tol ↑:>	From **0.001** to **100**	Maximum height difference.
<Height Tol ↓:>	From **0.001** to **100**	Maximum height difference.
<Beep near Pt:>	**On** or **Off**	Activates an acoustic warning signal when the horizontal radial distance from the current position to the point to stake out is equal or less than defined in **<Dist from Pt:>**.
<Dist from Pt:>	User input	Available when **<Beep near Pt: On:>** is selected. The horizontal radial distance from the current position to the point to stake out within which the acoustic warning signal is active.

Next step

PAGE (F6) changes to the **Info&Plt** page.

Road Configuration, Info&Plt page



CONT (F1)
To confirm the changes and move to the previous screen.

EDIT (F3)
To edit the highlighted **<Info Type:>**.

Description of fields

Field	Option	Description of Field
<Info Type:>	Choicelist	List of the different info pages available for stake-out and check. Refer to "35.6.4 Stake Out Info Page and Check Info Page" for information on how to define info pages.
<Plot Type:>		To configure the required plot view.
	Cross Plot	The **Plot** page in stake out and check shows a cross plot of the design at the current chainage.

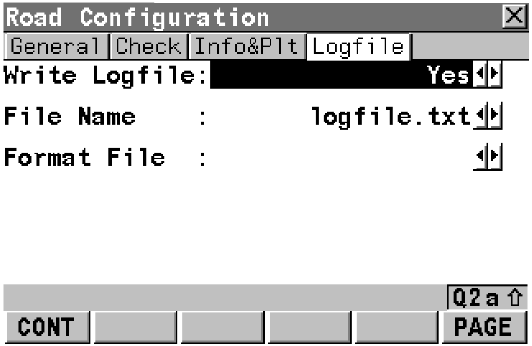
Field	Option	Description of Field
	Plan view	The **Plot** page in stake out and check shows the design from a birds eye view. The plan view includes the current station setup point, the point to stake out and the projected point on the stringline.
	Profile view	The **Plot** page in stake out and check shows a longsection (height over chainage) of the design.
<Pole Graphic:>	**Std Bitmap**	The pole indicating the current position in the stake out and check **Plot** page is shown as a standard bitmap.
	Actual Height	The pole indicating the current position in the stake out and check **Plot** page is scaled depending on the choosen pole height.
<Update X-Sec:>	**0.5m or 10s**, **1.0m or 30s** or **5.0m or 1min**	Update frequency of the cross section view on the **Plot** page when working in tracking mode.

Field	Option	Description of Field
		☞ The current position is updated with the selected frequency. Also all values shown for stake out or on the info pages are permanently updated. Only the representation of the cross section is updated after a chainage difference of X m and any X s/min. ☞ If not working in tracking mode the cross section view is updated with every measurement. ☞ A high update frequency can result in a lower measurement performance.
<Vertical Exg.:>	**0.5**, **1**, **2**, **5** or **10**	Vertical exaggeration for cross section plots. Vertical plot scale relative to horizontal.

Next step

PAGE (F6) changes to the **Logfile** page.

Road Configuration, Logfile page



CONT (F1)
To confirm the changes and move to the previous screen.

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	Activates the generation of a logfile using the selected **<Format File:>** and the storage of measured points. The logfile is generated when the application program is exited.

Field	Option	Description
<File Name:>	User input	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile has the extension *.log and is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **MANAGE Format Files** where an existing format file can be selected or deleted.

Next step

CONT (F1) to accept the changes and continue.

35.6.4 Stake Out Info Page and Check Info Page

Description

Depending on the working method used on the construction site, different information is written on the stakes. Road displays the information to be written on the stake on the **Info** page. The **Info** page can be customised to display the required information for each stake out and check method.

☞ Defining Info pages for Road follows the same philosophy used for display masks. Refer to the "15.2 Display Settings" for information on display masks.

Info pages

Check: Info Pages and corresponding methods

Nr	Method	Info Page type	Description
1	Stringline	**Check Strgl**	Used for Stringline.
2	Individual String-line	**Check Ind Strgl**	Used for Individual Stringline.
3	X-Slope	**Check X-Slope**	Used for X-Slope.
4	Slope Manual	**Check Man Slp**	Used for Slope manual.
5	Slope	**Check Slope**	Used for Slope.
6	Crown	**Check Crown**	Used for Crown.
7	Layer	**Check Layer**	Used for Layer.
8	DTM	**Check DTM**	Used for DTM.

Stake: Info Pages and corresponding methods

Nr	Method	Info Page type	Description
1	Stringline	**Stake Strgl**	Used for Stringline.
2	Individual String-line	**Stake Ind Strgl**	Used for Individual Stringline.
3	X-Slope	**Stake X-Slope**	Used for X-Slope.
4	Slope Manual	**Stake Man Slp**	Used for Slope Manual.
5	Slope	**Stake Slope**	Used for Slope.
6	Crown	**Stake Crown**	Used for Crown.
7	Layer	**Stake Layer**	Used for Layer.

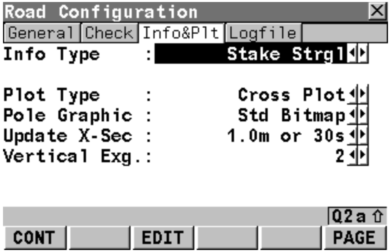
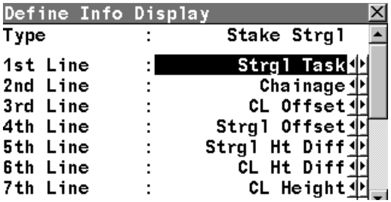
Changing display items of the Info page

Description

The different info pages are part of the configuration.

Changing items step-by-step

Step	Description
1.	Refer to "35.6.1 Overview of all Configuration Settings".
2.	Press **PAGE (F6)** until the **Info&Plt** page is active.
3.	**Configuration**, **Info&Plt** page

Step	Description
	Choose the **Info Type** to change. 
4.	Press **EDIT (F3)** to move to **Define Info Display**. Modifying of the selected **Info Type** can now begin. 

Next step

IF selected Info Type is	THEN
Check Strgl	refer to " Info page for Stringline".
Check Ind Strgl	refer to " Info page for Individual Stringline".

IF selected Info Type is	THEN
Check X-Slope	refer to " Info page for X-Slope".
Check Man Slp	refer to " Info page for Slope Manual and Slope".
Check Slope	refer to " Info page for Slope Manual and Slope".
Check Crown	refer to " Info page for Crown".
Check Layer	refer to " Info page for Layer".
Check DTM	refer to " Info page for DTM".
Stake Strgl	refer to " Info page for Stringline".
Stake Ind Strgl	refer to " Info page for Individual Stringline".
Stake X-Slope	refer to " Info page for X-Slope".
Stake Man Slp	refer to " Info page for Slope Manual and Slope".
Stake Slope	refer to " Info page for Slope Manual and Slope".
Stake Crown	refer to " Info page for Crown".
Stake Layer	refer to " Info page for Layer".

Info page for Stringline

Description

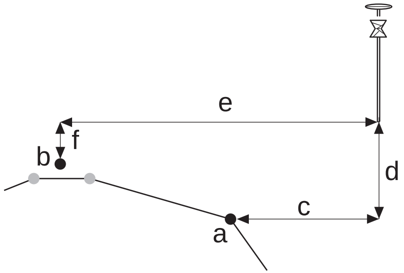
This info page is used for the following methods:

- Check **Stringline**
- Stake **Stringline**.

Access step-by-step

Step	Description
1.	Select **Road Config** in **Configuration**.
2.	Press **PAGE (F6)** until the **Info&Plt** page is active.
3.	**Configuration**, **Info&Plt** page Choose the **Info Type** to change: • for Check **<Info Type: Check Strgl>** • for Stake **<Info Type: Stake Strgl>**
4.	Press **EDIT (F3)** to move to **Define Info Display**. Modifying of the selected **Info Type** can now begin.

Available items



a) Stringline to stake out
b) Centreline
c) **<Strgl Offset:>**
d) **<Strgl Ht Diff:>**
e) **<CL Offset:>**
f) **<CL Ht Diff:>**

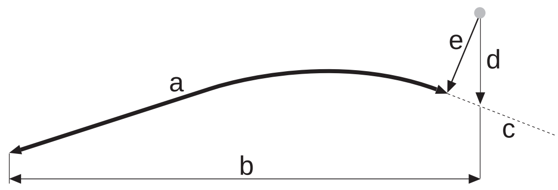
All fields from **Stake-Stringline**, **Stake** page are available for the **Info** page.

Description of fields

Field	Option	Description
<Strgl Task:>	Output	Name defined for the stringline/centreline task.
<ΔOffset:>	Output	Horizontal offset between the defined position and the current position. ☞ Refer to the different stake out methods for more details.
<ΔHeight:>	Output	Vertical offset between the defined position and the current position. ☞ Refer to the different stake out methods for more details.
<ΔChainage:>	Output	Difference between the defined chainage **<def Chainage:>** on the General page and the current chainage **<Chainage:>** shown on the **Stake** page. ☞ If no defined chainage exists, for example if staking out random chainages or checking, this field reads **<ΔChainage:----->**.
<Chainage:>	Output	The current chainage. This field is independent of the chosen **<Orientation:>** and **<Guidance:>** in **Configuration**.

Field	Option	Description
<def Chainage:>	Output	Chainage to stake-out.
<Strgl Offset:>	Output	Horizontal offset from the stringline.
<Strgl Ht Diff:>	Output	Height difference from the defined stringline.
<Strgl Name:>	Output	Name of the stringline to stake out or the stake out is relative to.
<2nd Line Name:>	Output	Name of the 2nd stringline.
<2nd Line Ch:>	Output	Current chainage at 2nd stringline, considering station start information if available.
<2nd Line Off:>	Output	Current perpendicular offset to the 2nd string-line including the defined stake/check **<2nd Line Off:>** of the **General** page.
<2nd Line HtD:>	Output	Current height difference to the 2nd stringline including the defined stake/check **<2nd Line HtD:>** of the **General** page.
<CL Ht Diff:>	Output	Height difference from the centreline.
<CL Height:>	Output	Height of the centreline at the current chainage.
<CL Radius:>	Output	Radius of the centreline at the current chainage.
<CL Type:>	Output	Curve type of the centreline.

Field	Option	Description
<CL Offset:>	Output	Perpendicular horizontal offset from the centreline. This field is independent of the chosen **<Orientation:>** and **<Guidance:>** in **Configuration**.
<CL Tangent:>	Output	Tangent direction of the centreline at the current chainage.
<Angle to Alig:>	Output	The defined value for the angle to alignment.
<Act Angle to Alig:>	Output	The current angle to alignment.
<Near Tang Pt:>	Output	Refer to "35.5.3 The Stake Page" for details on this field.
<Near Vt TngPt:>	Output	Distance to the nearest vertical tangent point of the design.
<Vert Sqr Off:>	Output	Offset perpendicular to the vertical component of the centreline. This value may be useful when dealing with pipelines, cables and in the construction segment.
<Vert Chainage:>	Output	Chainage the measured point is project to perpendicular to the vertical component of the centreline.

Field	Option	Description
		 a) Vertical chainage **<Vert Chainage:>** b) Chainage **<Chainage:>** c) Centreline d) Centreline height difference **<CL Ht Diff:>** e) Vertical square offset **<Vert Sqr Off:>**
<CL Grade:>	Output	Grade of the centreline at the current position.
<Dirc to Point:>	Output	Direction from the current position to the point to stake out.
<Dist to Point:>	Output	Distance from the current position to the point to stake out.
<Def Easting:>	Output	Easting of the point to stake out.
<Def Northing:>	Output	Northing of the point to stake out.
<Def Height:>	Output	Height of the point to stake out.
<Act Easting:>	Output	Easting of the current position.
<Act Northing:>	Output	Northing of the current position.
<Act Height:>	Output	Height of the current position.

Field	Option	Description
<Curr Des Est:>	Output	Easting of the design for the current position (relevant point at the centreline).
<Curr Des Nor:>	Output	Northing of the design for the current position (relevant point at the centreline).
<Curr Des Hgt:>	Output	Height of the design for the current position (relevant point at the centreline).
<Quality 3D:>	Output	The 3D coordinate quality of the point coordinates. Refer to "7.3 Point Management" for detailed information.

Next step

CONT (F1) to confirm the changes and continue.

Info page for Individual Stringline

Description

This info page is used for the following working methods:

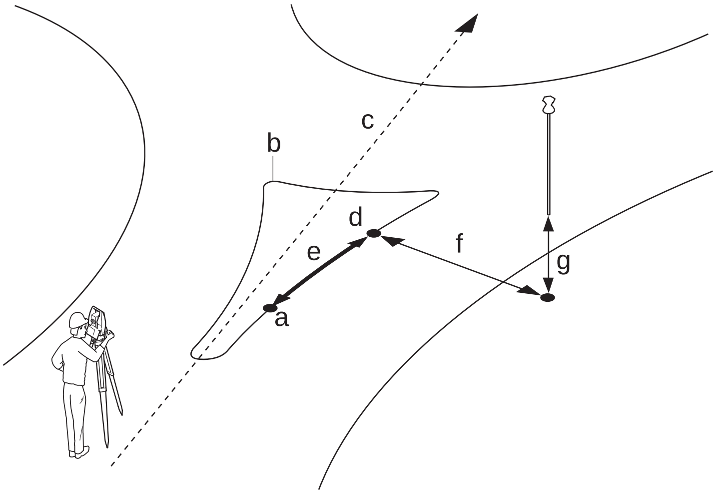
- Check **Individual Stringline**.
- Stake **Individual Stringline**

Access step-by-step

Step	Description
1.	Select **Road Config** in **Configuration**.
2.	Press **PAGE (F6)** until the **Info&Plt** page is active.

Step	Description
3.	**Configuration**, **Info&Plt** page Choose the **Info Type** to change: • for Check **<Info Type: Check Ind Strgl>** • for Stake **<Info Type: Stake Ind Strgl>**
4.	Press **EDIT (F3)** to move to **Define Info Display**. Modifying of the selected **<Info Type:>** can now begin.

Available items



Stake Out of Roundabout

a) Position to stake out

b) Stringline to stake out

c) Centreline

d) **<Chainage:>**

e) **<ΔChainage:>**

f) **<ΔOffset:>**

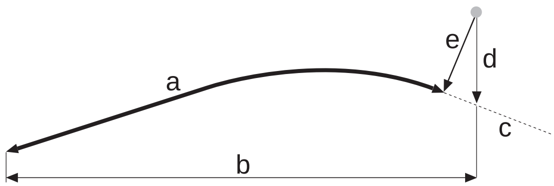
g) **<ΔHeight:>**

All fields from **Stake-Stringline**, **Stake** page are available for the **Info** page.

Field	Option	Description
<Strgl Task:>	Output	Name defined for the stringline/centreline task.
<2nd Line Name:>	Output	Name of the 2nd stringline.
<2nd Line Ch:>	Output	Current chainage at 2nd stringline, considering station start information if available.
<2nd Line Off:>	Output	Current perpendicular offset to the 2nd stringline including the defined stake/check **<2nd Line Off:>** of the **General** page.
<2nd Line HtD:>	Output	Current height difference to the 2nd stringline including the defined stake/check **<2nd Line HtD:>** of the **General** page.
<ΔOffset:>	Output	Horizontal offset between the defined position and the current position. Refer to the different stake out methods for more details.
<ΔHeight:>	Output	Vertical offset between the defined position and the current position. Refer to the different stake out methods for more details.

Field	Option	Description
<ΔChainage:>	Output	Difference between the defined chainage **<def Chainage:>** on the **General** page and the current chainage **<Chainage:>** shown on the **Stake** page. ☞ If no defined chainage exists, for example if staking out random chainages or checking, this field reads **<ΔChainage:----->**.
<Chainage:>	Output	The current chainage. This field is independent of the chosen **<Orientation:>** and **<Guidance:>** in **Configuration**.
<def Chainage:>	Output	Chainage to stake-out.
<Strgl Offset:>	Output	Horizontal offset from the stringline.
<Strgl Ht Diff:>	Output	Height difference from the defined stringline.
<Strgl Name:>	Output	Name of the stringline to stake out or the stake out is relative to.
<CL Ht Diff:>	Output	Height difference from the centreline.
<CL Height:>	Output	Height of the centreline at the current chainage.
<CL Radius:>	Output	Radius of the centreline at the current chainage.
<CL Type:>	Output	Curve type of the centreline.

Field	Option	Description
<CL Offset:>	Output	Perpendicular horizontal offset from the centreline. This field is independent of the chosen **<Orientation:>** and **<Guidance:>** in **Configuration**.
<CL Tangent:>	Output	Tangent direction of the centreline at the current chainage.
<Angle to Alig:>	Output	The defined value for the angle to alignment.
<Act Angle to Alig:>	Output	The current angle to alignment.
<Near Tang Pt:>	Output	Refer to "35.5.3 The Stake Page" for details on this field.
<Near Vt TngPt:>	Output	Distance to the nearest vertical tangent point of the design.
<Vert Sqr Off:>	Output	Offset perpendicular to the vertical component of the centreline. This value may be useful when dealing with pipelines, cables and in the construction segment.
<Vert Chainage:>	Output	Chainage the measured point is project to perpendicular to the vertical component of the centreline.

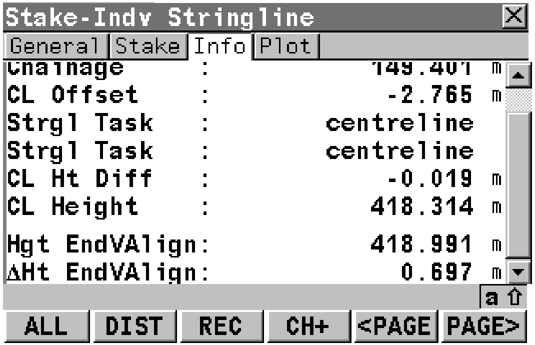
Field	Option	Description
		 a) Vertical chainage **<Vert Chainage:>** b) Chainage **<Chainage:>** c) Centreline d) Centreline height difference **<CL Ht Diff:>** e) Vertical square offset **<Vert Sqr Off:>**
<CL Grade:>	Output	Grade of the centreline at the current position.
<Dirc to Point:>	Output	Direction from the current position to the point to stake out.
<Dist to Point:>	Output	Distance from the current position to the point to stake out.
<Def Easting:>	Output	Easting of the point to stake out.
<Def Northing:>	Output	Northing of the point to stake out.
<Def Height:>	Output	Height of the point to stake out.
<Act Easting:>	Output	Easting of the current position.
<Act Northing:>	Output	Northing of the current position.

Field	Option	Description
<Act Height:>	Output	Height of the current position.
<Curr Des Est:>	Output	Easting of the design for the current position (relevant point at the stringline).
<Curr Des Nor:>	Output	Northing of the design for the current position (relevant point at the stringline).
<Curr Des Hgt:>	Output	Height of the design for the current position (relevant point at the stringline).
<Hgt EndVAlign:>	Output	Height at the endpoint of the vertical alignment of the stringline.
<ΔHt EndVAlign:>	Output	Height difference to the endpoint of the vertical alignment of the stringline.
<Quality 3D:>	Output	The 3D coordinate quality of the point coordinates. Refer to "7.3 Point Management" for detailed information.

Next step

CONT (F1) to confirm the changes and continue.

Working with pipelines



When staking/checking pipes a common task is to use height differences to the start/end of the pipe. The two Info page items for individual Stringlines enable you to add the height difference to the end of the vertical alignment **(<ΔHt EndVAlign:>)** as well as the height of the end of the vertical alignment **(<Ht EndVAlign:>)**.

Info page for X-Slope

Description

This info page is used for the following working methods:

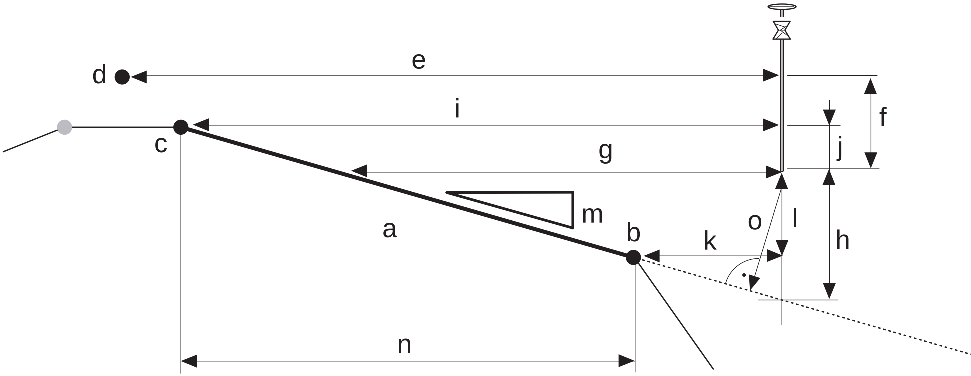
- Check **X-Slope**.
- Stake **X-Slope**

Access step-by-step

Step	Description
1.	Select **Road Config** in **Configuration**.
2.	Press **PAGE (F6)** until the **Info&Plt** page is active.
3.	**Configuration**, **Info&Plt** page

Step	Description
	Choose the **Info Type** to change: • for Check **<Info Type: Check X-Slope:>** • for Stake **<Info Type: Stake X-Slope:>**
4.	Press **EDIT (F3)** to move to **Define Info Display**. Modifying of the selected **<Info Type:>** can now begin.

Available items



a) X-slope to stake out
b) Right stringline of the X-slope **<Right Name:>**
c) Left stringline of the X-slope **<Left Name:>**
d) Centreline
e) **<CL Offset:>**
f) **<CL Ht Diff:>**
g) **<X-Slp Offset:>**
h) **<X-Slp Ht Diff:>**
i) **<Left Offset:>**
j) **<Left Ht Diff:>**
k) **<Right Offset:>**
l) **<Right Ht Diff:>**
m) **<Slope Ratio:>**
n) **<Width:>**
o) **<Square Off:>**

All fields from **Stake-X-Slope**, **Stake** page are available for the **Info** page.

Field	Option	Description
<X-Slope Task:>	Output	Name defined for the X-slope task.
<2nd Line Name:>	Output	Name of the 2nd stringline.
<2nd Line Ch:>	Output	Current chainage at 2nd stringline, considering station start information if available.
<2nd Line Off:>	Output	Current perpendicular offset to the 2nd stringline including the defined stake/check **<2nd Line Off:>** of the **General** page.
>2nd Line HtD:>	Output	Current height difference to the 2nd stringline including the defined stake/check **<2nd Line HtD:>** of the **General** page.
<ΔOffset:>	Output	Horizontal offset between the defined position and the current position. ☞ Refer to the different stake out methods for more details.
<ΔHeight:>	Output	Vertical offset between the defined position and the current position. ☞ Refer to the different stake out methods for more details.

Field	Option	Description
<ΔChainage:>	Output	Difference between the defined chainage **<def Chainage:>** on the **General** page and the current chainage **<Chainage:>** shown on the **Stake** page. If no defined chainage exists, for example if staking out random chainages or checking, this field reads **<ΔChainage:----->**.
<Chainage:>	Output	The current chainage. This field is independent of the chosen **<Orientation:>** and **<Guidance:>** in **Configuration**.
<def Chainage:>	Output	Chainage to stake-out.
<X-Slp Offset:>	Output	Horizontal offset from the X-slope.
<X-Slp Ht Diff:>	Output	Height difference to the X-slope. If no stake height difference is used **<X-Slp Ht Diff**: **ΔHeight>**.
<Left Name:>	Output	Name of the left stringline defining the X-slope.
<Left Offset:>	Output	Horizontal offset from the left point of the X-slope.
<Left Ht Diff:>	Output	Height difference from the left point of the X-slope.

Field	Option	Description
<Right Name:>	Output	Name of the right stringline defining the X-slope.
<Right Offset:>	Output	Horizontal offset from the right point of the X-slope.
<Right Ht Diff:>	Output	Height difference from the right point of the X-slope.
<Ref Line:>	Output	Indicates which side of the X-slope the stake out is relative to.
<Ref Offset:>	Output	Horizontal offset from the stringline of the X-slope used as reference. Depends on **<Ref Line:>** and is identical to **<Right Offset:>** or **<Left Offset:>**.
<Ref Ht Diff:>	Output	Height difference from the stringline of the X-slope used as reference. Depends on **<Ref Line:>** and is identical to **<Right Ht Diff:>** or **<Left Ht Diff:>**.
<X-Slope Ratio:>	Output	Slope ratio of the X-slope.
<Square Offset:>	Output	Offset from the X-slope, perpendicular to the X-slope.
<CL Ht Diff:>	Output	Height difference from the centreline.
<CL Height:>	Output	Height of the centreline at the current chainage.

Field	Option	Description
<CL Radius:>	Output	Radius of the centreline at the current chainage.
<CL Type:>	Output	Curve type of the centreline.
<CL Offset:>	Output	Perpendicular horizontal offset from the centreline. This field is independent of the chosen **<Orientation:>** and **<Guidance:>** in **Configuration**.
<CL Tangent:>	Output	Tangent direction of the centreline at the current chainage.
<Width:>	Output	Horizontal width of the X-slope.
<Near Tang Pt:>	Output	Refer to "35.5.3 The Stake Page" for details on this field.
<Near Vt TngPt:>	Output	Distance to the nearest vertical tangent point of the design.
<CL Grade:>	Output	Grade of the centreline at the current position.
<Dirc to Point:>	Output	Direction from the current position to the point to stake out.
<Dist to Point:>	Output	Distance from the current position to the point to stake out.
<Def Easting:>	Output	Easting of the point to stake out.
<Def Northing:>	Output	Northing of the point to stake out.

Field	Option	Description
<Def Height:>	Output	Height of the point to stake out.
<Act Easting:>	Output	Easting of the current position.
<Act Northing:>	Output	Northing of the current position.
<Act Height:>	Output	Height of the current position.
<Curr Des Est:>	Output	Easting of the design for the current position (relevant point on the X-Slope = **<Act Easting:>**).
<Curr Des Nor:>	Output	Northing of the design for the current position relevant point on the X-Slope = **<Act Northing:>**).
<Curr Des Hgt:>	Output	Height of the design for the current position (relevant point on the X-Slope).

Next step

CONT (F1) to confirm the changes and continue.

Info page for Slope Manual and Slope

Description

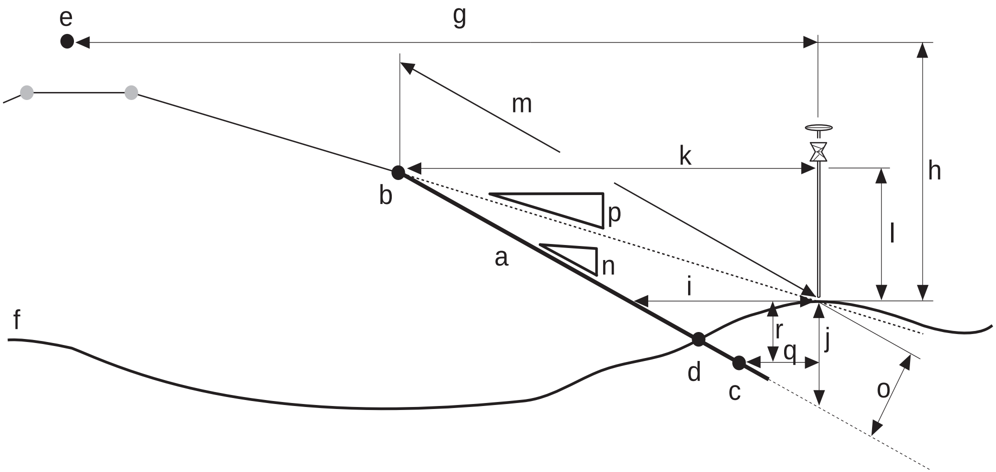
This info page is used for the following working methods:

- Check **Slope Manual**, **Slope**.
- Stake **Slope Manual**, **Slope**.

Access step-by-step

Step	Description
1.	Select **Road Config** in **Configuration**.
2.	Press **PAGE (F6)** until the **Info&Plt** page is active.
3.	**Configuration**, **Info&Plt** page Choose the **Info Type** to change: • for Check **<Info Type: Check Man Slope>**, **<Info Type: Check Slope>** • for Stake **<Info Type: Stake Man Slope>**, **<Info Type: Stake Slope>**
4.	Press **EDIT (F3)** to move to **Define Info Display**. Modifying of the selected **<Info Type:>** can now begin.

Available items



a) Slope to stake out/check
b) Hinge point **<Hinge Name:>**
c) Second stringline of slope **<2nd Name:>**
d) Real catch point
e) Centreline
f) Natural surface
g) **<CL Offset:>**
h) **<CL Ht Diff:>**
i) **<Slope Offset:>**
j) **<Slope Ht Diff:>**
k) **<Hinge Offset:>**
l) **<Hinge Ht Diff:>**
m) **<Slope Dist Hg:>**
n) **<Slope Ratio:>**
o) **<Square Offset:>**
p) **<Current Ratio:>**
q) **<2nd Offset:>**
r) **<2nd Ht Diff:>**

All fields from **Stake-Slope**, **Stake** page are available for the **Info** page.

Field	Option	Description
<Slope Task:>	Output	Name defined for the slope task.
<ΔOffset:>	Output	Horizontal offset between the defined position and the current position. Refer to the different stake out methods for more details.
<ΔHeight:>	Output	Vertical offset between the defined position and the current position. Refer to the different stake out methods for more details.
<ΔChainage:>	Output	Difference between the defined chainage **<def Chainage:>** on the **General** page and the current chainage **<Chainage:>** shown on the **Stake** page. If no defined chainage exists, for example if staking out random chainages or checking, this field reads **<ΔChainage:----->**.
<Chainage:>	Output	The current chainage. This field is independent of the chosen **<Orientation:>** and **<Guidance:>** in **Configuration**.
<def Chainage:>	Output	Chainage to stake-out.
<Slope Offset:>	Output	Horizontal offset from the slope.

Field	Option	Description
<Slope Ht Diff:>	Output	Height difference from the slope. If no stake height difference is used **<Slope Ht Diff**: **ΔHeight>**.
<Ht Diff Rail:>	Output	Height difference from the batter rail to mark the slope (for **<Slope Method: Batter Rail>**).
<Hinge Name:>	Output	Name of the stringline defining the hinge of the slope.
<Hinge Offset:>	Output	Horizontal offset from the hinge point of the slope.
<Hinge Ht Diff:>	Output	Height difference from the hinge point of the slope.
<2nd Name:>	Output	Name of the second stringline defining the slope.
<2nd Offset:>	Output	Horizontal offset from the second stringline of the slope.
<2nd Ht Diff:>	Output	Height difference from the second stringline of the slope.
<Slope Ratio:>	Output	Ratio of the slope. ☞ The display format depends on the type chosen for **<Slope Format:>** on the **Project Configuration**, **General** page.

Field	Option	Description
<Slope Dist Hg:>	Output	Slope distance to the hinge point. All defined settings for a batter rail or reference point are already taken into account. This is the information to write on the stake.
<Slope Rat Gon:>	Output	Slope ratio in gon.
<Slope Rat Deg:>	Output	Slope ratio in decimal degrees.
<Slope Rat %:>	Output	Slope ratio in percent.
<Current Ratio:>	Output	Ratio of the slope from the current position to the hinge. For the catch point the **<Actual Ratio:>** is identical to the **<Slope Ratio:>**.
<Square Offset:>	Output	Offset from the slope, perpendicular to the slope.
<CL Ht Diff:>	Output	Height difference from the centreline.
<CL Height:>	Output	Height of the centreline at the current chainage.
<CL Radius:>	Output	Radius of the centreline at the current chainage.
<CL Type:>	Output	Curve type of the centreline.

Field	Option	Description
<CL Offset:>	Output	Perpendicular horizontal offset from the centreline. This field is independent of the chosen **<Orientation:>** and **<Guidance:>** in **Road Configuration**.
<CL Tangent:>	Output	Tangent direction of the centreline at the current chainage.
<Angle to Alig:>	Output	Available for Manual Slope. The defined value for the angle to alignment.
<Act Angle to Alig:>	Output	Available for Manual Slope. The current angle to alignment.
<Traveler Ht:>	Output	Height of the traveller in use. Refer to "35.11.7 Methods for Slope Staking" for information on the different methods of slope staking.
<Near Tang Pt:>	Output	Refer to "35.5.3 The Stake Page" for details on this field.
<Near Vt TngPt:>	Output	Distance to the nearest vertical tangent point of the design.
<CL Grade:>	Output	Grade of the centreline at the current position.
<Dirc to Point:>	Output	Direction from the current position to the point to stake out.
<Dist to Point:>	Output	Distance from the current position to the point to stake out.

Field	Option	Description
<Def Easting:>	Output	Easting of the point to stake out.
<Def Northing:>	Output	Northing of the point to stake out.
<Def Height:>	Output	Height of the point to stake out.
<Act Easting:>	Output	Easting of the current position.
<Act Northing:>	Output	Northing of the current position.
<Act Height:>	Output	Height of the current position.
<Curr Des Est:>	Output	Easting of the design for the current position (relevant point on the X-Slope = **<Act Easting:>**).
<Curr Des Nor:>	Output	Northing of the design for the current position relevant point on the X-Slope = **<Act Northing:>**).
<Curr Des Hgt:>	Output	Height of the design for the current position (relevant point on the slope).
<Quality 3D:>	Output	The 3D coordinate quality of the point coordinates. Refer to "7.3 Point Management" for detailed information.

Next step
CONT (F1) to confirm the changes and continue.

Info page for Crown

Description

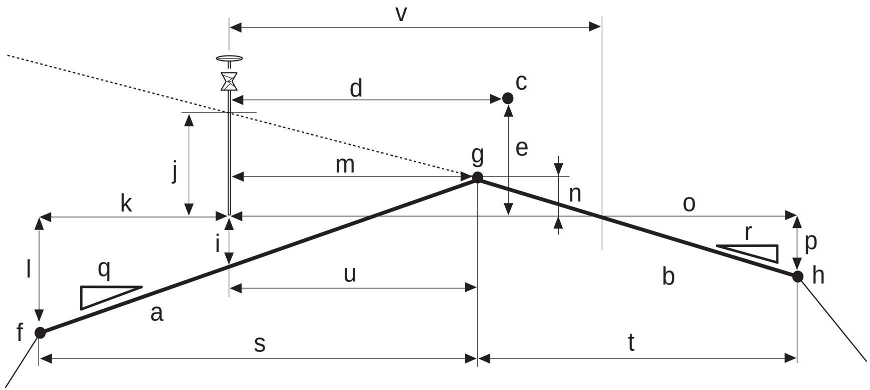
This info page is used for the following working methods:

- Check **Crown**.
- Stake **Crown**

Access step-by-step

Step	Description
1.	Select **Road Config** in **Configuration**.
2.	Press **PAGE (F6)** until the **Info&Plt** page is active.
3.	**Configuration**, **Info&Plt** page Choose the **Info Type** to change: • for Check **<Info Type: Check Crown>** • for Stake **<Info Type: Stake Crown>**
4.	Press **EDIT (F3)** to move to **Define Info Display**. Modifying of the selected **<Info Type:>** can now begin.

Available items



a) Left X-slope of road crown
b) Right X-slope of road crown
c) Centreline
d) **<CL Offset:>**
e) **<CL Ht Diff:>**
f) Left most stringline of the crown **<Left Name:>**
g) Middle stringline of the crown **<Mid Name:>**
h) Right most stringline of the crown **<Right Name:>**
i) **<Left XS Ht D:>**
j) **<Right XS Ht D:>**
k) **<Left Offset:>**
l) **<Left Ht Diff:>**
m) **<Mid Offset:>**
n) **<Mid Ht Diff:>**
o) **<Right Offset:>**
p) **<Right Ht Diff:>**
q) **<L X-Slp Ratio:>**
r) **<R X-Slp Ratio:>**
s) **<Left Width:>**
t) **<Right Width:>**

All fields from **Stake-Crown**, **Stake** page are available for the **Info** page.

Field	Option	Description of Field
<Crown Task:>	Output	Name defined for the road crown task.
<2nd Line Name:>	Output	Name of the 2nd stringline.
<2nd Line Ch:>	Output	Current chainage at 2nd stringline, considering station start information if available.
<2nd Line Off:>	Output	Current perpendicular offset to the 2nd stringline including the defined stake/check **<2nd Line Off:>** of the General page.
<2nd Line HtD:>	Output	Current height difference to the 2nd stringline including the defined stake/check **<2nd Line HtD:>** of the General page.
<ΔOffset:>	Output	Horizontal offset to the stringline of the crown defined as the reference line. If working in the zig zag mode, Road automatically selects the correct stringline as the reference depending on whether the measured point is to the left or right of the middle stringline. Refer to "35.4.11 The Zig Zag Mode" for more information on the zig zag mode.
<ΔHt Left:>	Output	Vertical offset to the left/right X-slope defining the road crown.
<ΔHt Right:>	Output	Vertical offset to the left/right X-slope defining the road crown.

Field	Option	Description of Field
<ΔChainage:>	Output	Difference between the defined chainage **<def Chainage:>** on the **General** page and the current chainage **<Chainage:>** shown on the **Stake** page. If no defined chainage exists, for example if staking out random chainages or checking, this field reads **<ΔChainage:----->**.
<Chainage:>	Output	The current chainage. This field is independent of the chosen **<Orientation:>** and **<Guidance:>** in **Configuration**.
<def Chainage:>	Output	Chainage to stake-out.
<Left XS Ht D:>	Output	Height difference from the road crowns left X-slope.
<Right XS Ht D:>	Output	Height difference from the road crowns right X-slope.
<Ht Diff Crown:>	Output	Height difference from **<Active X-Slp:>** of the crown.
<Active X-Slp:>	Output	Indicates if you are on the left or right X-slope of the road crown.

Field	Option	Description of Field
<Active XS Rat:>	Output	Slope ratio of **<Active X-Slp:>**. This value is equal to **<L X-Slp Ratio:>** or **<R X-Slp Ratio:>** depending on the value of **<Active X-Slp:>**.
<Left Name:>	Output	Name of the left most stringline defining the road crown.
<Left Offset:>	Output	Horizontal offset from the left stringline of the road crown.
<Left Ht Diff:>	Output	Height difference from the left stringline of the road crown.
<Right Name:>	Output	Name of the left most stringline defining the road crown.
<Right Offset:>	Output	Horizontal offset from the right stringline of the road crown.
<Right Ht Diff:>	Output	Height difference from the right stringline of the road crown.
<Mid Name:>	Output	Name of the mid stringline defining the road crown.
<Mid Offset:>	Output	Horizontal offset from the mid stringline of the road crown.
<Mid Ht Diff:>	Output	Height difference from the mid stringline of the road crown.
<L X-Slp Ratio:>	Output	Slope ratio of the road crowns left X-slope.

Field	Option	Description of Field
<R X-Slp Ratio:>	Output	Slope ratio of the road crowns right X-slope.
<Left Width:>	Output	Horizontal width of the road crowns left X-slope.
<Right Width:>	Output	Horizontal width of the road crowns right X-slope.
<CL Ht Diff:>	Output	Height difference from the centreline.
<CL Height:>	Output	Height of the centreline at the current chainage.
<CL Radius:>	Output	Radius of the centreline at the current chainage.
<CL Type:>	Output	Curve type of the centreline.
<CL Offset:>	Output	Perpendicular horizontal offset from the centreline. This field is independent of the chosen **<Orientation:>** and **<Guidance:>** in **Road Configuration**.
<CL Tangent:>	Output	Tangent direction of the centreline at the current chainage.
<Near Tang Pt:>	Output	Refer to "35.5.3 The Stake Page" for details on this field.
<Near Vt TngPt:>	Output	Distance to the nearest vertical tangent point of the design.
<CL Grade:>	Output	Grade of the centreline at the current position.

Field	Option	Description of Field
<Dirc to Point:>	Output	Direction from the current position to the point to stake out.
<Dist to Point:>	Output	Distance from the current position to the point to stake out.
<Def Easting:>	Output	Easting of the point to stake out.
<Def Northing:>	Output	Northing of the point to stake out.
<Def Height:>	Output	Height of the point to stake out.
<Act Easting:>	Output	Easting of the current position.
<Act Northing:>	Output	Northing of the current position.
<Act Height:>	Output	Height of the current position.
<Curr Des Est:>	Output	Easting of the design for the current position (relevant point on the crown = **<Act Easting:>**).
<Curr Des Nor:>	Output	Northing of the design for the current position relevant point on the crown = **<Act Northing:>**).
<Curr Des Hgt:>	Output	Height of the design for the current position (relevant point on the crown).

Next step

CONT (F1) to confirm the changes and continue.

Info page for Layer

Description

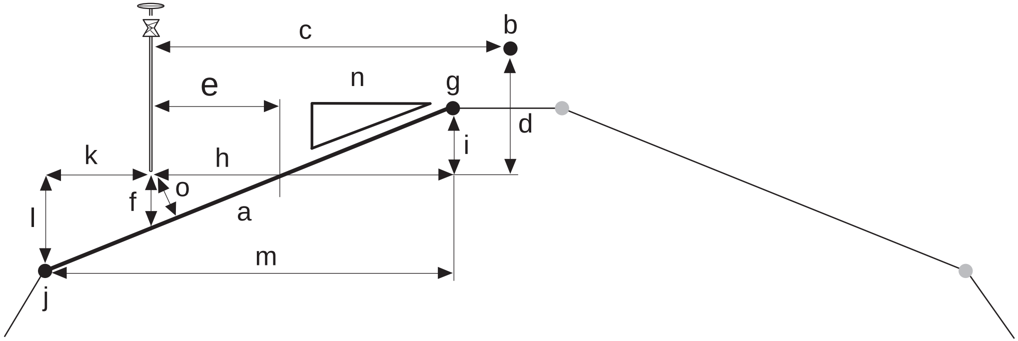
This info page is used for the following working methods:

- Check **Layer**.
- Stake **Layer**

Access step-by-step

Step	Description
1.	Select **Road Config** in **Configuration**.
2.	Press **PAGE (F6)** until the **Info&Plt** page is active.
3.	**Configuration**, **Info&Plt** page Choose the **Info Type** to change: • for Check **<Info Type: Check Layer>** • for Stake **<Info Type: Stake Layer>**
4.	Press **EDIT (F3)** to move to **Define Info Display**. Modifying of the selected **<Info Type:>** can now begin.

Available items



a) Relevant part of the layer
b) Centreline
c) **<CL Offset:>**
d) **<CL Ht Diff:>**
e) **<Slope Offset:>**
f) **<Layer Ht Diff:>**
g) **<Right Name:>**
h) **<Right Offset:>**
i) **<Right Ht Diff:>**
j) **<Left Name:>**
k) **<Left Offset:>**
l) **<Left Ht Diff:>**
m) **<Width:>**
n) **<Slope Ratio:>** or **<X-Slope Ratio:>**
o) **<Square Off:>**

All fields from **Roa**d **Stake-Layer**, **Stake** page are available for the **Info** page.

Field	Option	Description
<Layer Task:>	Output	Name defined for the layer task.
<Layer Name:>	Output	Name of the layer to check.
<Chainage:>	Output	Chainage of the current measured position.

Field	Option	Description
<ΔChainage:>	Output	Difference between the defined chainage **<def Chainage:>** on the **General** page and the current chainage **<Chainage:>** shown on the **Stake** page. If no defined chainage exists, for example if staking out random chainages or checking, this field reads **<ΔChainage:----->**.
<def Chainage:>	Output	Chainage to stake-out.
<Layer Offset:>	Output	Horizontal offset from the layer. Surface between the left line **<Left Line:>** and the right line **<Right Line:>**.
<Layer Ht Diff:>	Output	Height difference to the layer.
<ΔHeight:>	Output	Height difference to the layer.
<Left Name:>	Output	Name of the stringline next to the current position on the left hand side.
<Left Offset:>	Output	Horizontal offset from the left stringline **<Left Name:>**.
<Left Ht Diff:>	Output	Height difference to the left stringline **<Left Name:>**.
<Right Name:>	Output	Name of the stringline next to the current position on the right hand side.

Field	Option	Description
<Right Offset:>	Output	Horizontal offset from the right stringline **<Right Name:>**.
<Right Ht Diff:>	Output	Height difference to the right stringline **<Right Name:>**.
<Slope Ratio:>	Output	Ratio of the slope between the left stringline **<Left Name:>** and the right stringline **<Right Name:>**. ☞ The display format of the **<Slope Ratio:>** depends on the type chosen for **<Slope Format:>** on **Project Configuration**, **General** page.
<X-Slope Ratio:>	Output	Ratio of the X-slope between the left stringline **<Left Name:>** and the right stringline **<Right Name:>**. ☞ The display format of the **<X-Slope Rat:>** depends on the type chosen for **<X-Slope Format:>** on **Project Configuration**, **General** page.
<Square Offset:>	Output	Offset from the slope, perpendicular to the slope.
<CL Ht Diff:>	Output	Height difference from the centreline.
<CL Height:>	Output	Height of the centreline at the current chainage.

Field	Option	Description
<CL Radius:>	Output	Radius of the centreline at the current chainage.
<CL Type:>	Output	Curve type of the centreline.
<CL Offset:>	Output	Horizontal offset from the centreline at the current chainage.
<CL Tangent:>	Output	Tangent direction of the centreline at the current chainage.
<Near Tang Pt:>	Output	Refer to "35.5.3 The Stake Page" for details on this field.
<Near Vt TngPt:>	Output	Distance to the nearest vertical tangent point of the design.
<CL Grade:>	Output	Grade of the centreline at the current position.
<Act Easting:>	Output	Easting of the current position.
<Act Northing:>	Output	Northing of the current position.
<Act Height:>	Output	Height of the current position.
<Curr Des Est:>	Output	Easting of the design for the current position (relevant point on the layer = **<Act Easting:>**).
<Curr Des Nor:>	Output	Northing of the design for the current position relevant point on the layer = **<Act Northing:>**).

Field	Option	Description
<Curr Des Hgt:>	Output	Height of the design for the current position (relevant point on the layer).

Next step

CONT (F1) to confirm the changes and continue.

Info page for DTM

Description

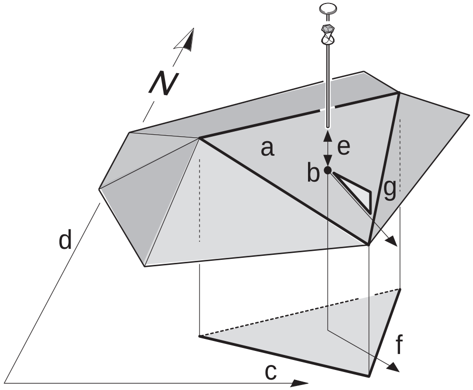
This info page is used for the following working methods:

- Check **DTM**.

Access step-by-step

Step	Description
1.	Select **Road Config** in **Configuration**.
2.	Press **PAGE (F6)** until the **Info&Plt** page is active.
3.	**Configuration**, **Info&Plt** page Choose the **Info Type** to change: • for Check **<Info Type: Check DTM>**
4.	Press **EDIT (F3)** to move to **Define Info Display**. Modifying of the selected **<Info Type:>** can now begin.

Available items



a) Relevant triangle of the DTM
b) Projected point on DTM
c) Easting
d) Northing
e) **<DTM Ht Diff:>**
f) **<Flow Directn:>**
g) **<Flow Ratio:>**

Field	Option	Description
<DTM Task:>	Output	Name defined for the DTM task.
<DTM Ht Diff:>	Output	Vertical height difference to the DTM.
<ΔHeight:>	Output	Height difference to the layer.
<DTM Height:>	Output	Height of the DTM at the current measured position.
<Flow Directn:>	Output	Direction of maximum slope ratio on the current DTM triangle. This is the direction water would flow towards from the projected point.
<Flow Ratio:>	Output	Slope ratio of the DTM. This is the maximum slope ratio of the triangle.

Field	Option	Description
<DTM Name:>	Output	Name of the DTM surface.
<Act Easting:>	Output	Easting of the current position.
<Act Northing:>	Output	Northing of the current position.
<Act Height:>	Output	Height of the current position.
<Curr Des Est:>	Output	Easting of the DTM for the current position (= **<Act Easting:>**).
<Curr Des Nor:>	Output	Northing of the DTM for the current position (= **<Act Northing:>**).
<Curr Des Hgt:>	Output	Height of the DTM for the current position.
<Quality 3D:>	Output	The 3D coordinate quality of the point coordinates. Refer to "7.3 Point Management" for detailed information.

Next step

CONT (F1) to confirm the changes and continue.

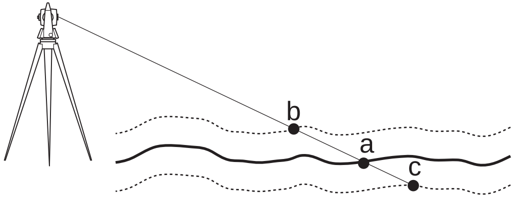
35.6.5 Auto Positioning

Description

To make stake out of points even more efficient a motorised instrument offers you the possibility to automatically aim to the stake out position. Various auto positioning methods are available:

Type	Description
2D	The instrument positions horizontally in the direction of the point to stake out.
3D	The instrument positions horizontally and vertically to the point to stake out.
2D + Meas	Positions the instrument using iterative measurements.
Advance	Offers the possibility of fixing certain stake out values.

When using the **3D** method the instrument will only point to the correct position on the ground if the point to stake out has the same height as the natural surface. If the natural surface is higher than the point to stake out, the measured point would be closer than the stake out point. If the natural surface is lower than the point, the measured point would be further away.



a) Point to stake out, defined with 3D coordinates
b) Position if natural surface is higher than point to stake out
c) Position if natural surface is lower than point to stake out

To avoid this problem Road offers the possibility of iterative positioning using the auto position method **2D + Meas**.

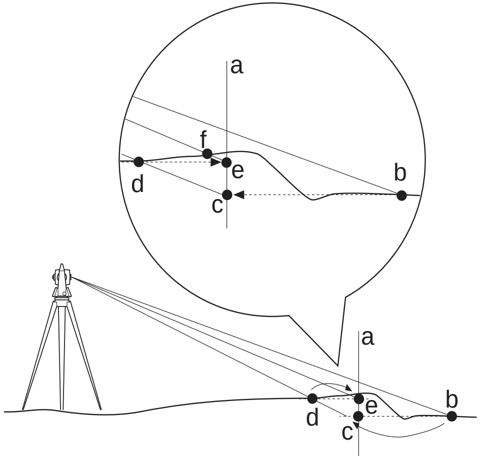
Auto Position 2D + Measure

Description

This auto position method **2D + Meas** allows the instrument to aim at a 2D position. As the natural surface height is unknown the correct position is calculated via iterations.

Workflow

The first position (b) the instrument points to is defined by the 2D coordinates (a) of the point to stake out (= horizontal direction) and the current vertical angle. Therefore, aim the instrument at the approximate position of the point to stake out.
Road then compares the measured 2D position with the stake out position to determine a new position (c) to aim at. As no information about the natural surface is available, Road calculates a point at the same height as the measured position. The new position (d) is measured and compared again with the point to stake out (a).
This iteration process runs until the tolerances defined for the stake out are reached.



a) 2D position to stake out
b) First position measured defined by 2D coordinates and current vertical angle
c) New position calculated based on height of b
d) Second position measured
e) New position calculated base on height of d. The measured position for this point is within the defined tolerance, the correct position is found.

Depending on the settings chosen on **Configuration**, **Posit** page the instrument will turn on the red laser as soon as the position is found.

Auto position step-by-step

Step	Description
1.	Select **Project Config** in **Configuration**.
2.	Press **PAGE (F6)** until the **Posit** page is active.
3.	**Configuration**, **Posit** page. Choose **<Auto Position: 2D + Meas>**.
☞	Make sure that the instrument uses the reflectorless EDM mode.

Step	Description
4.	As the instrument uses the current vertical angle for the first iteration aim the instrument at the position you expect the point to stake out.
5.	Press **SHIFT POSIT (F4)** to start the iterative positioning of the instrument.
☞	The instrument spins to the horizontal direction and uses the current vertical angle for the first iteration. As soon as the defined **<Position Tol:>** from **Configuration**, **Posit** is reached, the instrument stops.
☞	Depending on the settings chosen on **Configuration**, **Posit** page, the instrument turns on the red laser to mark the height.

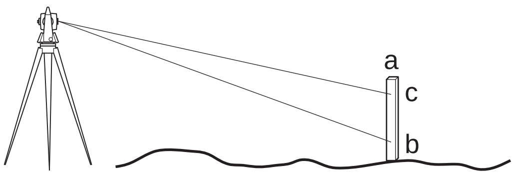
Auto Position Advanced

Description

The advanced option for auto positioning allows you to let the instrument aim at positions with certain parameters fixed. For example, let the instrument find the height on the peg.

Auto position step-by-step

In this example, the height of the X-slope should be marked on a peg by using the auto position function.



a) Peg placed at the correct position
b) First height, manually chosen direction
c) Required height on the peg

Step	Description
1.	Select **Project Config** in **Configuration**.
2.	Press **PAGE (F6)** until the **Posit** page is active.
3.	**Configuration**, **Posit** page. Choose **<Auto Position: Advanced>**.
☞	Make sure that the instrument uses the reflectorless EDM mode.
4.	After stake out of the peg at the correct position with **Stake X-Slope** aim the instrument at the peg.
5.	Press **SHIFT POSIT (F4)** to start the iterative positioning of the instrument.
6.	**Auto Position** Highlight **<Height:> (Dir = fixed)**.
7.	Press **CONT (F1)**
☞	The instrument will search for the point on the peg at the required height without changing the horizontal direction.
☞	As soon as the defined **<Height Tol:>** from **Configuration**, **Posit** is reached, the instrument stops. Refer to "35.6.5 Auto Positioning" for more information.
☞	Depending on the settings chosen on **Configuration**, **Posit** page, the instrument turns on the red laser to mark the height.

35.7 Managing the Project

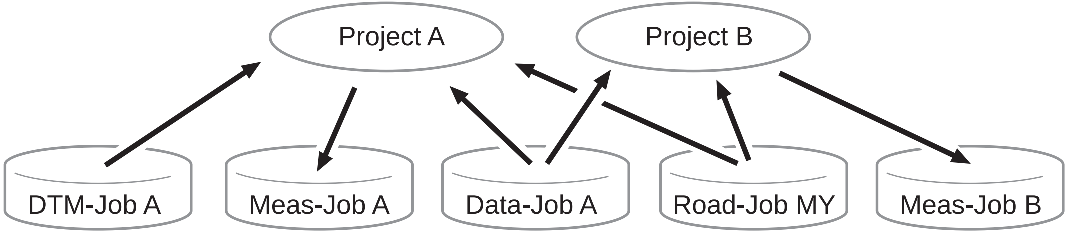
35.7.1 Overview

Description

- Working on a construction site implies working with various data such as:
  - Control points as reference
  - Data for road stake out
  - Measurement data
  - DTM's etc.
- To avoid having to select individual data sets each time the application is used, data can be grouped into projects. This makes the selection much easier and reduces the risk of selecting wrong data set.

Project

- A project consists of different kinds of jobs that belong together. By selecting a project automatically all referenced jobs are selected as well. A project can reference:
  - one fixpoint job
  - one measurement job
  - one road job
  - one DTM job.
- Since jobs are just referenced by a project, they can be used in more than one Road project, as well as in other applications. For example the same collection of control points may be used in two different projects.



Project A and Project B reference the same fixpoint job (Data-Job A) and road job (Road-Job MY), however, their results are stored into different measurement jobs (Meas-Job A; Meas-Job B).

Fixpoint job	The fixpoint job holds all control point information needed in the field. Control points are, for example, points with known coordinates used for a TPS set-up. The fixpoint job is a source of information. Data is read from it, but not written to it.
Measurement job	The measurement job is where information generated in the field is recorded. All measurements, points and other values stored in the field are added to this job.
Road job	All road design information, either typed in manually or exported from a design package is stored in the road job. Like the fixpoint job, it is a source of information. Refer to "35.8 Managing the Road Job" for more information on road jobs.
DTM job	Holds DTM or TIN data (**D**igital **T**errain **M**odel; **T**riangular **I**rregular **N**etwork). Like a fixpoint job or road job, the DTM job is a source of information. Refer to "35.8.6 Working with a DTM Job" for more information on DTM jobs.

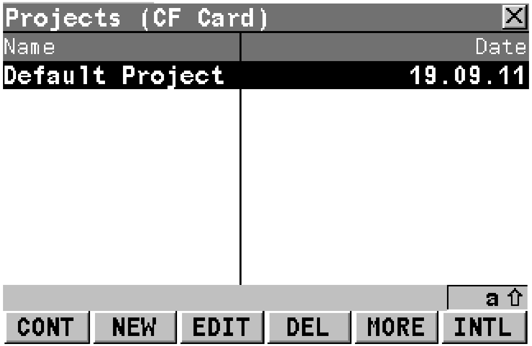
☞ The same job can be used as a fixpoint and measurement job.

☞ Road jobs and DTM jobs cannot be selected as a fixpoint or a measurement job. When selecting a job, a filter is applied to show only the relevant jobs in the selection list.

35.7.2 Selecting a Project from Task Management

Accessing the screens Projects (Device)

Highlight the Project on the **Setup** screen and press ENTER.



CONT (F1)
To select the highlighted project and to continue.

NEW (F2)
To create a new project. Refer to "35.7.4 Creating a New Project".

EDIT (F3)
To edit the highlighted project. This project also becomes the active project. Refer to "35.7.5 Editing an Existing Project".

DEL (F4)
To delete the highlighted project. Refer to "35.9.4 Deleting an Existing Project"

MORE (F5)
To toggle between the project date and project time.

SHIFT TIME/NAME (F5)
To sort the list by time or name.

35.7.3 Selecting a Project by Resuming the Last Task (Advanced Mode)

Description

Road remembers the last active task used on the project. When the application is resumed, the last active task is remembered and can be accessed again. This avoids the selection of project, method and task to be staked out or checked every time after turning off the instrument.

Accessing the screens

Press **RESUM (F4)** on the **Road Begin** screen.

35.7.4 Creating a New Project

Access

Press **NEW (F2)** on the **Road Projects** screen.

Description

Projects group the different kinds of jobs to give fast access and manage complex sites.

Create a project step-by-step

Step	Description
1.	Press **NEW (F2)** in Projects Management.
2.	**New Project**, **General** page. Define the following: • **<Name:>** (This field is mandatory), • **<Description:>**, • **<Creator:>** and • **<Device:>** for the project.
3.	Press **PAGE (F6)** changes to the **Jobs** page.
4.	**New Project**, **Jobs** page. Choose the following jobs to be used in the new project: • **<Fixpoint Job:>**, • **<Meas Job:>**, • **<Road Job:>** and • **<DTM Job:>**. It is possible to add or remove jobs to the project at a later stage.
5.	Press **STORE (F1)** to accept the changes and continue.

35.7.5 Editing an Existing Project

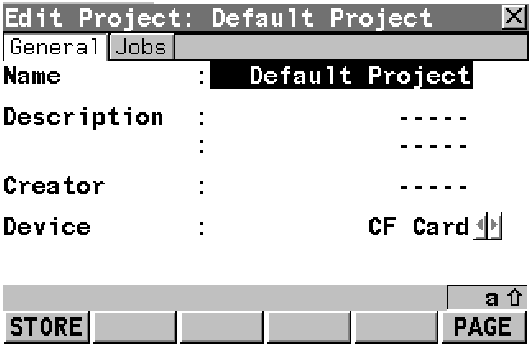
Access

Highlight the desired project and press **EDIT (F3)** on the **Road Projects** screen.

Description

The project details contain general information about the project as well as the list of jobs referenced by the project.

Edit Project Job Name, General page



STORE (F1)
To accept changes and continue.

Description of fields

Field	Option	Description of Field
<Name:>	User input	Project name, must be unique. This field is mandatory.
<Description:>	User input	Two line description of the project.
<Creator:>	User input	Name of the creator of the project.
<Device:>	**CF Card**	The device on which the job is stored.

Next step

PAGE (F6) changes to the **Jobs** page.

Edit Project: Job Name, Jobs page

STORE (F1)
To accept changes and continue.

Description of fields

Field	Option	Description
<Fixpoint Job:>	Choicelist	The job that contains the point data to be used.
<Meas Job:>	Choicelist	The active job. Points which are occupied in staking out or check are stored in this job. The data from this job is shown in **MANAGE Data: Job Name**.
<Road Job:>	Choicelist	The active road job. Refer to "35.8 Managing the Road Job".

Field	Option	Description
<DTM Job:>	Choicelist	The active DTM job. DTM jobs may be created in GGO. Refer to "35.8.6 Working with a DTM Job".

Next step

CONT (F1) to accept the changes and continue.

☞ Selecting a **<Fixpoint Job:>** and a **<Meas Job:>** is mandatory.

☞ Every job selection will bring up only the jobs that are valid. For example, the list of **<Road Job:>** is different to the one for **<Meas Job:>** and **<Fixpoint Job:>**.

35.8 Managing the Road Job

35.8.1 Overview

Two parts

Each road job consists of two major parts:

- **Design data:** Contain all the information about the road design. For example, the geometry of the centreline or the formation layer of the road. These data are either typed in manually or converted from a road design package. Refer to "35.8.4 Creating a New Road Job" for information on how to create road jobs.
- **Working tasks:** Define how the different elements of the road design are used within the stake out or check situations. For example, the same edge of the road is staked out once to define the shoulder and a second time with a certain offset as the gutter. Refer to "35.4 Step 3 - Working in Advanced mode" for more information on tasks.

Tasks define how the design elements of the road are staked out or checked in the field.

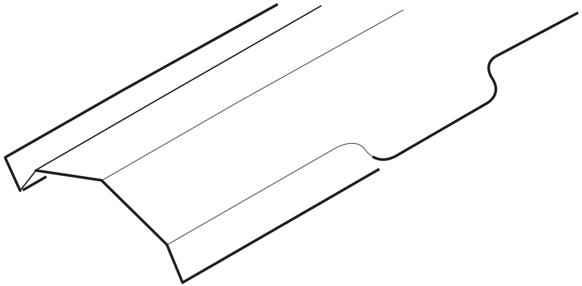
35.8.2 Working with the Design Data (Stringlines and Layers)

Description

Depending on the complexity of the road job, the design data may vary from being a single horizontal alignment to a design containing profiles with dozens of defined vertices. Road offers the possibility of grouping these design elements logical for faster access.

Stringlines

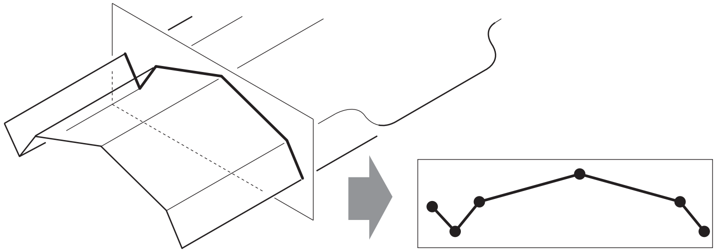
When manually typing in a road job, alignments and cross sections are used. Alignments are defined by geometric elements, for example straights and arcs, and the cross sections by vertices. Furthermore, one defines at which chainage a certain cross section is used. By doing this the vertices are connected to create a series of lines representing the three dimensional design of the road.



Stringline representation of a road design.

In Road such lines defining the design are called stringlines. Stringlines are the base elements used for stake out and check activities. Stringlines have a project unique name by which they are identified and selected. Whenever a new road design is typed in or imported from a design package these stringlines are generated automatically in the background.

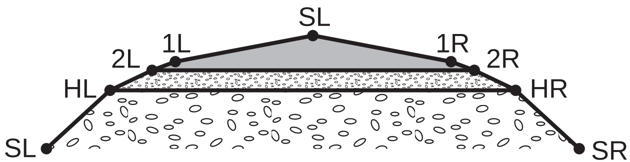
☞ A cross section may be derived from the stringline model by slicing the group of stringlines with a vertical plane orthogonal to the centreline.



Vertical cut of a stringline group defines a cross section.

Layers

Roads generally consist of layers made of different materials, for example road surface of asphalt or concrete, layers of different gravel and so on. At different times throughout a project it may be required to work with different layers of the road. Road allows the possibility of creating such layers by grouping together sets of stringlines.



Example for a road with three different layers (general fill, gravel, final surface).

Type	Description
Layer one - general fill	Defined by the two hinge points HL, HR and the slope points SL, SR.

Type	Description
Layer two - gravel	Defined by the two hinge points HL, HR and 2L, 2R.
Layer three - final surface	Defined by the centreline CL and by 1L, 2L, 1R, 2R.

☞ Stringlines are referenced by layers and can be used in more than one layer.

☞ Every layer is relative to a centreline. This centreline does not have to be a part of the layer. In the previous example, layer one - general fill - uses the centreline for calculation even though the centreline is not part of the layer surface. Whereas the centreline is part of layer three - final surface.

35.8.3 Working with the Tasks (Advanced Mode)

Description

When staking out or checking a road, it is often the case that it is not possible to finish a particular task in one go. Road gives you the possibility of storing the element to be staked out or checked together with all defined settings as a work task. Tasks are stored as a part of the project.

Such tasks are also useful when working in a noisy and rough environment where it is not possible to reflect on whether a particular parameter should be used or not. In this case, you can define a task in the office and simply call-up the task in the field.

Every element defined for stake out or check, independent of whether it is a stringline, slope, X-slope, crown, layer or DTM, may be stored as a task. Tasks are created in the same way as elements are selected, during stake out or check. Refer to "35.4 Step 3 - Working in Advanced mode" for more information on creating tasks using the selection wizard.

☞ Tasks use the basic elements of every road job: stringlines. Deleting or modifying a stringline used for a task automatically affects the task.

☞ The seven last used tasks used on the project of each stake out/check type are remembered. For example the stake out method **Stringline** retains the last seven stringlines staked out/checked in this project.

35.8.4 Creating a New Road Job

Description

There are two ways of creating road jobs:

Typing them in manually by using the Alignment Tool Kit (ATK) program.

OR

Converting data created in a design package.

Manually entered data

Data can be typed in and edited with ATK. Refer to "34 Roads - ATK" for information on how to enter data manually.

Converted data

The Design to Field component of GGO offers converters from several road design and CAD packages. Several design packages also include a built in converter to Road. As different design packages follow different philosophies in representation, creation and storage of data the conversion process differs slightly.

The GGO can be found on the Zoom80 release DVD.

35.8.5 Deleting an Existing Road Job

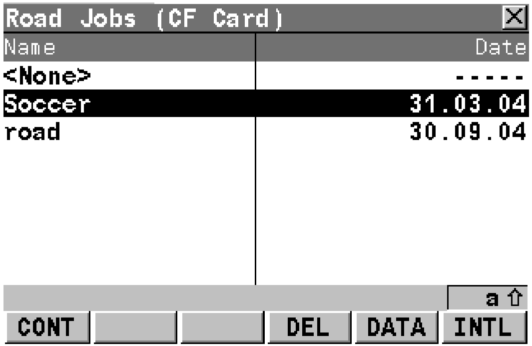
Access

Highlight the desired job and press **DEL (F4)** on the **Road Jobs** screen.

Description

Road jobs, like measurement jobs, fixpoint jobs and DTM jobs, are only referenced by a project, this means that it is possible to use one job in more than one project. Deleting a road job deletes it from all projects that may reference it.

Road Jobs (Device)



CONT (F1)
To select the highlighted road job and return to the previous screen.

DEL (F4)
To delete the highlighted road job.

DATA (F5)
To view/edit the data from the road job. Refer to "35.6 Configuring".

Delete road job step-by-step

Step	Description
1.	**Road Jobs (Device)**. Highlight the road job to delete.
2.	Press **DEL (F4)** to delete the road job.

Next step

CONT (F1) to accept the changes and continue.

35.8.6 Working with a DTM Job

Access

Highlight the **<DTM Job:>** on the **New Project** or **Edit Project**, **Jobs** page and press **ENTER**.

Description

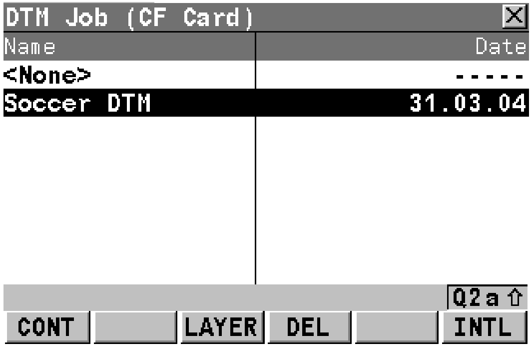
A DTM job (**D**igital **T**errain **M**odel) may consist of multiple DTM layers or surfaces. These DTM layers may cover either different locations, be on top of each other or even intersect each other. Refer to "35.11.3 Basic Elements for Road Stake and Check Measurements" for more information on DTM jobs in projects.

DTM jobs consist like road jobs of two major parts:

Type	Description
Design part	Contains all the information of the different triangle representing the various DTM layers.
Work task part	Defines how the DTM represented in the design part should be used in the field. For example which vertical shift should be added to the defined DTM surface. Tasks are stored as a part of the project.

☞ DTM's are used in the Road check method DTM.

DTM Jobs (Device)



CONT (F1)
To select the highlighted DTM job and continue.

LAYER (F3)
To view the DTM layers of the highlighted DTM job.

DEL (F4)
To delete the highlighted DTM job.

35.9 Viewing and Editing the Design Data

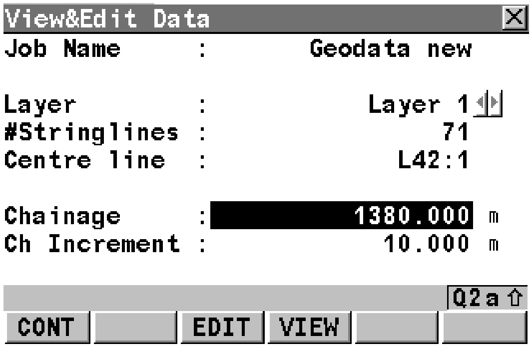
35.9.1 Overview

Access

Press **DATA (F5)** on the **Road Setup** screen or **Road Jobs** screen.

Road View&Edit Data

The design data stored within the road job contains all of the information about the road design. This includes the stringlines and layers (for example, the geometry of the centreline or the layers of the different materials/surfaces which form the road). The design data can be viewed and partially edited in these **View** and **Edit** screens.



CONT (F1)
To return to the **Road Setup** screen.

EDIT (F3)
To edit the following design data:
1) to edit the general job details,
2) to select another centreline and include/exclude stringlines from the selected layer,
3) to change the start chainage of the centreline of the selected layer.

VIEW (F4)
To view the following design data in a selected layer:
1) to view specific details of the layer centreline,
2) to view the list of all stringlines in the layer,
3) to view cross-section plots.

Description of fields

Field	Option	Description
<Job Name:>	Output	The name of the active road job, as defined in the project.
<Layer:>	Output or choicelist	To select a layer from the active road job. All of the layers within the active road job can be selected.
<#String-lines:>	Output	The number of stringlines from the selected layer.
<Centre line:>	Output or user input	The name of the layer centreline.
<Chainage:>	Output or user input	To enter a start chainage to use when viewing the data. The default value is the start chainage of the layer centreline.
<Ch Incre-ment:>	Output	To enter a chainage increment to use when stepping through the data

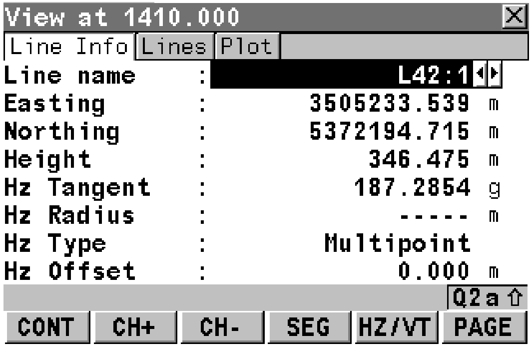
If a centreline has not been defined, a start chainage cannot be entered and the field will be shown as "**----**". If a centreline has not been defined, a chainage increment cannot be entered and the field will be shown as "**----**".

35.9.2 Viewing the Design Data

Access

Press **VIEW (F4)** on the **Road View&Edit Data** screen.

Viewing details of the layer centreline



CONT (F1)
To return to the **View&Edit Data** screen.

CH+ (F2)
To increase the chainage by the chainage increment, as defined in the **View&Edit Data** screen.

CH- (F3)
To decrease the chainage by the chainage increment, as defined in the **View&Edit Data** screen.

SEG (F4)
To enter the **Segment Info** screen.

HZ/VT (F5)
To toggle between the vertical alignment data and the horizontal alignment data.

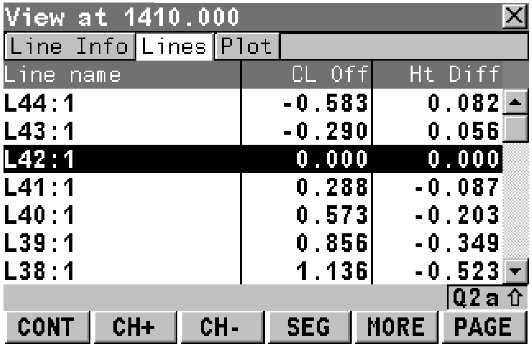
PAGE (F6)
To move to the next page.

SHIFT INIT (F5)
To force a re-calculation of all values.

Description of fields

Field	Option	Description
<Line name:>	Choicelist	To select a stringline from the layer.
<Easting:>	Output	The East coordinate of the stringline.
<Northing:>	Output	The North coordinate of the stringline.
<Height:>	Output	The height of the stringline.
The following fields/values can be toggled, by using the **HZ/VT (F5)** softkey:		
<Hz Tangent/Grade:>	Output	The tangent direction or grade of the stringline.
<Hz/Vt Radius:>	Output	The horizontal/vertical radius of the stringline segment.
<Hz/Vt Type:>	Output	The horizontal/vertical segment type.
<Hz/Vt Offset:>	Output	The horizontal/vertical offset to the layer centreline.
☞ If a value has not been defined, the field will be shown as "**-----**".		

Viewing a list of all stringlines in the layer



CONT (F1)
To return to the **View&Edit Data** screen.

CH+ (F2)
To increase the chainage by the chainage increment, as defined in the **View&Edit Data** screen.

CH- (F3)
To decrease the chainage by the chainage increment, as defined in the **View&Edit Data** screen.

SEG (F4)
To enter the **Segment Info** screen.

MORE (F5)
To toggle between the height differences or absolute heights at the selected chainage.

PAGE (F6)
To move to the next page.

SHIFT HOME (F2)
To move to the start of the list of string-lines.

SHIFT END (F3)
To move to the end of the list of string-lines.

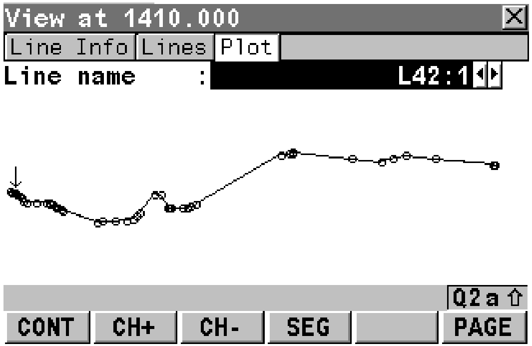
SHIFT INIT (F5)
To force a re-calculation of all values.

Description of columns

Column	Description of column
Line Name	The name of the stringline in the selected layer.
CL off	The offset of the stringline from the layer centreline.
The following columns/values can be toggled, by using the **MORE (F5)** softkey:	
Ht Diff	The height difference of the stringline to the layer centreline.
Height	The absolute height of the stringline.

Viewing cross sections

This page shows a cross section view of the design data at the selected chainage and the name of the selected stringline. Only stringlines with height information are shown. The displayed arrow points at the centreline or at the stringline which was last selected. No selection or zoom/pan functionality is available.



CONT (F1)
To return to the **View&Edit Data** screen.

CH+ (F2)
To increase the chainage by the chainage increment, as defined in the **View&Edit Data** screen.

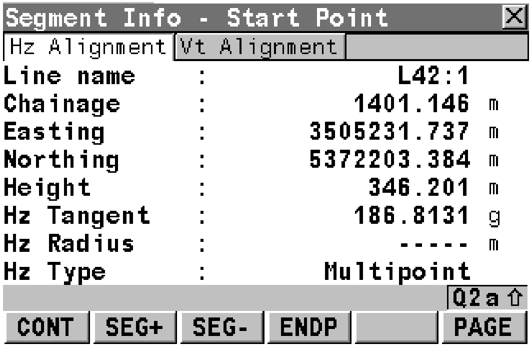
CH- (F3)
To decrease the chainage by the chainage increment, as defined in the **View&Edit Data** screen.

SEG (F4)
To enter the **Segment Info** screen.

PAGE (F6)
To move to the next page.

SHIFT INIT (F5)
To force a re-calculation of all values.

Viewing the segment: the Hz Alignment page



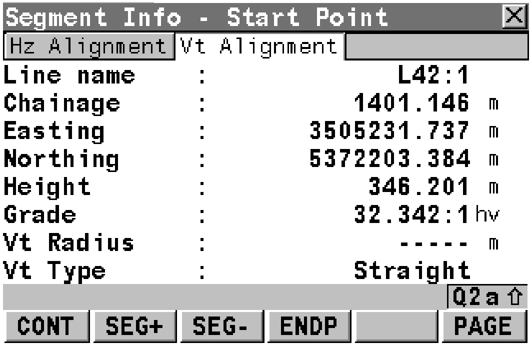
CONT (F1)
To return to the **View** screens.
SEG+ (F2)
To move to the next segment.
SEG- (F3)
To move to the previous segment.
ENDP/STRTP (F4)
To toggle between the start point and the end point of the segment.
PAGE (F6)
To move to the next page.

Description of fields

Field	Option	Description
<Line Name:>	Output	The name of the selected stringline.
The following fields/values can be toggled, by using the **ENDP/STRTP (F4)** softkey:		
<Chainage:>	Output	The chainage of start/end point of the segment.
<Easting:>	Output	The East coordinate of the start/end point of the segment.

Field	Option	Description
<Northing:>	Output	The North coordinate of the start/end point of the segment.
<Height:>	Output	The height of the start/end point of the segment.
<Hz Tangent:>	Output	The tangent direction at the start/end point of the segment.
<Hz Radius:>	Output	The radius at the start/end point of the segment (is not toggled).
<Hz Type:>	Output	The current segment type (is not toggled).
If a value has not been defined, the field will be shown as "**-----**".		

Viewing the segment: the Vz Alignment page



CONT (F1)
To return to the **View** screens.

SEG+ (F2)
To move to the next segment.

SEG- (F3)
To move to the previous segment.

ENDP/STRTP (F4)
To toggle between the start point and the end point of the segment.

PAGE (F6)
To move to the next page.

Description of fields

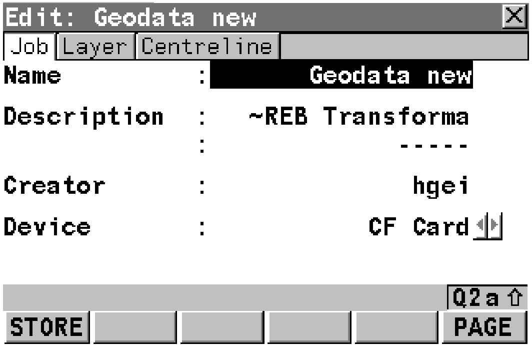
Field	Option	Description
<Line Name:>	Output	The name of the selected stringline.
The following fields/values can be toggled, by using the **ENDP/STRTP (F4)** softkey:		
<Chainage:>	Output	The chainage of start/end point of the segment.
<Easting:>	Output	The East coordinate of the start/end point of the segment.
<Northing:>	Output	The North coordinate of the start/end point of the segment.
<Height:>	Output	The height of the start/end point of the segment.
<Grade:>	Output	The grade at the start/end point of the segment (is not toggled).
<Vt Radius:>	Output	The radius at the start/end point of the segment (is not toggled).
<Vt Type:>	Output	The current segment type (is not toggled).
If a value has not been defined, the field will be shown as "**----**".		

35.9.3 Editing the Design Data

Access

Press **EDIT (F3)** on the **Road View&Edit Data** screen.

Editing the job details



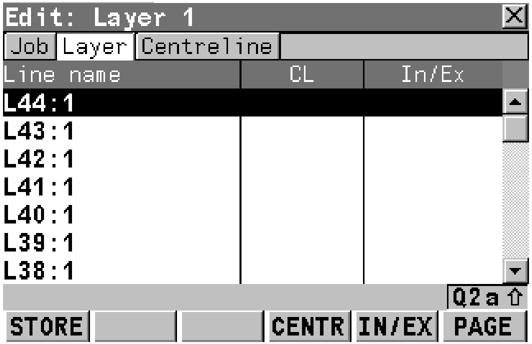
STORE (F1)
To return to the View&Edit Data screen.

PAGE (F6)
To move to the next page.

Description of fields

Field	Option	Description
<Name:>	User input	The unique name of the road job. The name may be up to 16 characters long and may include spaces. This field is mandatory.
<Description:>	User input	A detailed description of the road job (two lines are available). This field is optional.
<Creator:>	User input	The name of the person who created the road job. This field is optional.
<Device:>	**CF Card**	The device on which the road job is stored.

Selecting another centreline and including/excluding stringlines from the selected layer



STORE (F1)
To store data and return to the **View&Edit Data** screen.

CENTR (F4)
To set the highlighted stringline as the layer centreline.

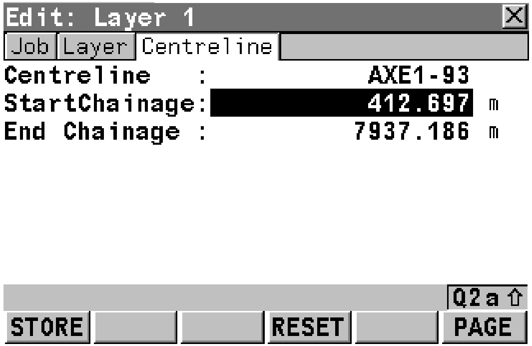
IN/EX (F5)
To include/exclude the highlighted stringline from the layer.

PAGE (F6)
To move to the next page.

Descripion of columns

Column	Description of column
Line Name	The column showing the names of the stringlines
CL	The column showing the stringline which is set as the layer centreline
In/Ex	The column showing which stringlines are excluded from the layer

Changing the start chainage of the centreline of the selected layer



STORE (F1)
To store data and return to the **View&Edit Data** screen.

RESET (F4)
To clear all changes made to the start chainage reset to the original start chainage.

PAGE (F6)
To move to the next page.

Description of fields

Field	Option	Description of field
<Centreline:>	User input	The name of the centreline.
<StartChainage :>	User input	To enter a start chainage for the layer centreline. By using the centreline length, the end chainage is automatically calculated.
<End Chainage:>	User input	The end chainage of the layer centreline, as calculated from the start chainage.

35.9.4 Deleting an Existing Project

Access

Highlight the desired project and press **DEL (F4)** on the **Road Projects** screen.

Description

Deleting a project will not delete the measurement job, fixpoint job, road job and DTM job that it references.

☞ If two projects use the same control points by referencing the same fixpoint job, deleting one project and will not delete the control points for the other project.

Delete project step-by-step

Step	Description
1.	**Projects (Device name)**. Highlight the project to delete.
2.	Press **DEL (F4)** to delete the project.

Next step
CONT (F1) to accept changes and continue.

35.10 Working with the Extras Menu

35.10.1 Overview

Access

Press **SHIFT EXTRA (F5)** on any page of the measurement screen.

Description

- This menu contains additional functionality for each of the stake and check methods. This functionality is additional to those already existing functions which are available via the function keys.
- The functionality differs between the stake and check methods.

35.10.2 Common Extras - DTM Height

Description

Road offers the possibility to

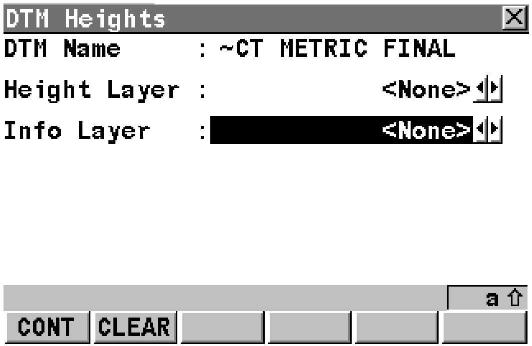
- switch to a height which is retrieved from an existing height layer, as defined in the DTM job associated with the project. The layer from the DTM is applied and used as a height reference for the staking out or checking of alignments.
- retrieve heights from an existing info layer, as defined in the DTM job associated with the project. The DTM used as info layer will not be considered for the stake values. Three new information lines are added to the **Info** page: **<DTM 2 Ht Diff:>**, **<DTM 2 Height:>** and **<DTM 2 Name:>**.

Once defined, each layer remains active until it is turned off by selecting **<None>**. DTM heights can be used for both 2D and 3D alignments.

Availability

- This menu function is available to the following stake and check methods: Stringline, Individual Stringline, X-Slope, Crown, Layer.

DTM Height



CONT (F1)
To apply the settings and return to **Stake** or **Check** screen.

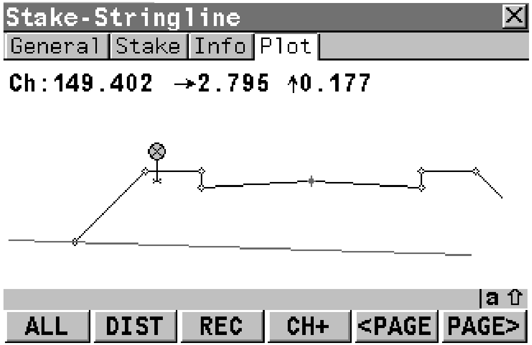
CLEAR (F2)
To select **<None>** for the height and the info Layer.

Description of fields

Field	Option	Description
<DTM Name:>	Output	DTM from active DTM job.
<Height Layer:>	Choicelist	Layer of the DTM to be used as a height reference. When selecting a DTM layer the relevant triangle of the DTM is shown on the **Plot** page. Refer to "Graphical display of current DTM element in cross-section plot".
	<None>	No DTM heights are applied for stake out or check. Select this option to deactivate the function.
<Info Layer:>	Choicelist	Layer of the DTM to be used as a height reference. When selecting a DTM layer the relevant triangle of the DTM is shown on the **Plot** page. Refer to "Graphical display of current DTM element in cross-section plot". The information lines **<DTM 2 Ht Diff:>**, **<DTM 2 Height:>** and **<DTM 2 Name:>** are automatically added to the end of the **Info** page.
	<None>	No additional lines are shown on the Info page. Select this option to deactivate the function.

Graphical display of current DTM element in cross-section plot

When selecting an Info layer the relevant triangle of the DTM is shown on the **Plot** page.



35.10.3 Common Extras - Shift Reference Line

Description

- When staking-out or checking different layers of the road strata, such as the sub-grade, gravel or asphalt, it is often found that not all of these layers are available in the design. For such cases Road offers the possibility to apply either a negative or positive height shift to the design values.

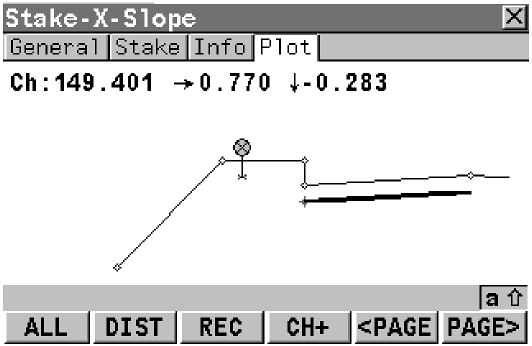
Availability

This menu function is available to the following stake and check methods:

- Slope, X-Slope.
  The **Shift Reference Line** item of the EXTRA menu stays disabled until the first measured position is available. The current chainage **<Chainage:>** is used for the cross-section shown to pick the reference line.

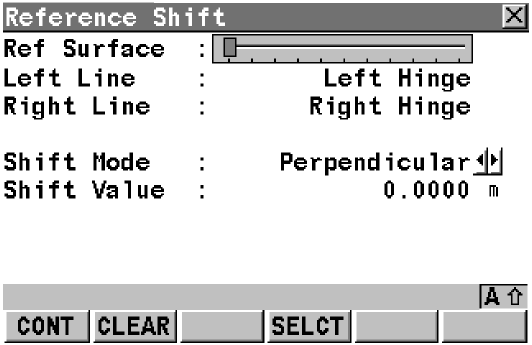
Example

In this example a gravel layer with a thickness of 10 cm should be staked-out. Therefore a negative vertical shift to the final design surface is applied. This shift is applied in the Selection Wizard by adding a vertical shift of -10 cm. As shown below the selected X-Slope is shifted by 10 cm.



When staking-out the newly shifted X-Slope, the original left edge of the shifted X-Slope is of little interest and it is the intersection with the left end slope that is of greater interest.

Screen

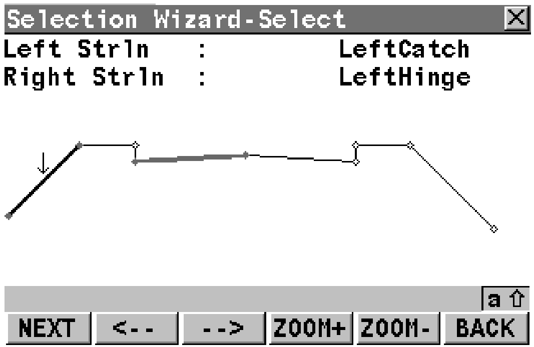


To apply these particular changes, the reference line for the X-Slope can be shifted using the **Shift Reference Line** menu function. Select the **Ref Surface** either via the slide-bar or by using the graphical selection by using **SELCT (F4)**. The required element for the reference shift is then confirmed with **CONT (F1)**.

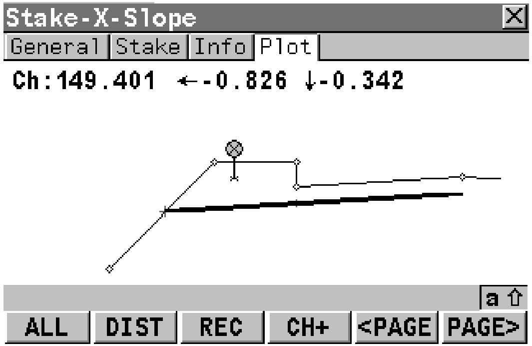
Description of fields

Field	Option	Description
<Ref Surface:>	Slide bar	-
<Left Line:>	Output	Shows the name of the left stringline from the with slidebar selected surface.
<Right Line:>	Output	Shows the name of the right stringline from the with slidebar selected surface.
<Shift Mode:>	Choicelist	The vertical shift applied to the surface selected via the slidebar.
	Plumbline	The shift defined under **<Shift Value:>** gets applied following the plumbline.

Field	Option	Description
	Perpendicular	The shift defined under **<Shift Value:>** gets applied perpendicular to the selected surface **<Ref Surface:>**.
<Shift Value:>	Input	Value the selected surface **<Ref Surface:>** gets shifted following the chosen **<Shift Mode:>.**

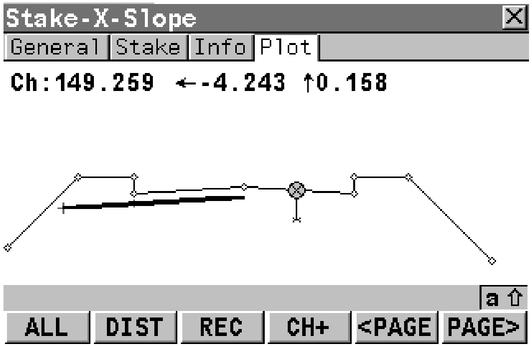


The graphical selection is identical to the workflow used in the Selection Wizard, with the original element highlighted in grey.



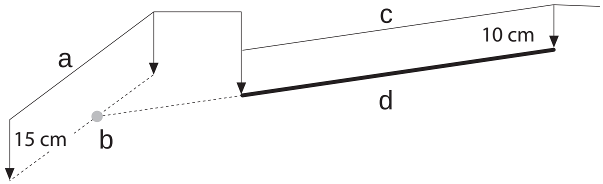
The expanded element and the shifted reference line, marked with a cross, are shown in the Plot page. The **<ΔOffset:>** and **<ΔHeight:>** values displayed on the **Stake** page guide you to the new shifted position.

In **Reference Shift** a shift for the reference surface can also be applied by using **<Shift Value:>**. This value can either be perpendicular to the reference surface or along the plumbline, depending on the selected **<Shift Mode:>**.



The screen shows the previous X-Slope, with the 10 cm gravel layer and the reference surface shifted by 15 cm by applying with **<Shift Mode: Plumbline>** a **<Shift Value: 0.150m>** on the **Reference Shift** screen.

Graphic



a) Reference Surface
b) Shifted Reference Point
c) Original X-Slope
d) Shifted X-Slope

35.10.4 Common Extras - Reinitialise Search

Description

When staking or checking complex road designs it can happen that the actual position is not projected to the desired segment of the alignment. The Reinitialise Search forces a re-projection of the actual position.

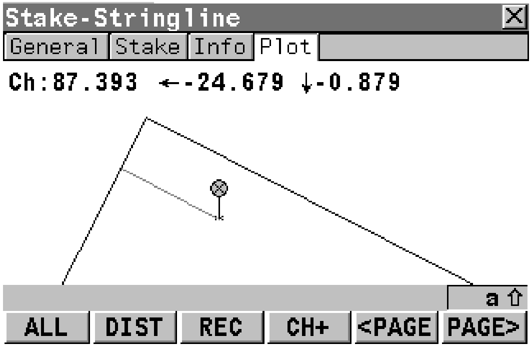
Availability

This menu function is available to the following stake and check methods:

- Stringline, Indiv Stringline, X-Slope, Manual Slope, Slope, Layer and Crown.

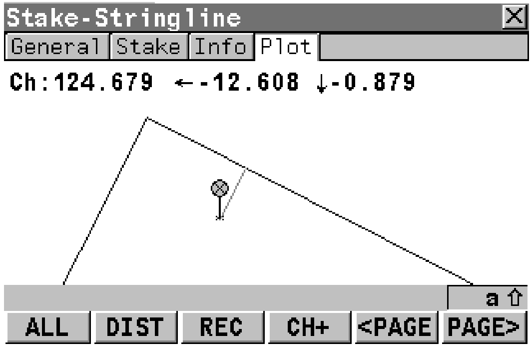
Example

Before initialisation



This screen shows the projection of the actual position to the left segment, although the distance to the right segment is shorter.

After initialisation



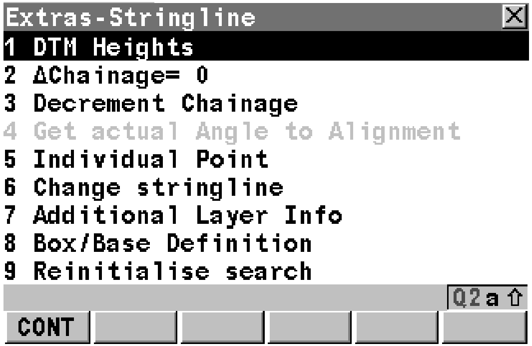
This screen shows the projection after the reinitialisation.

35.10.5 Extras for Stringline

Description

The extra functionality for the staking and checking of Stringlines is similar to the extra functionality for X-Slope, Layer and Crown.

Extras Menu

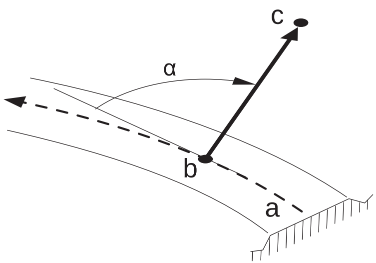


CONT (F1)
To start the highlighted extras item

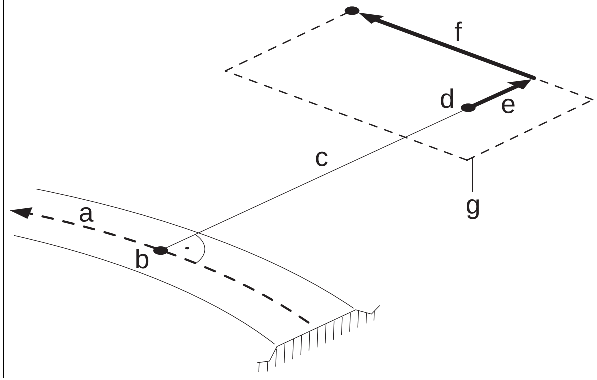
Description of menu functions

Menu function	Description
DTM Height	Refer to "35.10.2 Common Extras - DTM Height".
ΔChainage = 0	To set **<def Chainage:>** on the **General** page of the stake out to the current chainage. ☞ This extra functionality is only available for stake out methods.

Menu function	Description
Decrement Chainage	To decrement the **<def Chainage:>** on the **General** page of the stake out by the **<Ch Increment:>**.
Get actual Angle to Alignment	To project a measured point to the alignment considering the entered **<def Chainage:>**. This functionality is only available for **<Offset Direc.: Angle to Alignment>** in **Configuration**, **General** page. Workflow: 1. Measure a point with **DIST (F2)**. 2. Press **SHIFT EXTRA (F5)** to access the Extra Menu. 3. Select **Get actual Angle to Alignment**. 4. At the defined chainage the angle between the tangent direction and the direction to the actual position is calculated. This angle is used as new angle to alignment in **Configuration**, **General** page.

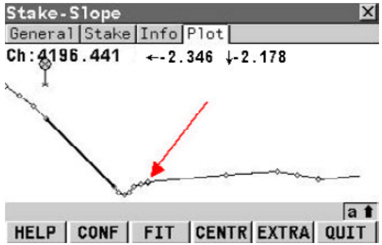
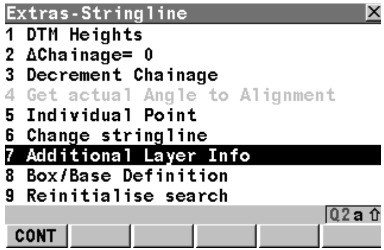
Menu function	Description
	5. Continue with staking out using the calculated **<def Chainage:>** and **<Angle to Alig:>** values. These values are valid until new values are defined manually or by using the **Get actual Angle to Alignment**.
	 a) Alignment b) Defined chainage c) Current position α Angle to alignment

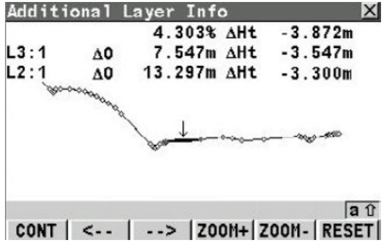
Menu function	Description
	To access **Data: Fixpoint job name** which allows you to stake out points with known Easting, Northing and Height. Points can either be selected from the fixpoint job or manually typed in. The **<def Chainage:>** and **<Stake Offset:>** on the **General** page of the stake out are calculated based on the coordinates of the selected point. The height for the stake out will be set as **<Manual Height:>**. If the chosen point has no height the design height will be used. If the point has a height it is possible to use that one or continue working with the design height.
Change stringline	To access **Selection Wizard-Select** which allows you to chose a different stringline for the stake-out. This change is only temporary and will not effect the task.
Additional Layer Info	This function allows additional road data to be obtained during a check or stake survey of a road element. It is no longer required to change the layer or stringline in Standard Mode or to change to a different task in Advanced Mode.

Menu function	Description
	Road elements include centrelines, kerb and gutters and slopes.
Box/Base Definition	This function allows a box or similar structure to be set out (related to a stringline chainage and parallel offset) during a check or stake survey of a road element. A base point of the box, user defined dimensions of the box (a base distance and a base offset) are required. Road elements include centrelines, kerb and gutters and slopes. 

Menu function	Description
	a) Centreline b) Defined chainage c) Stake offset d) Base point e) Base offset f) Base distance g) Box to stake out

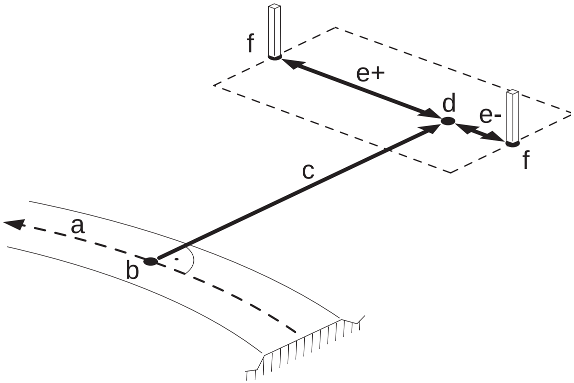
Additional Layer Info

Step	Description	
1.	Press **SHIFT EXTRA (F5)** to access **Extras** menu.	
2.	Select **Additional Layer Info**. Press **CONT (F1)** to continue to the next screen.	

Step	Description
3.	Press **<-- (F2)** and **--> (F3)** to select the relevant element in the plot. The information displayed shows the current slope ratio of the element, the height difference and the offset and height difference from the left and right vertices of the element.  Press **CONT (F1)** to store the selected element, which is then automatically recalled. Press **RESET (F6)** to move back to the originally selected element.

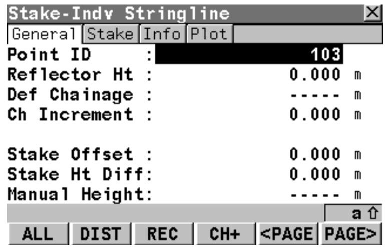
Box/Base Definition

Step	Description
	The following steps describe the stake out of two reference pegs from a centreline chainage and offset.

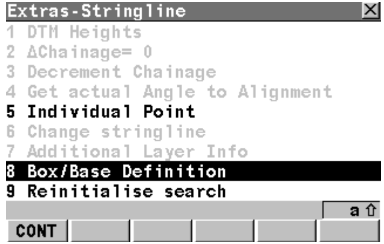
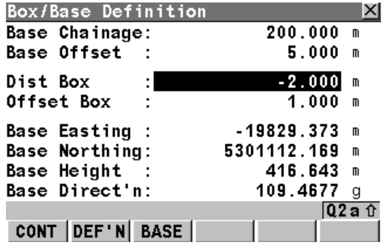
<table>
<tr><th>Step</th><th>Description</th></tr>
<tr><td></td><td>


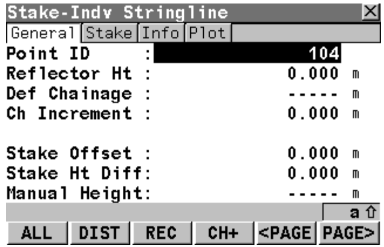
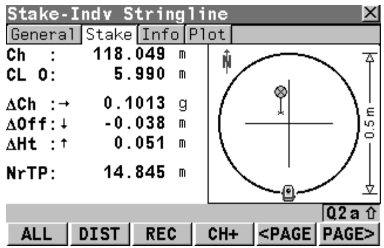
a) Centreline
b) Defined chainage
c) Stake offset
d) Base point
e) Base distance, positive (e+), negative (e-)
f) Peg to stake out
</td></tr>
<tr><td>1.</td><td>
Define the base point for the box/base stake-out using **<Stake Offset:>** and **<Stake Ht Diff:>** from the **General** page.

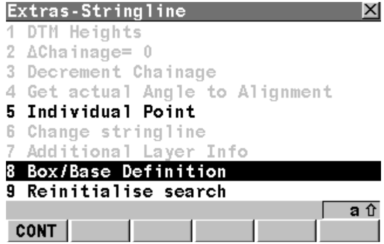
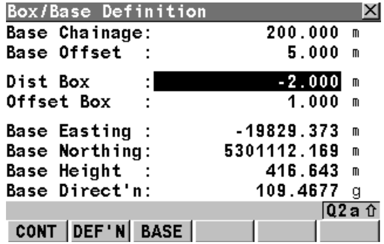
Press **SHIFT EXTRA (F5)** to access **Extras** menu.



</td></tr>
</table>

Step	Description
2.	Select **Box/Base Definition**. Press **CONT (F1)** to continue to the next screen. 
3.	The position defined by **<Def Chainage:>** and **<Stake Offset:>** is used as **<Base Chainage:>** and **<Base Offset:>** when accessing **Box/Base Definition** for the first time within a stake-out session. 
4.	Similar to the stake-out of individual points in the **Extras** menu, the Box/Base functionality calculates the new point to stake-out and changes the according values of **<Def Chainage:>**, **<Stake Offset:>** and activates the **<Manual Height:>** functionality. To avoid that these values are used as the next base point when accessing the box/base menu press **BASE (F3)** in the Box/Base Definition screen to freeze the values of the base point. **BASE (F3)** is now replaced by **CLEAR (F3)**. If a different base had been defined before, use **DEF'N (F2)** to overwrite the values before pressing **BASE (F3)**.

Step	Description
5.	Define the **<Base Distance:>** and **<Base Offset:>** in the **Box/Base definition** screen. **<Base Distance:>** and **<Base Offset:>** follow the same rules as used for the definition of offsets and chainages in general, (offset to the right = positive; distance in direction of increasing chainage = positive). Press **CONT (F1)** to continue to the next screen.
6.	The values of **<Def Chainage:>**, **<Stake Offset:>** and the **<Manual Height:>** are adjusted accordingly. 
7.	The fields **<ΔChainage:>**, **<ΔOffset:>** and **<ΔHeight:>** on the **Stake** page guide you to the new position to stake-out. Press **SHIFT EXTRA (F5)** to access **Extras** menu. 

Step	Description
8.	Select **Box/Base Definition**. Press **CONT (F1)** to continue to the next screen. 
9.	The next point of the box to stake-out can now be defined. To change back to the original chainage and offset defined for the base point definition use **CLEAR (F3)** from the **Box/Base Definition** screen. 
10.	Start with step 1. to define a new box/base.

35.10.6 Extras for X-Slope, Layer and Crown

Description

The extra functionality for the staking and checking of X-Slope, Layer and Crown is similar to the extra functionality for Stringlines.

Extras Menu

CONT (F1)
To start the highlighted extras item

Description of menu functions

Menu function	Description
DTM Height	Refer to "35.10.2 Common Extras - DTM Height".
ΔChainage = 0	To set **<def Chainage:>** on the **General** page of the stake out to the current **<Chainage:>**. ☞ This extra functionality is only available for stake out methods.

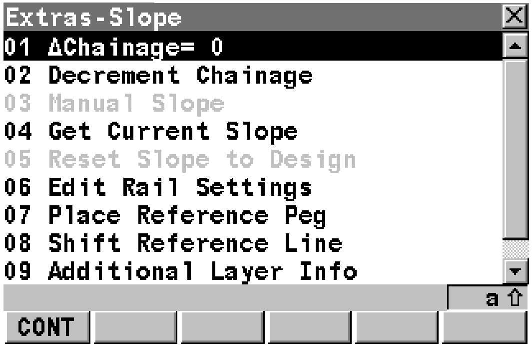
Menu function	Description
Decrement Chainage	To decrement the **<def Chainage:>** on the **General** page of the stake out by the **<Ch Increment:>**.
Shift Reference Line	Refer to "35.10.3 Common Extras - Shift Reference Line".
Additional Layer Info	Refer to "35.10.5 Extras for Stringline" for details.

35.10.7 Extras for Slope

Description

The extra functionality for the staking and checking of Slopes is similar to the extra functionality for manually defined slopes and design slopes. Depending on the **<Slope Method:>** chosen in **Road Configuration**, the menu items may vary. Differences are pointed out in the table below.

Extras Menu



CONT (F1)
To start the highlighted extras item

Description of menu functions

Menu function	Description
ΔChainage = 0	To set **<def Chainage:>** on the **General** page to the current **<Chainage:>**. This extra functionality is only available for stake out methods.

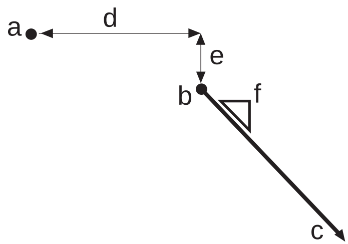
Menu function	Description
Decrement Chainage	To decrement the **<def Chainage:>** on the **General** page of the stake out by the **<Ch Increment:>**.
Manual Slope	To access **Slope Definition** which allows a manual slope to be defined. The defined manual slope is then used for all points to stake out or check. ☞ The manual slope is active until it is turned off with **Reset Slope to Design** from **Extras**.
Get Current Slope	To access **Slope Definition**. The slope ratio **<Current Ratio:>** of the last measured position is used as the defined **<Slope Ratio:>**. All others values in**Slope Definition** are filled in with the last measured position. The defined manual slope is used for all points to stake out or check. ☞ The manual slope is active until it is turned of with **Reset Slope to Design** from **Extras**.
Reset Slope to Design	To deactivate a manually defined slope and return to the slope defined in the design.

Menu function	Description
	☞ **Reset Slope to Design** can be used as an indicator if working with an manual slopes, as it is only enabled if a manual slope is active.
Place Surface Reference Peg	To type in a define hinge height difference. ☞ **Place Surface Reference Peg** is active for **<Slope Method: Ref. Point Surf>**.
Shift Reference Line	Refer to "35.10.3 Common Extras - Shift Reference Line".
Additional Layer Info	Refer to "35.10.5 Extras for Stringline" for details.

Defining slopes manually

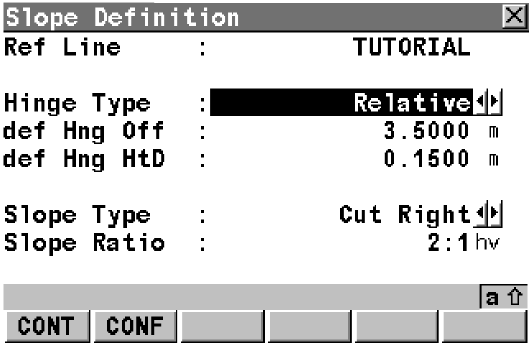
Description

Slopes are defined relative to the centreline.



a) Centreline
b) Hinge point
c) New slope
d) **<def Hng Off:>**
e) **<def Hng HtD:>**
f) **<Slope Ratio:>**

Screen

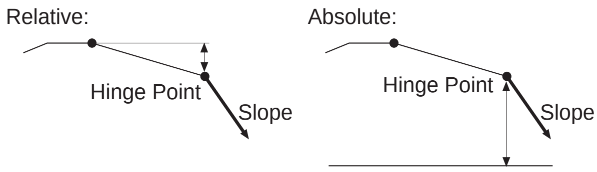


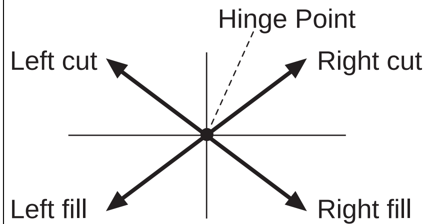
CONT (F1)
To accept changes and move to the next screen depending on the settings for slope staking.

CONF (F2)
To configure the Road application program. Accesses **Configuration**.

Description of fields

Field	Option	Description
<Ref Line:>	Output	The centreline the slope is defined relative to.
<Hinge Type:>	Choicelist	The vertical offset type for the hinge point.
	Relative	Define the hinge point by the height difference relative to the selected **<Ref Line:>**.
	Absolute	Define the hinge point using its absolute height.

Field	Option	Description
		
	Hold Hinge	The hinge point of the slope stays fixed at the defined stringline.
<def Hng Off:>	User input	The horizontal offset of the hinge point from the centreline/reference line.
<def Hng HtD:>	User input	The height difference of the hinge point from the centreline/reference line. This field is visible if **<Hinge Type: Relative>**.
<def Hng Elev:>	User input	The absolute height of the hinge point. This field is visible if **<Hinge Type: Absolute>**.

Field	Option	Description
<Slope Type:>	Choicelist	Differentiates if the defined slope is a cut/fill and left/right. 
<Slope Ratio:>	User input	Defines the ratio of the slope. The format of **<Slope Ratio:>** depends on the settings chosen in **Project Configuration** for **<Slope Format:>**.

35.11 Understanding Stake and Check Basics

35.11.1 Overview

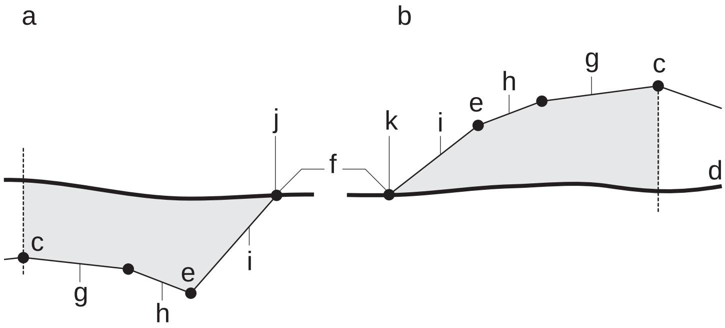
General

In order to make the chapters on staking and checking road alignments easier to understand, the basics are introduced in this chapter.

Please be aware that the terminology or workflow used on different construction sites may vary from the one used in this manual, however, basic principles remain the same.

35.11.2 Basic Terms

Technical terms



a) Cut situation
b) Fill situation
c) Centreline
d) Natural surface
e) Hinge point
f) Catch point
g) Carriage way
h) Shoulder
i) Slope
j) Top
k) Toe

Technical term	Description
Carriage way	The part of the road on which you drive once the road is finished.
Shoulder or **Verge**	Often located next to the carriage way, usually with a slightly higher slope ratio than the carriage way.
Slope	Located next to the verge and can be thought of as linking the road level with the natural surface. The ratio of the slope is greater than the ratio of the verge. A slope starts at the hinge point.
Natural surface or **original ground**	This is the undisturbed surface before project construction.
Finished road level	Describes the final road surface.

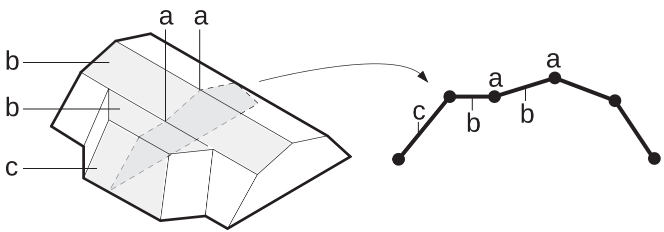
Technical term	Description
Catch point or **daylight point**	Indicates the point of intersection between the slope and the natural surface. Both the hinge point and the catch point lie on the slope. In the case of a cut slope, the catch point forms part of the top of a bank (top). In the case of a fill slope, the catch point forms part of the bottom of a bank (toe).
Chainage or **station**	The cumulative distance along the centreline, frequently but not always starting at zero.

35.11.3 Basic Elements for Road Stake and Check Measurements

Description

In general there are four different basic stake out and check elements:

- Stringlines, for example, a centreline.
- Cross slopes or X-slopes, for example, the final carriage way.
- Slopes, for example, the end-slopes of a cross section.
- Surfaces, for example, a DTM surface.



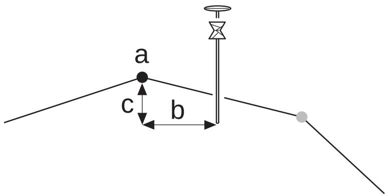
a) Stringlines
b) X-slopes
c) Slopes

Every stake out or check is based on one or more of these four base elements. For example, a road crown consists of two X-slopes with one common stringline.

Stringlines

The stake out of a stringline is used in different situations:

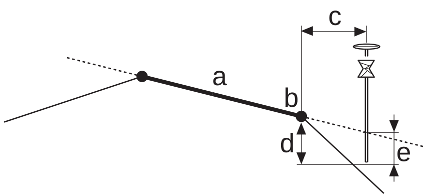
- Centreline of a road.
- Edges of a road or any other change in slope.
- Gutters.
- Pipelines, cables and any other alignment related design feature.



a) Stringline to stake out or check, in this case the centreline
b) Stringline offset **<Strgl Offset:>**
c) Stringline height difference **<Strgl Ht Diff:>**

X-slopes

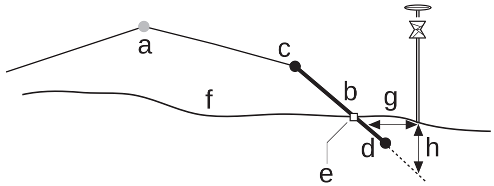
X-Slopes are defined by two stringlines. The two stringlines define the right and left edge of the X-slope. One of the two stringlines is used as the reference line.



a) X-slope to stake out or check
b) Reference line
c) Horizontal offset to reference line **<Ref Offset:>**
d) Height difference to reference line **<Ref Ht Diff:>**
e) Height difference to expanded X-slope **<X-Slp Ht Diff:>**

Slopes

Slopes, like X-slopes, are defined by two stringlines. Different to X-slope only one edge of the slope, the hinge point, is known. The second edge, catch point or daylight point, is defined by the intersection of the slope and the natural surface. As the natural surface is unknown this edge can only be staked out in the field. To find and stake out the catch point is the most important task if working with slopes.



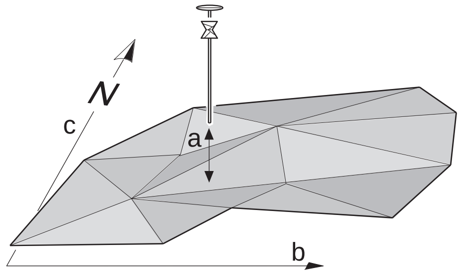
a) Centreline
b) Slope
c) Hinge Point
d) Second stringline defining the slope
e) Catch point
f) Natural surface
g) **<ΔOffset:>** from the slope
h) Height difference **<ΔHeight:>** from the slope

Surfaces

There are two types of surfaces supported that represent a three dimensional design:

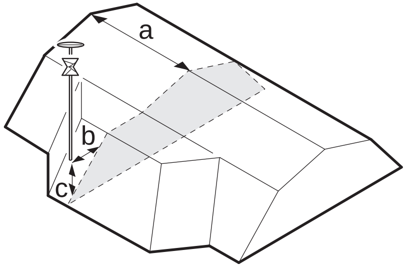
- DTM / TIN (**D**igital **T**errain **M**odel; **T**riangular **I**rregular **N**etwork).
- Layer.

A DTM consists of a number of 3D triangles. DTM's do not include information relating the DTM to a centreline. Positions are defined by easting, nothing and height value.



a) Height difference **<DTM Ht Diff:>** from the triangle of the DTM found in the same vertical as the measured point
b) Easting of coordinate system
c) Northing of the coordinate system

A layer is a combination of stringlines that form a 3D surface relative to a centreline. Thus it is possible to define points by chainage or station, offset and height. Refer to "35.8.2 Working with the Design Data (Stringlines and Layers)" for more information.



a) Chainage or station
b) **<Layer Offset:>**
c) Layer height difference **<Layer Ht Diff:>**

35.11.4 Shifts

Overview

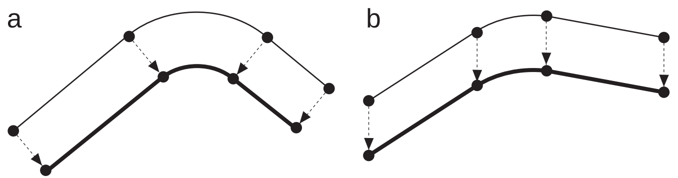
Description

When working on site, it is often the case that design data does not match the measured data. For example, an existing road surface that should intersect with the design surface may be 15 cm higher than the plans indicate. To guarantee a smooth intersection, this difference has to be distributed over the remaining 100 m of paving. To handle these situations, Road allows the possibility of adding shifts to the existing design data. A shift is applied when selecting the element to stake out/check.

☞ Note that shifts do not change the stored design. They are applied temporarily for stake out purpose.

Horizontal and vertical shifts

Horizontal shifts are always rectangular to the centreline of the element you are working with. Whereas vertical shifts defined along the plumb line.

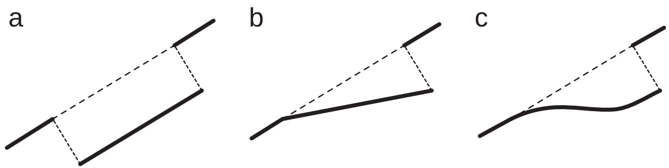


a) Horizontal alignment with constant shift
b) Vertical alignment with constant shift

Constant, linear and parabolic shifts

Three different types of shifts are supported:

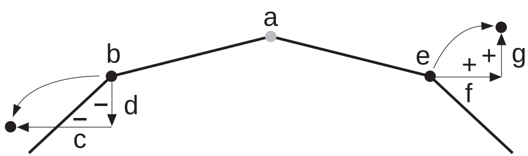
Type	Description
Constant	The shift stays the same from its start chainage or station to the end chainage or station.
Linear	The shift is linear interpolated along the chainage or station.
Parabolic	A parabolic shift is added between start and end chainage or station.



a) Constant shift
b) Linear shift
c) Parabolic shift and reverse curve

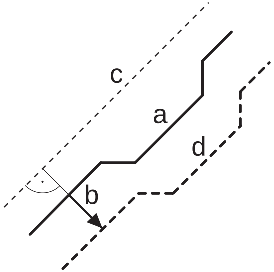
Sign convention for shifts

The sign convention for design shifts is identical to the one used for stake offset and height difference.



a) Centreline
b) Stringline on left side
c) Negative horizontal shift
d) Negative vertical shift
e) Stringline on right side
f) Positive horizontal shift
g) Positive vertical shift

☞ Horizontal stake offsets are always defined perpendicular to the centreline of the layer the stringline(s) belongs to.

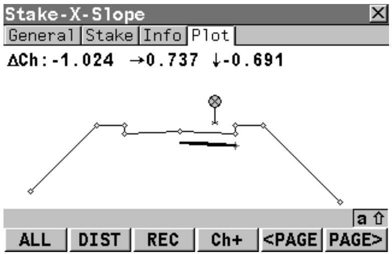


a) Stringline the horizontal shift is applied to
b) User defined horizontal shift for the stringline
c) Centreline
d) Shifted stringline

Plot page with shifts

Road offers for all stake out and check methods a page showing a graphical representation of the measured position in relation to the cross section. If shifts are applied to the design the plot shows the original unshifted cross section view of the design as well as the shifted element. The current element is shown in bold.

zoom in (● ±) zoom out (● .)



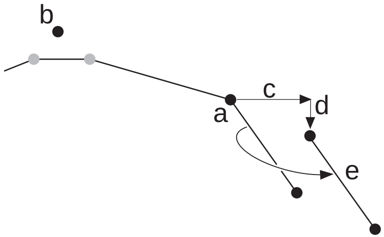
The original cross section of the design is shown as well as the shifted element in bold.

Shifts for stringlines, slopes, layers and DTM's

Description

The shifts applied to stringlines, slopes, road crowns layers and DTM's are identical with one exception:

- Given that DTM's are not defined relative to a centreline and hold no orientation information, no horizontal shift is possible for them.

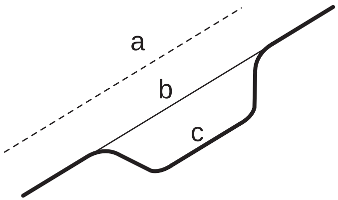


a) Slope to shift
b) Centreline
c) Value for horizontal shift
d) Value for vertical shift
e) Shifted slope

Shift for X-slopes and road crowns

Description

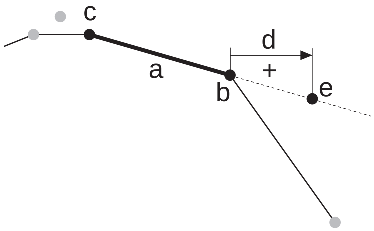
To allow widening and narrowing of X-slopes and road crowns, only one of the two stringlines defining the X-slope or crown is shifted when adding a horizontal shift. This is handy for small changes to the original design like for bus stops or emergency bays.



a) Centreline
b) Original stringline of the design
c) Stringline with horizontal parabolic shift

Horizontal shift

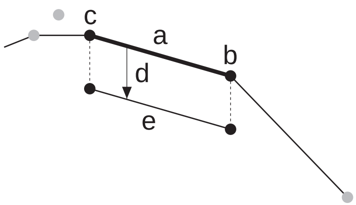
For X-slopes and crowns the horizontal shift is added to the stringline that is defined as reference line. To maintain the original X-slope/crown ratio the stringline is shifted along the X-slope/crown.



a) X-Slope to shift
b) Reference stringline of the X-slope
c) Second stringline of the X-slope
d) Positive horizontal shift
e) Position of the shifted reference stringline

Vertical shift

The vertical component of the shift for a X-slope or crown is applied to all stringlines.

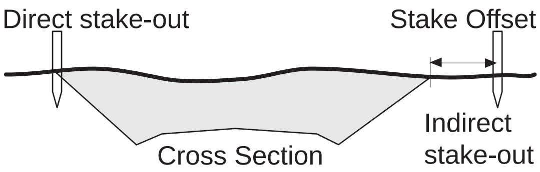


a) X-Slope to shift
b) Right stringline of the X-Slope
c) Left stringline of the X-slope
d) Negative vertical shift
e) Shifted X-slope

35.11.5 Stake Offset and Stake Height Difference

Description

When conducting a stake out, the aim is usually to mark the position of geometric elements defined by the design. For example, in the graphic below, the catch point of a slope. A point can be staked either directly or indirectly. In the case of an directly staked out point the peg ends up at exactly the position of the point to be staked out. Staking the same point indirectly, the peg will be placed with a certain offset to the point.



One reason to stake out a point indirectly is that the peg would not last long at the position of the actual point. In this example the peg staked out directly would be removed as soon as the excavation work starts.

☞

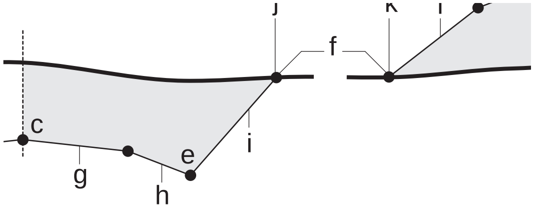
Horizontal stake offsets are like shifts always defined perpendicular to the centreline of the layer the stringline(s) belongs to. For X-slopes and road crowns the stake offset is applied following the same rules as pointed out for horizontal shifts. Refer to "35.11.4 Shifts" for more information.

Stake offset

For each stake out method a horizontal and/or vertical offset may be defined. The stake offset and stake height difference are defined on the **General** page of the stake out. Refer to " Stake offset / height difference working example" for information on defining stake offsets / height differences.

Sign convention for stake offset and height difference

The sign convention for stake offsets and height differences is identical to the one used for design shifts.

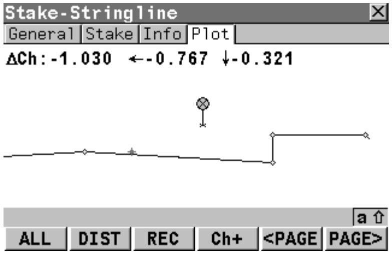


a) Centreline
b) Stringline on left side
c) Negative stake offset
d) Negative stake height difference
e) Stringline on right side
f) Positive stake offset
g) Positive stake height difference

Plot page with stake offset and stake height difference

Road offers for all stake out methods a page showing a graphical representation of the measured position in relation to the cross section. If stake offset and/or stake height difference are used the plot shows the original cross section view of the design as well as the position to stake out. The position to stake out is marked by a cross.

zoom in ± zoom out .



The position to stake out with the applied stake offset and/or height difference is indicated in the cross section plot by a cross.

35.11.6 Stake and Info Screens

Overview

Two positions

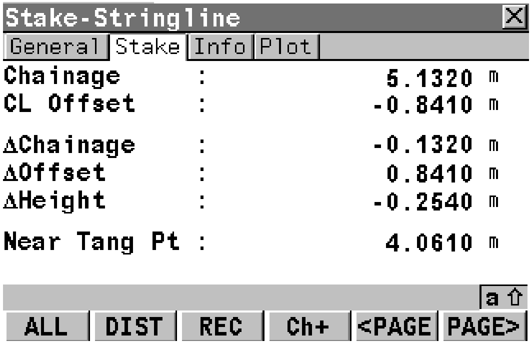
When staking out you are first of all interested in finding the position you want to place the peg. In the next step you have to write the required information on the peg.

Two steps

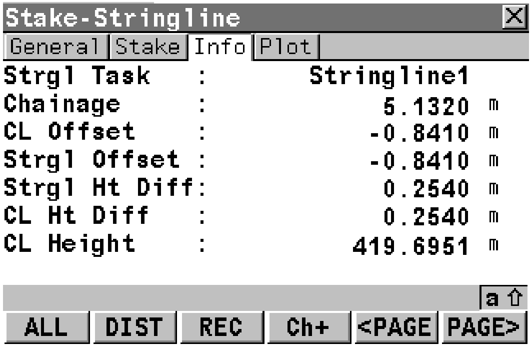
Stake out may be divided into two sequential steps:

Step	Description
1.	Find the position to place the peg.
2.	Mark the information on the peg that allows its final position to be determined.

The dialog used for stake out in Road reflects these two steps. One page, the **Stake** page, is used as a guide to the peg position and a second page, the **Info** page, indicates the values to mark on the peg.



The first step:
Stake - The **Stake** page is used for the first step of the actual stake out. It guides you to the position to be staked out. If the values for **<ΔChainage:>** and **<ΔOffset:>** are close enough to 0 you are in the right position to place the peg.



The second step:
Info - Shows the information to be marked on the peg for the construction worker or machine operator. The **Info** page is user definable.

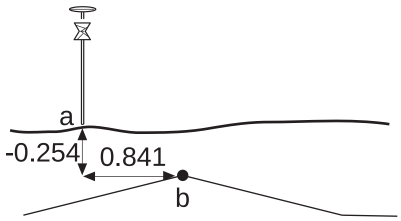
Independent if staking out stringlines, X-slopes, slopes or road crowns the screen always shows these two pages. As the information to be left on the peg varies depending on the object to be staked out and the working methods used on the

site the information page is for each stake method user definable. This allows to show all the required information in exactly the way needed.
The various checking methods use the same **Info** pages.

Stake offset / height difference working example

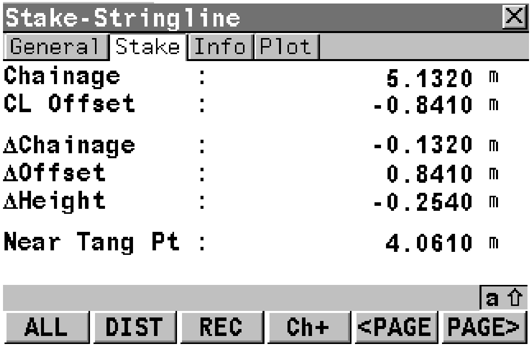
Example

This example shows the differences between staking out with and without stake offset / height difference. A stringline, in this case the centreline, should be staked out. Once without an stake offset, and once using an stake offset of 1 m. The stake height difference stays zero in both cases.

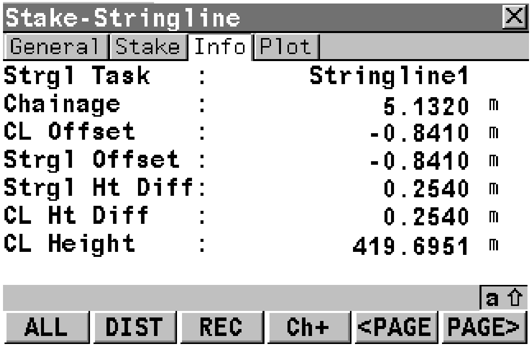


a) Current position; **<ΔOffset: 0.841>**, **<ΔHeight: -0.254>**
b) Position to stake out

No stake offset



Since, in this example, the stringline is also the centreline of the layer, the offset from the centreline **<CL Offset:>** and delta offset to the reference line **<ΔOffset:>** are equal but of opposite signs.

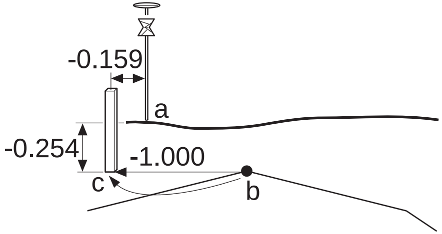


As no stake offset or stake height difference are used the values shown for stake out on the **Stake** page **<ΔOffset:>** and **<ΔHeight:>** are the same as shown on the **Info** page for **<Strgl Offset:>** and **<Strgl Ht Diff:>**.

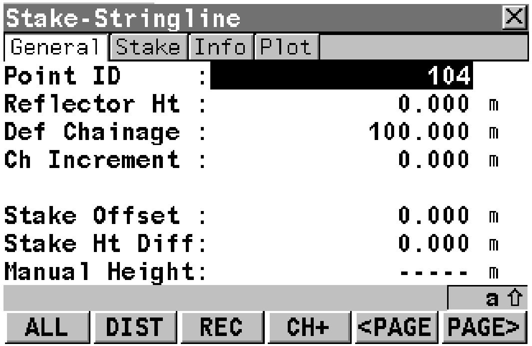
Info pages are user definable. Depending on the configurations chosen your **Info** page may look different.

Defined stake offset

Stake offsets / height differences can be defined for every stake out on the **General** page. In this example a stake offset **<Stake Offset: -1.000>** of 1 m to the left is used. The stake height difference stays zero.



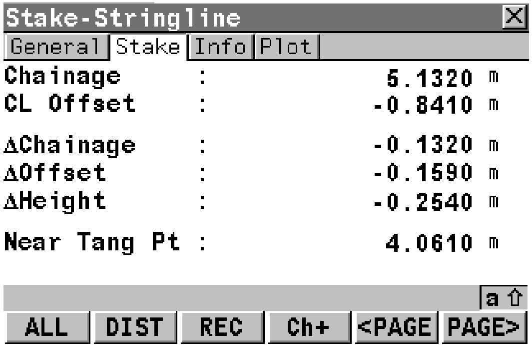
a) Current position
b) Stringline to stake out, in our case also the centreline
c) Position to stake out = stringline + stake offset



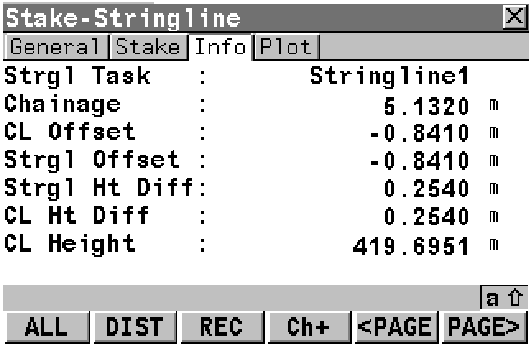
<Stake Offset:> and **<Stake Ht Diff:>** are stored with the task and will be maintained when the task is restarted. Refer to "35.11.5 Stake Offset and Stake Height Difference" for information on how stake offsets are defined.

Use stake offset

Working with a stake offset of -1 m and a stake height difference of 0 m returns the following results for the same position:



The horizontal offset **ΔOffset** from the position to stake out is now -0.159 m (0.841 - 1). All other values stay the same as when a stake-offset was not used.



The values on the **Info** page for **<Strgl Offset:>** and **<Strgl Ht Diff:>** now show how far the current position is away from the stringline.
If the peg is placed in its exact position, **<ΔOffset:>** on the **Stake** page would be equal to zero. **<Strgl Offset:>** on the **Info** page would show exactly the same value as that defined for **<Stake Offset:>** on the **General** page.

35.11.7 Methods for Slope Staking

Overview

Manual and design slopes

Road offers a manual slope stake out and a slope stake out by design.

Type	Description
Manual slopes	The slope is defined manually by offsets and the slope ratio relative to a known centreline.
Design slope	The slope is nominated out of the full 3D design of the road job.

Four methods of slope stake out

Independent if using manual or design slopes the following four different methods are available:

Method	Description
General	A generic slope stake out method.
Reference point	Stake out of a reference peg with a defined offset from the catch point. Refer to " Slope staking using a reference point".
Reference point surface	Stake out of a reference peg in the slope surface with a defined height difference to the hinge point. Refer to " Slope staking using a reference point surface".
Batter rails	Stake out of batter rails with defined peg heights. Refer to " Slope staking with batter rails".

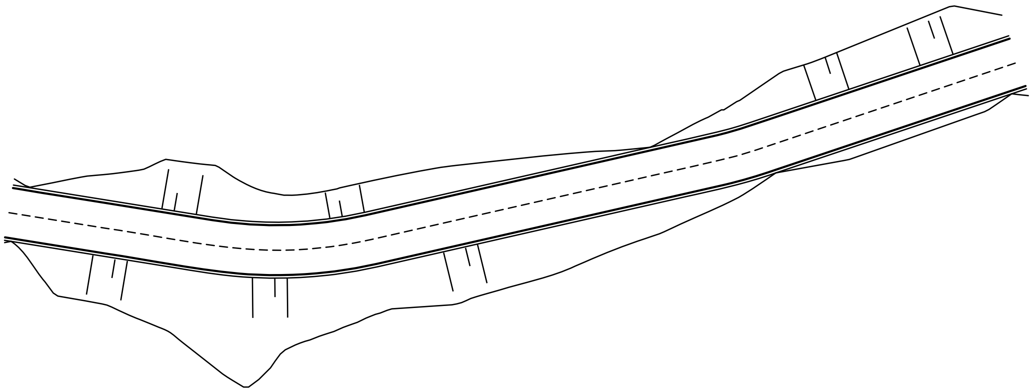
Method	Description
Batter rails with a reference peg	Stake out of batter rails with a defined offset from the catch point. Refer to " Staking batter rails using a reference point".

The method used for slope stake out **Slope Method** is selected as part of **Road Road Configuration**. Refer to "35.6.3 Configuration Settings for the Program - Road Config" for more information on choosing the slope method.

Extending design slopes

When using slopes generated by a design package the quality of the change from cut to fill or where slopes start and end depends a lot on the terrain model used for the project. Occasionally a cut is required where the design still shows a fill, or one of the lines defining the slope ends before intersecting with the natural surface.

Road can handle these different situations with a variety of slope extras. As soon as a measurement is taken outside of the defined design slope a message appears prompting if the slope should be extended. The extension of a line is always based on the end-tangent of the stringline. When moving back into the defined design a notification appears.

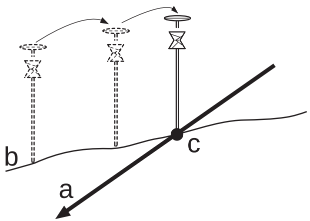


Slopes left and right of design changing from cut to fill.

General slope stake out

Description

This general slope stake out method involves a generic approach to slope stake out. No special batter rails or reference point parameters are defined.



a) Slope to stake out
b) Natural surface
c) Catch point

Slope method

Select **Slope Method: None** in **Configuration**, **General** page. Refer to "35.6.3 Configuration Settings for the Program - Road Config" for more information on choosing the slope method.

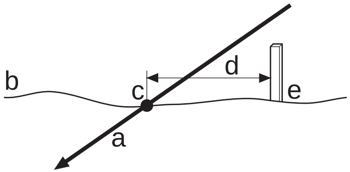
Workflow

As the natural surface is unknown the catch point can only be staked out iteratively. If staking out on a horizontal natural surface the values shown for **ΔOffsets** indicates how far the catch point is away. If the natural surface is not horizontal you may need more iterations.

Slope staking using a reference point

Description

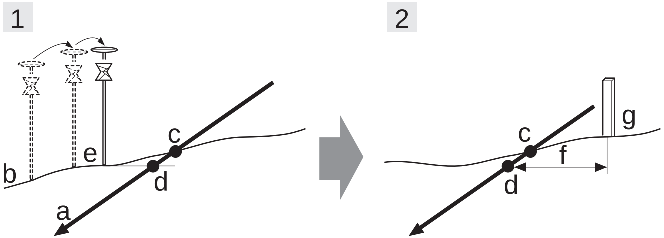
When staking out slopes using the reference point method, the catch point of the slope is marked with a reference peg using a defined offset. The grade of the slope is marked and controlled by "grade checkers".



a) Slope to stake out
b) Natural surface
c) Catch point of the slope
d) Defined reference point offset **<Ref Offset:>**
e) Reference peg

The reference point offset guarantees that all pegs are placed with the same horizontal offset to the catch point.

Workflow



a) Slope to stake out
b) Natural surface
c) Real catch point
d) Projected catch point
e) Approximate staked out catch point after three iterations
f) Defined reference point offset **<Ref Offset:>**
g) Reference peg

Step	Description
1.	The first step when staking out is to find the catch point of the slope. As the natural surface is unknown this has to be done iteratively. As soon as the measured position (e) is close enough to the real catch point (c), it may be used as the approximate catch point. Based on this approximate catch point, the projected catch point (d) on the slope is calculated. No reference point offset **<Ref Offset:>** and no traveller height **<Traveller Ht:>** are taken into account for this step. The projected catch point (d) is then used as a starting point for the stake out of the reference peg (g).

Step	Description
2.	The second step is to stake out the reference point relative to the projected catch point. Values in **Stake Slope Refpoint**, **Stake** page will guide you straight to the position to place the peg. The defined reference point offset **<Ref Offset:>** (f) is already taken into account. The catch point is marked indirectly via the reference peg. Values to be marked on the reference peg can be found on **Stake Slope Refpoint**, **Info** page.

The closer the real catch point and the approximated stake out catch point are, the closer the projected catch point gets to the real catch point.

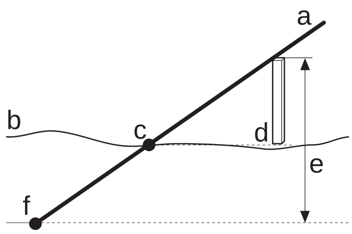
Slope method to be used

Select **<Slope Method: Reference Point>** in **Configuration**, **General** page. Refer to "35.6.3 Configuration Settings for the Program - Road Config" for information on how to change the slope method.

Slope staking using a reference point surface

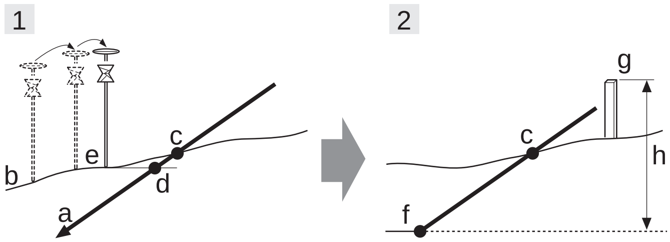
Description

When staking out slopes using the reference point surface method, the reference peg is staked out with a defined height difference to the hinge point.



a) Slope to stake out
b) Natural surface
c) Catch point of the slope
d) Reference peg
e) Defined hinge height difference
f) Hinge point

Workflow



a) Slope to stake out
b) Natural surface
c) Real catch point
d) Projected catch point
e) Approximate staked out catch point after three iterations
f) Hinge point
g) Reference peg
h) Defined hinge height difference **<Def Hinge Ht Diff:>**

Step	Description
1.	The first step when staking out is to find the catch point of the slope. As the natural surface is unknown this has to be done iteratively. As soon as the measured position (e) is close enough to the real catch point (c), it may be used as the approximate catch point. Based on this approximate catch point, the projected catch point (d) on the slope is calculated. The projected catch point (d) is then used as a starting point for the stake out of the surface reference peg (g).
2.	The second step is to define the hinge height difference. To do this, select **Place Surface Reference Peg** from the Extras Menu.
3.	The third step is to stake out the surface reference point relative to the projected catch point. Values in **Stake Slope Refpoint**, **Stake** page will guide you straight to the position to place the peg. The defined hinge height difference **<Def Hinge Ht Diff:>** (h) is already taken into account. Values to be marked on the reference peg can be found on **Stake Slope Refpoint**, **Info** page.

The closer the real catch point and the approximated stake out catch point are, the closer the projected catch point gets to the real catch point.

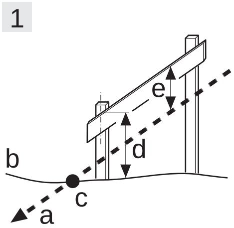
Slope method to be used

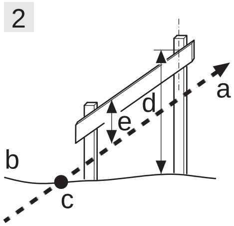
Select **<Slope Method: Ref. Point Surf>** in **Configuration**, **General** page. Refer to "35.6.3 Configuration Settings for the Program - Road Config" for information on how to change the slope method.

Slope staking with batter rails

Description

When staking out slopes with the batter rail method the grade of the slope is marked with a board. Using this method it is not necessary to stake out the catch point first.





1 Batter rail for a cut
2 Batter rail for a fill
a) Slope to stake out
b) Natural surface
c) Catch point of the slope
d) Rail over ground **<Rail over Grd:>**
e) Rail over batter **<Rail ov Batt:>**

The defined **<Rail over Grd:>** should guarantee that the rails are positioned as high as possible, to make them easier to use.

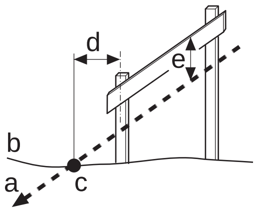
Slope method to be used

Select **<Slope Method: Batter Rail>** in **Configuration**, **General** page. Refer to "35.6.3 Configuration Settings for the Program - Road Config" for information on how to change the slope method.

Staking batter rails using a reference point

Description

This method is used if batter rails with a constant distance from the inner peg to the catch point are required.



a) Slope to stake out
b) Natural surface
c) Catch point of the slope
d) Defined reference point offset **<Ref offset:>**
e) Height of the "traveller" **<Traveller Ht:>**

Workflow

Staking out batter rails the reference peg method is separated in two steps.

Step	Description
1.	The first step is to stake out the catch point of the slope. The reference point offset **<Ref Offset:>** and traveller height **<Traveller Ht:>** are not taken in account in this step. Based on this approximate catch point the projected catch point on the slope is calculated. The projected catch point is used as a starting point for the stake out of the reference peg.
2.	The second step is to stake out the reference point relative to the projected catch point. Values in **Stake Slope Refpoint**, **Stake** page will guide you straight to the position to place the peg. The defined reference point offset **<Ref Offset:>** and traveller height **<Traveller Ht:>** are taken into account. Values to be marked on the batter can be found on **Stake Slope Refpoint**, **Info** page.

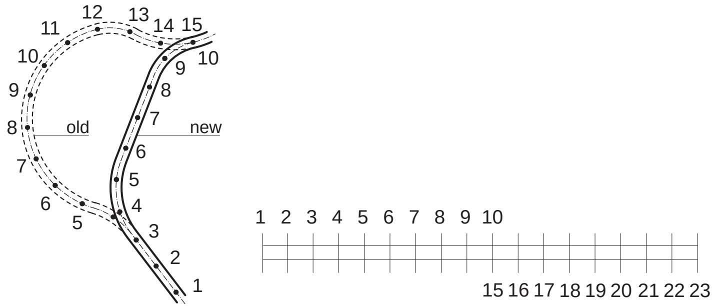
Slope method

Select **<Slope Method: Reference Batter>** in **Configuration**, **General** page. Refer to "35.6.3 Configuration Settings for the Program - Road Config" for information on how to change the slope method.

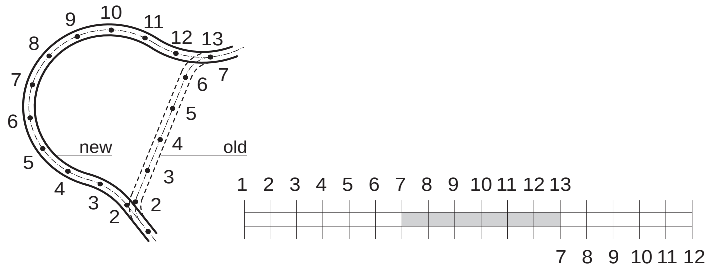
35.11.8 Chainage or Station Equations

Description

Chainage or station equations are used to adjust the alignment chainage or station. The most common reason for doing so is the insertion or removal of curves during the design process. Inserting or removing a curve would require recalculating the chainage or station of an entire alignment. Using chainage or station equations eliminates this need. Chainage or station equations can create either a gap or an overlap as shown in the following diagrams.



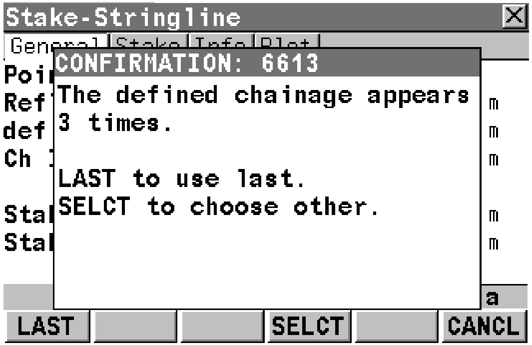
Gap chainage or station equation. Chainage or station back 10 = chainage or station ahead 15.



Overlap chainage or station equation. Chainage or station back 13 = chainage or station ahead 7.

Multiple chainage or station

In the case of the overlap shown in the example, the chainages or stations between seven and thirteen appear twice. When typing in a duplicate chainage or station, a message box prompts if the previous selected chainage or station should be used again or if a new one should be selected from all existing chainage or station equations.

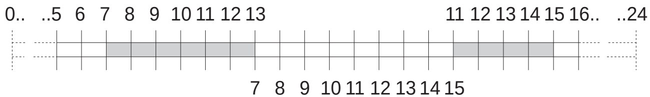


LAST (F1)
To use the previously selected chainage or station equation for the entered chainage or station.

SELCT (F4)
To select the chainage or station out of a list of all available chainage or station equations for the entered chainage or station.

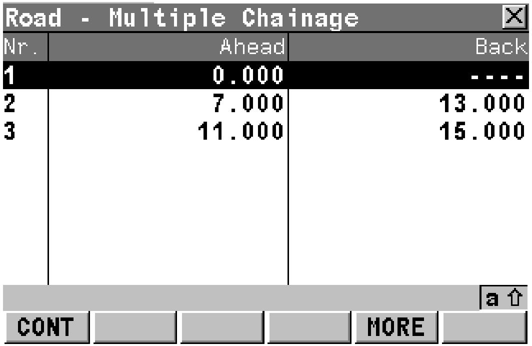
Example

As more than one chainage or station equation is possible a chainage or station can appear more than twice on a design. In this example the chainages or stations 11 to 13 appear three times.



Overlap chainage or station equation. Chainage back 13 = chainage ahead 7 and chainage back 15 = chainage ahead 11.

If typing in chainage or station 12 in this example in **Multiple Chainage** to select the right chainage or station looks as follows:



CONT (F1)
To select the highlighted chainage or station equation and return to the stake out dialog.

MORE (F5)
To switch the last column to show the end chainage or station of the chainage or station equation.

Description of columns

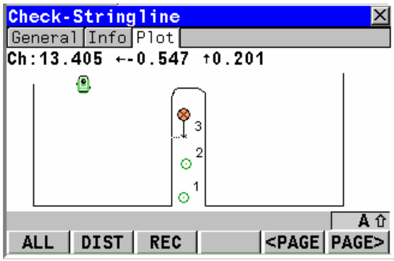
Column	Description
End	Shows the end chainage or station for the chainage or station equation, reads in our example 13.000 for **Nr** 1, 15.000 for **Nr** 2 and 24.000 for **Nr** 3. **End** shows till which chainage or station the current chainage or station equation is valid. As for the first part of the alignment no chainage or station equation exists **Ahead** stays empty for the first row.

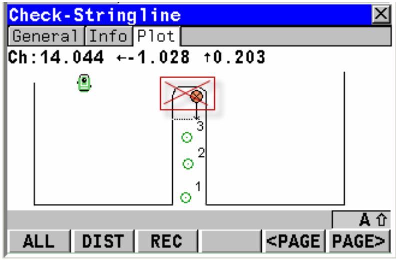
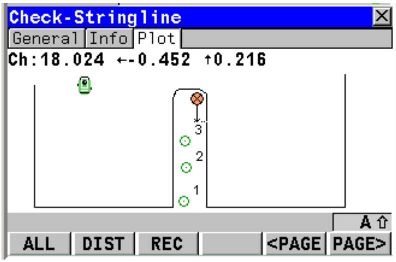
35.11.9 Working Corridor

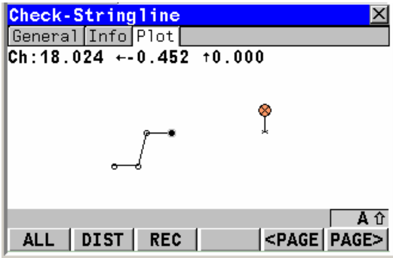
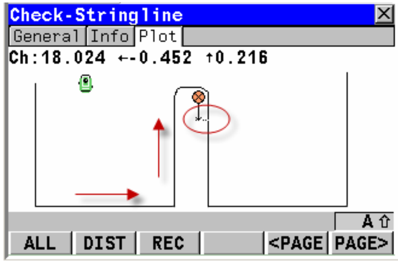
Description

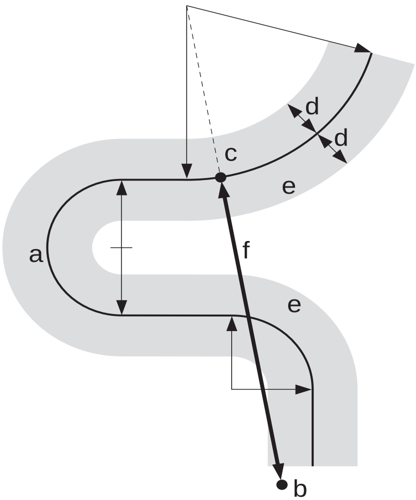
A working corridor is a defined offset range left and right of the centreline.

Why is a working corridor used?

Step	Description
1.	A job may require that all stake points are not allowed outside a defined/reserved area. In this case along the alignment the working corridor maybe used to give the user a warning if they are located outside this area: **Measured position is outside of the defined working corridor**. ☞ It is still possible to stake outside of the working corridor.
2.	Along an irregular alignment a working corridor warning message and the re-initialize tool together can be useful to recognize a projection to an unexpected centreline element and then to re-initialize the projection to the closest centreline element. In the diagram below you can see the projection to the centreline for the first three measurements is as expected. 

Step	Description
	Now consider the user skips a section of the alignment and measures the next point much further along. See that the projection is to an unexpected element on the centreline. With a suitably defined working corridor, the user would receive a warning message that they are outside the working corridor.  The re-initialize tool, "35.10.4 Common Extras - Reinitialise Search", can be used to find the nearest projection of the measured position to the selected line. 

Step	Description
3.	By entering a working corridor, you also set the width at which the cross section will display in the plot page. Note if the **same** stringline can be intersected more than once, then only the nearest intersection point is shown in the cross section. The measured position is always shown, no matter what distance it is from the cross section. In the below diagrams you can see the alignment direction. The corresponding cross section is shown according to the measured point and in the direction of the alignment. 
4.	If the point is located before the start of the alignment (b) and a user entered working corridor is used (e), you would also see the warning message **Measured position is outside of the defined working corridor**. The example below shows how Road finds the centreline point (c) with the smallest perpendicular offset (f) whether a user defined a working corridor is entered or not.

Step	Description
	 a) Centreline b) Measured position c) Projected point on the centreline d) Defined offset range for the working corridor e) Working corridor f) Offset from the centreline if no working corridor is used

35.12 Understanding the Geometry

35.12.1 Horizontal and Vertical Geometry Elements

Horizontal alignment

Road supports the following elements in the horizontal component of alignments:

- Straights
- Arcs
- Clothoids, entry and exit as well as partial
- Cubic parabolas
- Full/Partial Bloss curves (parabola of degree five)
- Multipoints, all elements that cannot be described by one of the previous types are represented by discrete points along the curve. For example, a line parallel to a clothoid.

Vertical alignment

Road supports the following elements in the vertical component of alignments:

- Straights
- Arcs
- Quadratic parabolas
- Multipoints, all elements that cannot be described by one of the previous types are represented by discrete points along the curve.

35.12.2 Horizontal and Vertical Shifts

Description

Horizontal and vertical shifts are added when creating a task within the selection wizard.

Road offers the following four different types of shifts:

- Constant
- Linear
- Parabolic
- Reverse Curve

A shift is always an overlay of the existing design and is stored with the task. In the case of a horizontal alignment the shift is applied perpendicular to the centre-line. For the vertical part of the alignment, shifts are applied following the plumb line.

Constant

A constant shift is applied from the begin chainage of the shift to the end chainage of the shift.

Linear

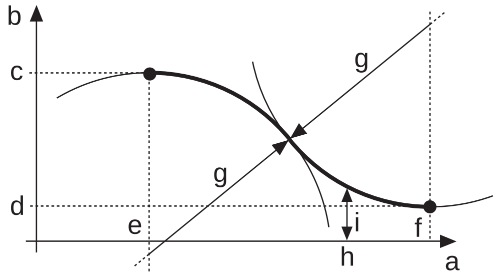
The difference between the shift at the begin chainage and the shift defined at the end chainage is distributed in a linear fashion.

Parabolic

The difference between the shift at the begin chainage and the shift defined at the end chainage is distributed using a cubic parabola. Parabolic shifts allow a smooth transition between the existing curve and the shifted part.

Reverse curve

Two arcs with the same radius are used to distribute the shift. As for parabolic shifts, reverse curves guarantee a smooth transition between the existing curve and the shifted part.

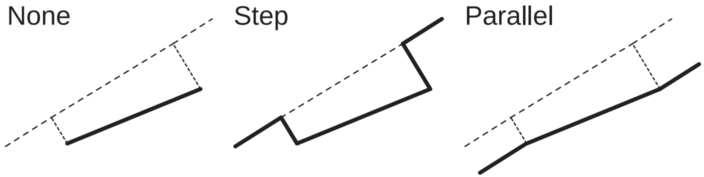


a) Chainage
b) Shift
c) Start shift at chainage (e)
d) End shift at chainage (f)
e) Start chainage of the shift
f) End chainage of the shift
g) Radius of the two arcs used as transition curve
h) Random chainage between (e) and (f)
i) Shift applied at chainage (h)

Behavior before/after the shifted area

Road offers three possibilities how the area before the start chainage and after the end chainage of the shift should be treated.

Type	Description
None	The curve exists between the start chainage and end chainage of the shift.
Step	Outside of the defined shift area the original design is used. This means a "step" will appear at the start and/or end of the shifted area.
Parallel	The start shift is used from the start of the alignment till the start chainage and the end shift from the end chainage on till the end of the alignment.



The three possibilities for curve behavior outside of the shifted area.

35.12.3 Extension of the Centreline

Description

Whenever centrelines need to be extended, for example, at the start and end area of an alignment or slope. The projection of the measured position to the centreline is made using the tangent of the start/end point of the centreline.
In this case a warning appears informing that the original design is exceeded. As soon as a measured position is within the design area once again, Road will notify you.

Concept

When expanding the centreline the geometry will be continued using the tangent of the start/end point of the centreline.

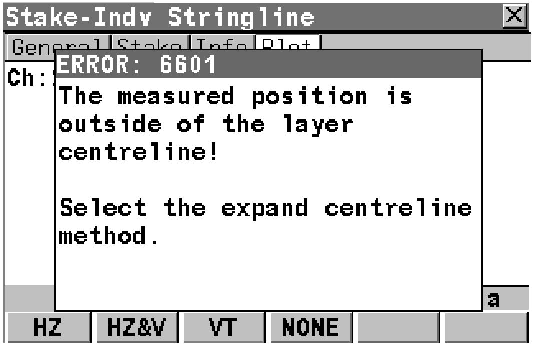
a) Centreline
b) Extended centreline

Method

Description

When staking-out in the region of the start/end area of the design centreline, situations occur where an expansion of the centreline is useful. As soon as dropping outside the defined centreline Road will prompt if and with which method the centreline should be expanded.

Screen



HZ (F1)
Only the horizontal alignment is expanded.

HZ&V (F2)
the horizontal and the vertical alignment are expanded.

VT (F3)
Only the vertical alignment is expanded.

NONE (F4)
Will not expand the centreline at all, and for all measurements outside the centreline no information is displayed.

☞ The extension of a centreline is made following its start/end tangent. Outside of the original design area correct results cannot be guaranteed.

35.13 Quick Start Tutorial (Advanced Mode)

35.13.1 Overview

Description

This tutorial guides you through some basic Road techniques as you stake and check a bike path.

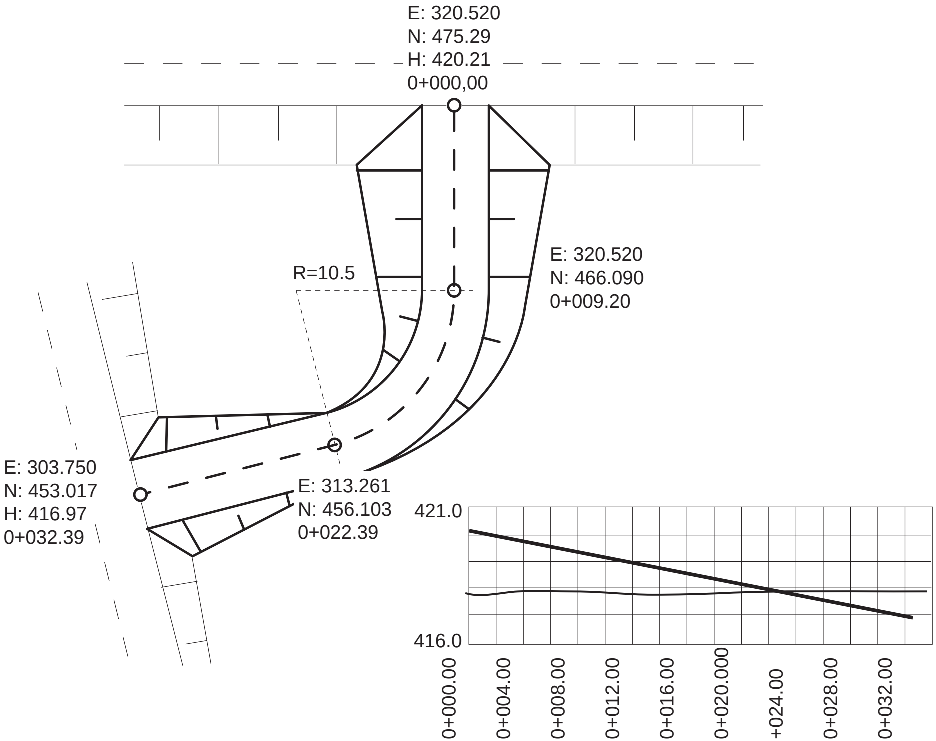
Designed on a CAD System, the data for the bike path has been converted into the onboard format. The design is a short ramp that connects a road with an already existing part of the bike path.

In this tutorial chapter, you will learn how to:

- Create a project that includes your road data
- Change your road configurations
- Select the element to stake out
- Stake out the centreline of the design
- Find catch points for slopes and place batter rails
- Check a road layer surface
- Shift design to fit existing road level

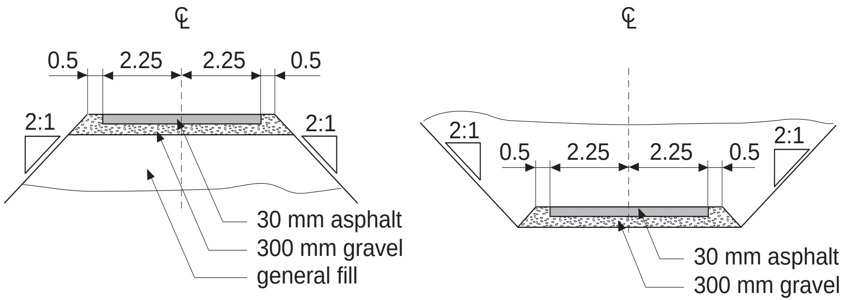
This chapter is separated in five exercises. You can work through the entire tutorial or complete each exercise at a time.

Graphical overview Horz / Vert align-ments



The data representing a bike bath connecting two existing roads is used during your tutorial.

Graphical overview Cross sections



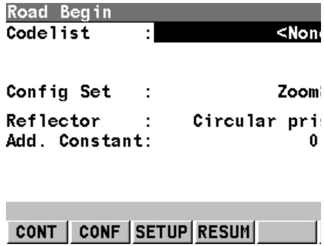
The bike path changes from a fill to a cut. Two different types of cross sections are used.

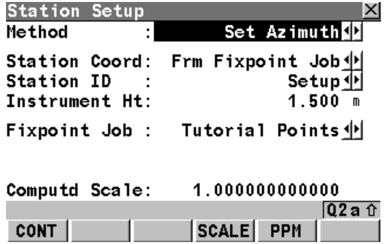
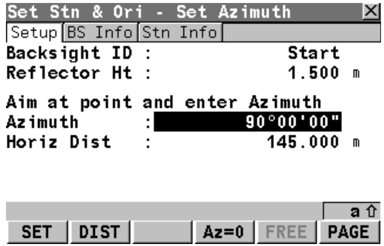
35.13.2 Exercise 1a: Setting Up and Getting Started

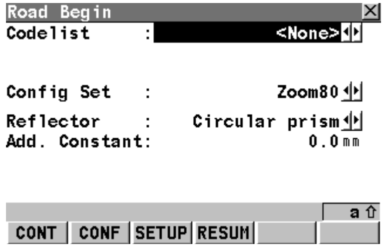
Uploading the data

- This exercise uses the tutorial data distributed with the Zoom80 release DVD.
- Copy all data from SampleData\Applications\Road\Tutorial to the CF card under \DBX\.
- All parts of this task can be completed in the office.

Setting up the TPS

Step	Description
1.	Set up in the upper left corner of your survey area.
2.	Turn on and press **PROG**. Select **Road**.
3.	**Road Begin** Select **<Codelist:>**, Select **<Config Set:>** and Select **<Reflector:>**. Press **SETUP (F3)**. 

Step	Description
4.	**Station Setup**. Select **<Method: Set Azimuth>**. Select **<Station Coord: Frm Fixpoint Job>**. Select **<Station ID: Setup>**. The coordinates of this point are: East=305, North=475, Height=418. Enter the instrument height **<Instrument Ht:>**. Select **<Fixpoint Job: Tutorial Points>**. Press **CONT (F1)** to continue. 
5.	**Set Stn & Ori - Set Azimuth**. Enter **<Backsight ID: Start>** Enter the reflector height **<Reflector Ht:>** Enter **<Azimuth: 100.0000>** if working with gon. Enter **<Azimuth: 90>** if working with degrees. Aim the instrument in the direction of the start point of the tutorial alignment. Press **SET (F1)**. 

Step	Description
6.	Press **OK (F4)** to complete the setup. 

35.13.3 Exercise 1b: Creating the Project and Task and also Configuring

Description

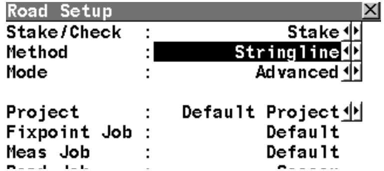
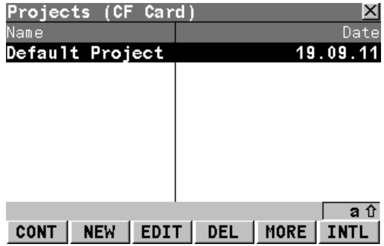
- In this exercise, you will create a new project that contains the road data converted from the original CAD design data. To make sure that the right configurations are used you will need to check them. Then the first element to stake out, the centreline of the bike path, is selected.
- Most of the time, when working on a construction site, it is not possible to finish a task in one go. Road deals with this by "remembering" the tasks you have been working on. The special shifts, names and other settings of the task you have defined are stored and can be called up again. This makes it also possible to prepare the tasks in the office, where all the paper plans, CAD drawings, recent updates and a good cup of coffee are available.

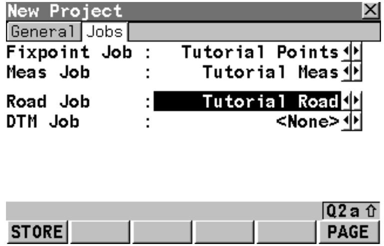
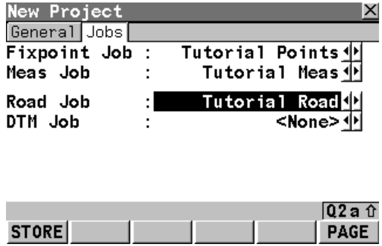
Uploading the data

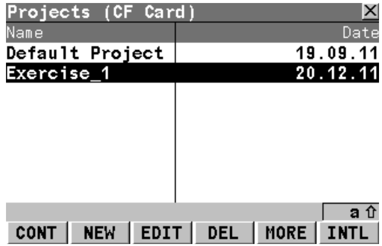
- This exercise uses the tutorial data distributed with the Zoom80 release DVD.
- Copy all data from SampleData\Applications\Road\Tutorial to the CF card under \DBX\.
- All parts of this task can be completed in the office.

Creating a new project

Step	Description
1.	Press **CONT (F1)** to access **Road Setup**. (these steps continue from Exercise 1a)

Step	Description
2.	Highlight and open the choicelist for **<Project:>**. 
3.	Press **NEW (F2)**. When creating a project, Road lets you group the jobs - the fixpoint job, the measurement job, the road job, and the DTM job to give you faster access. 
4.	**The General page**. Enter **<Project Name: Exercise_1>**, Enter a description (optional) **<Description:>**, Enter a name (optional) **<Creator:>** and Select the storage device **<Device: CF Card>**. Press **PAGE (F6)** to move to the **Jobs** page. 

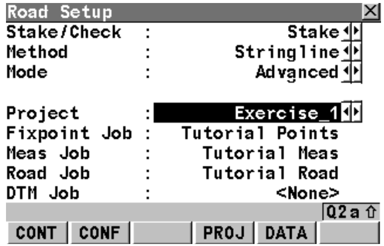
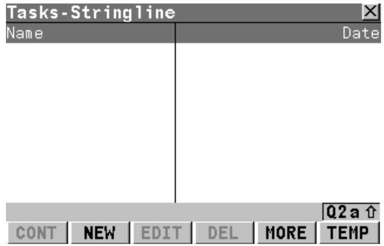
Step	Description
5.	**The Jobs page**. Highlight and open the choicelist for **<Fixpoint Job:>**. Highlight and select the job **<Tutorial Points:>**. In a fixpoint job all the control data needed in the field is stored. Control data are points with known coordinates used for a TPS set-up or points. Press **CONT (F1)** to continue. 
6.	Select the other jobs in the same way: Select **<Meas Job: Tutorial Meas>**, Select **<Road Job: Tutorial Road>** and Select **<DTM Job: None>**. Press **STORE (F1)** to store the project. 

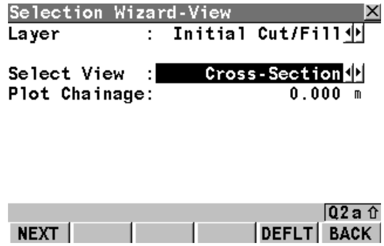
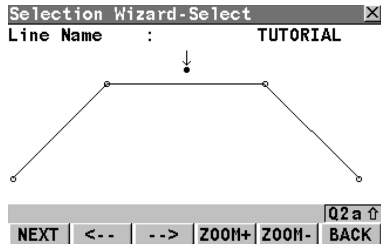
Step	Description
7.	The new project **Excercise_1** has been created. When working with the project the next time it is no longer necessary to select all different parts that belong to the project separately. When the project is selected all parts come with it. This helps to make the access easier and avoids errors based on a wrong selection.  Press **CONT (F1)** to access **Road Setup**.

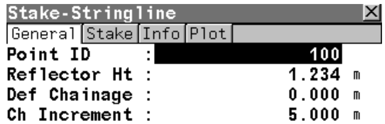
Understanding the geometry and the tasks

- Before the actual earthworks start the centreline of the new bike path should be staked out to give an overview of where it will run.
- Road differentiates between the pure data stored in your road job and the tasks you create based on them. For example, the centreline to stake out exists as a line stored in the road job containing all information about the geometry of the line. If you stake it out this pure geometry information is not enough. You define special shifts or decide that the line should only be staked out within a certain chainage range.The same line in the road job can be staked out in different ways. Such a definition of how a certain element is staked out is called a task.
- In the following part you will create a task for the stake out of the centreline.

Creating a new task

Step	Description
8.	Select **<Stake/Check: Stake>**, Select **<Method: Stringline>**, Select **<Mode: Advanced>**, Ensure **<Project: Exercise_1>** is selected. Press **CONT (F1)** to access **Task Management**. 
9.	Press **NEW (F2)** to start the Selection Wizard. The selection wizard guides you through the selection of the new task. The new task is created when you reach the last screen of the Selection Wizard and end it with **FINSH (F1)**. 
10.	Select **<Task Type: Stringline>**. Enter **<Task Name: Bike CL>**. Select **<Use Zig Zag: No>**. Select **<Shift Horiztl: None>**. Select **<Shift Verticl: None>**. Press **NEXT (F1)** to continue. 

Step	Description
11.	Select **<Layer: Initial Cut/Fill>**. Road can store different layers of a road. This makes it possible to store, for example, the final surface of the pavement as well as the surface for the first cut or fill. The centre-line you stake out is shown on all layers. Select **<Select View: Cross-Section>** as you will select the centreline of the bike path in a cross section view of the design.  The **<Plot Chainage:>** for the cross section is by default the start chainage of your alignment. Press **NEXT (F1)** to continue.
12.	Select **<Line Name: TUTORIAL>**. Select this line by using the **(F2)** and **(F3)** keys. The stringline name is the name defined during the conversion in GGO or the name of the stringline from the design package. Press **NEXT (F1)** to continue. 

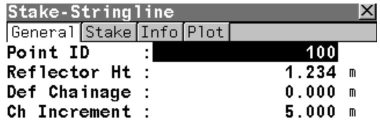
Step	Description	
13.	Select **<Stake Mode: 3D>** as you are also interested in the height of the centreline. Select **<Use Min/Max: No>** as you want to use the whole length of the centreline. Press **FINSH (F1)** to confirm the changes, end the Selection Wizard and create the new task. The new task you have created is stored with all the defined settings as part of the project. To run the stake out it is only necessary to call up the task again.	
14.	You are now ready to stake the bike path centreline.	

Checking/Changing the configurations

Configurations define how the application appears and how it behaves. The configurations are separated in two groups:

- Project configurations, they are common for the whole project. For example how chainages are displayed.
- Road configurations, they are road specific. For example the working corridor left and right of the alignment.

All configurations can be stored in configuration sets.

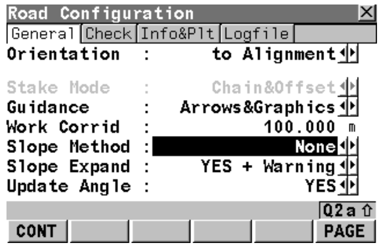
<table>
<tr><th>Step</th><th>Description</th></tr>
<tr><td>15.</td><td>Press SHIFT CONF (F2) to access Configuration.

</td></tr>
<tr><td>16.</td><td>Choose Road Config.

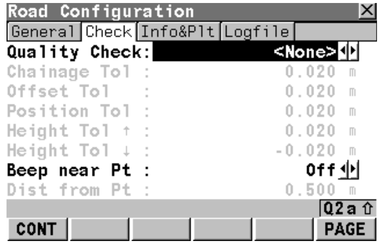
</td></tr>
<tr><td>17.</td><td>The General page

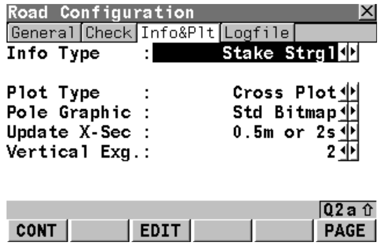
Select <Orientate: to Alignment>.
The <Stake Mode:> changes to Chain & Offset

Select <Guidance: Arrows & Graphics>.

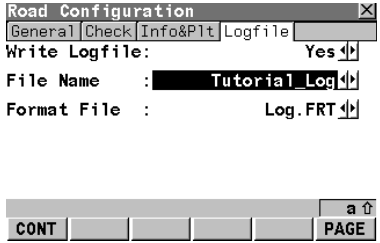
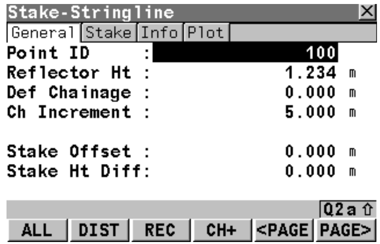
Select <Work Corrid: 10.000m> to define the working corridor left and right of the centreline.

Press PAGE (F6) to move to the Check page.

</td></tr>
</table>

<table>
<tr><th>Step</th><th>Description</th></tr>
<tr><td>18.</td><td>
Select <Quality Check: None>,
Select <Beep near Pt: Off>.
Press PAGE (F6) to move to the Info&Plt page.


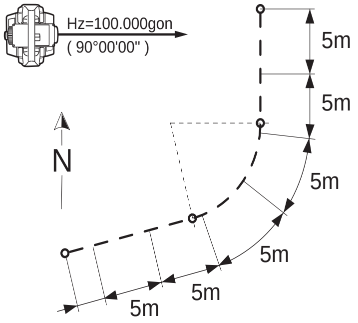
</td></tr>
<tr><td>19.</td><td>
Select <Info Type: Stake Strgl>.
Select <Plot Type: Cross Plot>.
Select <Update X-Sec: 0.5m> or <Update X-Sec: 2s> for the update frequency of the cross section view.
Select <Vertical Exg: 2> for the vertical exaggeration for the cross-section plot.
Press PAGE (F6) to move to the Logfile page.


</td></tr>
</table>

Step	Description
20.	Select **<Write Logfile: Yes>**. Points are stored in the measurement job as well as the log file. Select **<File Name: Tutorial_Log>**. Select **<Format File: Log.FRT>**. Variables defined in the chosen format file are written to the log file. Press **CONT (F1)** to continue. 
21.	All changes are applied to the configuration set you have chosen before and stored with it. This means the next time you select the configuration set Road appears in the way you have defined it. You are ready to stake the bike path centreline. 

35.13.4 Exercise 2: Staking the Centreline

Description



Pegs to place every 5 m and on every start/end point of a segment (=tangent point).

- In this exercise you will stake out the centreline of the bike path defined as a task "Bike_CL" in the previous exercise. For the centreline a peg every 5 m and one at every start and endpoint of an element, the tangent points, should be placed.

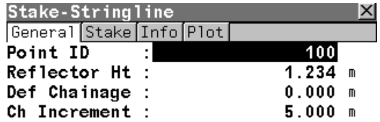
Preparation

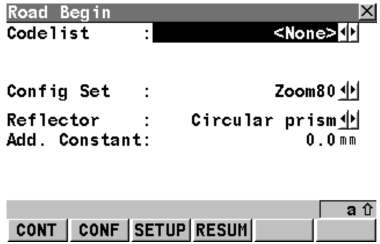
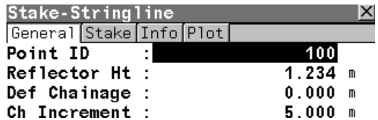
- To run this exercise you need an open space of about 30 x 30 m and 10 pegs.

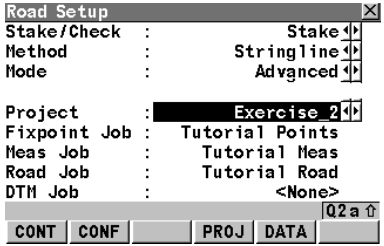
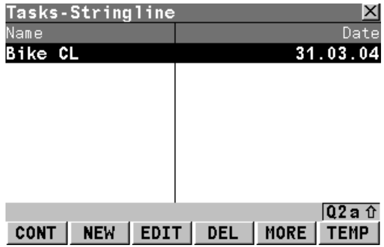
Uploading the data

- This exercise uses the tutorial data distributed with the Zoom80 release DVD.
- Copy all data from SampleData\Applications\Road\Tutorial to the CF card under \DBX\.
- If you continue from Exercise 1 you can use Exercise_1 as well.

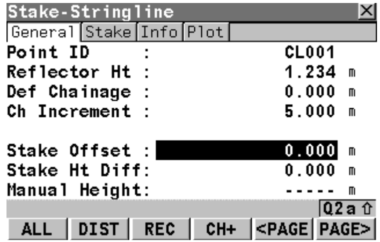
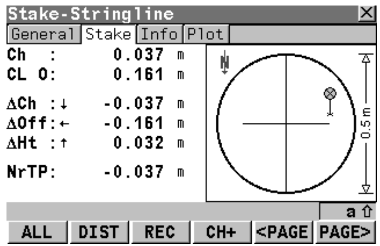
Selecting the project and the task

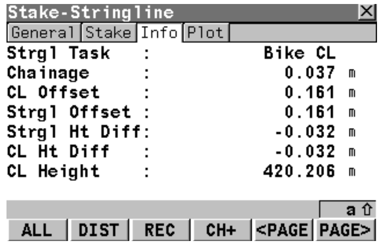
Step	Description Option 1 - Continuing from Exercise 1	
1.	If you have just completed Exercise1a/1b and have not changed screens, then you are ready to stake the bike path centre-line.	

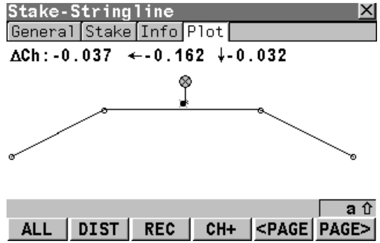
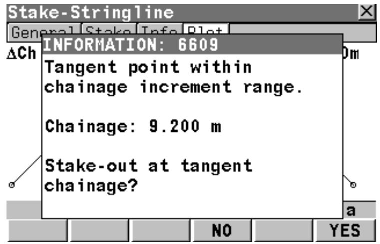
Step	Description Option 2 - Continuing from Exercise 1	
1.	If you have just completed Exercise1a/1b and have either turned off the instrument or exited from the Road program, the following steps apply.	
2.	Turn on and press **PROG**. Select **Road**.	
3.	Press **RESUM (F4)** to simply start up the last task that you have been working on.	
4.	You are ready to stake the bike path centreline.	

	Description Option 3 - Starting with Exercise 2
1.	Press **CONT (F1)** to access **Road Setup**. (these steps continue from Exercise 1a)
2.	Select **<Stake/Check: Stake>**, Select **<Method: Stringline>**, Select **<Mode: Advanced>**, Ensure **<Project: Exercise_2>** is selected. Press **CONT (F1)** to access **Task Management**. 
3.	Highlight and select the existing task **Bike CL**. Press **CONT (F1)**. 

Staking the centre-line

Step	Description
1.	The **General** page. On this page you define the point ID, reflector height, at which chainage your stake-out should start, which chainage increment should be used and stake offsets.  Enter a point ID **<Point ID: CL001>**. Enter the reflector height **<Reflector Ht:>**. Enter **<Def Chainage: 0.000>**. The chainage for the first point you stake out is zero. Enter **<Ch Increment: 5.000>**. No increment is required if staking random chainages. Leave **<Stake Offset:>** and **<Stake Ht Diff:>** at 0. Press **PAGE (F6)** to change to the **Stake** page.
2.	The **Stake** page. you see the difference between the current position and the position to stake out. The bulls eye on the right hand side gives you a graphical feedback of your position relative to the point to stake out.  As **<Orientation: To Alignment>** has been chosen in **Configuration** the bulls eye is relative to the centreline.

Step	Description
	The bulls eye is orientated relative to the centreline, with the tangent of the centreline running from 6 o'clock to 12 o'clock. When working in the tracking mode the delta values get populated instantaneously. Press **DIST (F2)** to populate this page with the values for the current measured position. The three delta values on this page show you the difference between the current position and the position to stake out. Bring the values for **<ΔChainage:>** and **<ΔOffset:>** as close to zero as required. Mark the position of the start point of the centreline. Press **PAGE (F6)** to move to the **Info** page.
3.	The **Info** page. This page is user definable. This gives you the advantage that you can configure the Info page to display the information you need. If the radius of the centreline should also be left on the pegs, just add it! Press **REC (F3)** to store the position of the staked point. Press **PAGE (F6)** to move to the **Plot** page. 

Step	Description
4.	The **Plot** page. This page gives you a graphic representation of the cross-section at the current chainage and your position relative to it. The plot page also shows you the numeric values of the difference to the position to stake-out. Press **CH+ (F4)** to increase the current chainage by the defined chainage increment. Stake out the point at chainage 5.000. 
5.	Press **CH+ (F4)** to increase the current chainage by the defined chainage increment. A message box comes up telling you that there is a tangent point, the start point of the curve, within the chainage increment range. Press **YES (F6)** to stake out the tangent points. 
6.	Stake out all points and tangent points along the centreline until the last chainage.

35.13.5 Exercise 3: Staking Out Slopes

Description

- In this exercise the slopes for the cut and fills of the bike path should be marked. The catch point (intersection between natural surface and design slope) should be staked out and marked.

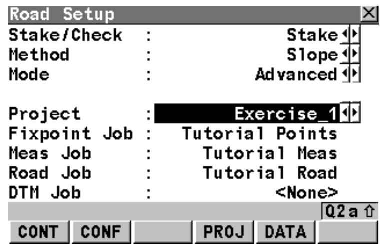
Preparation

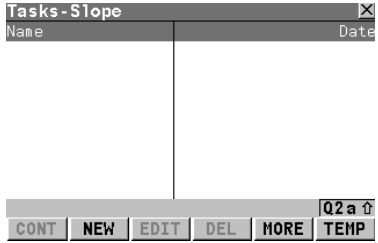
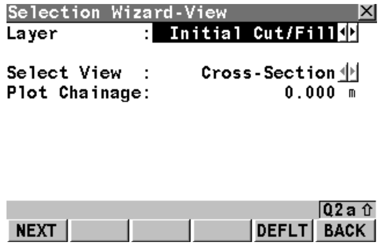
- To run this exercise you need an open space of about 30 x 30 m, 10 pegs and a tape.

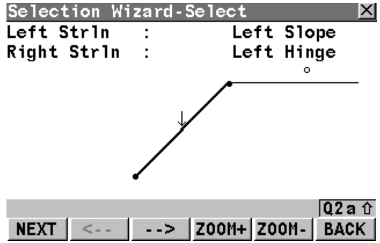
Uploading the data

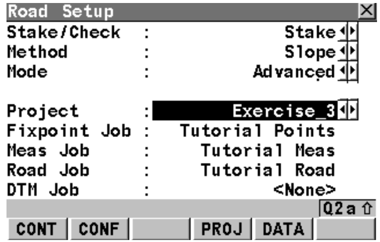
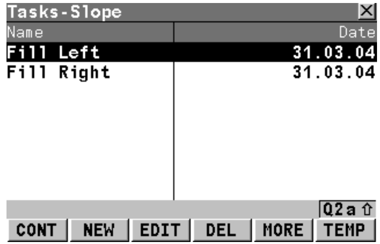
- This exercise uses the tutorial data distributed with the Zoom80 release DVD.
- Copy all data from SampleData\Applications\Road\Tutorial to the CF card under \DBX\.
- If you continue from Exercise 1 you can use Exercise_1 as well.

Selecting the project and the task

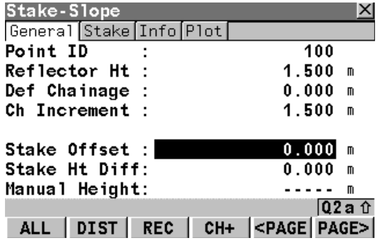
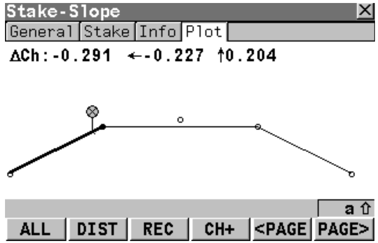
Step	Description Option 1 - Continuing from Exercise 1
1.	Access **Road Setup**. In Exercise 1, a task was created for the stringline. In Exercise 3, you will create a task for the slope.
2.	Select **<Stake/Check: Stake>**, Select **<Method: Slope>**, Select **<Mode: Advanced>**, Ensure **<Project: Exercise_1>** is selected. Press **CONT (F1)** to access **Task Management**. 

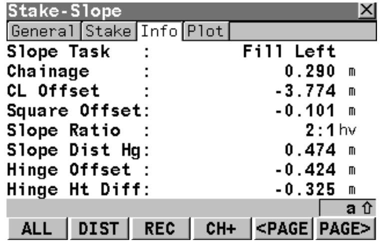
Step	Description Option 1 - Continuing from Exercise 1
3.	Press **NEW (F2)** to start the Selection Wizard. The selection wizard guides you through the selection of the new task. The new task is created when you reach the last screen of the Selection Wizard and end it with **FINSH (F1)**. 
4.	Select **<Task Name: Fill Left>**, Select **<Shift Horiztl: None>**, Select **<Shift Verticl: None>**. Press **NEXT (F1)** to continue. 
5.	Select **<Layer: Initial Cut/Fill>**, Select **<Select View: Cross-Section>**, Select **<Plot Chainage: 0.000>**. Press **NEXT (F1)** to continue. 

Step	Description Option 1 - Continuing from Exercise 1
6.	Select **<Left Strln: Left Slope>**. Select **<Right Strln: Left Hinge>**. Select this line by using the **(F2)** and **(F3)** keys. Press **NEXT (F1)** to continue. 
7.	Select **<Hinge: Right Strln>**, Select **<Use Min/Max: No>**. Press **FINSH (F1)** to confirm the changes, end the Selection Wizard and create the new task. The new task you have created is stored with all the defined settings as part of the project. To run the stake out it is only necessary to call up the task again. 

<table>
<tr><th></th><th>Description Option 2 - Starting with Exercise 3</th><th></th></tr>
<tr><td>1.</td><td>Press CONT (F1) to access Road Setup.
(these steps continue from Exercise 1a)</td><td></td></tr>
<tr><td>2.</td><td>Select <Stake/Check: Stake>,
Select <Method: Slope>,
Select <Mode: Advanced>,
Ensure <Project: Exercise_3> is selected.
Press CONT (F1) to access Task Management.</td><td>
</td></tr>
<tr><td>3.</td><td>Highlight and select the existing task Fill Left.
Press CONT (F1).</td><td>
</td></tr>
</table>

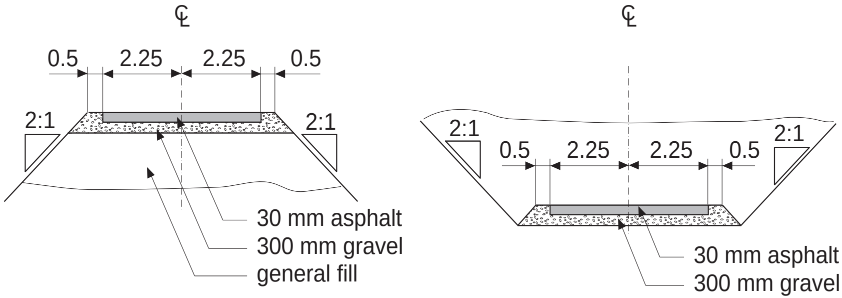
Staking the catch point

Step	Description
1.	The **General** page Enter a point ID **<Point ID:>**, Enter the reflector height **<Reflector Ht:>**. Enter **<Def Chainage: 0.000>**, Enter **<Ch Increment: 5.000>**, Leave **<Stake Offset:>** and **<Stake Ht Diff:>** at 0. Press **PAGE (F6)** to move to the **Plot** page. 
2.	The **Plot** page This page shows the measured position in relation to the cross section at the current chainage. Press **DIST (F2)** to populate the Plot page with the values for the current measured position. Bring the values **<ΔChainage:>** and **<ΔOffset:>** as close to zero as required. Mark the position of the catch point. Press **PAGE (F6)** to move to the **Info** page. 

Step	Description
3.	The **Info** page This page shows all the information to be left on the peg for the guys who actually build your bike path. This page is user defineable. So, if you are used to seeing the displayed values in a different sequence or want to see other items simply select them in the **Configuration**. 
4.	Depending on the workflow you favour you can now either stake all catchpoints on one side of the centreline or flip between the right and left slope of the cut. • To work ahead on one side of the road simply press **CH+ (F4)** to increase to the next chainage. • To change to the right side of the cut simply press **ESC** to return to **Task Management**. Select **Fill Right** and move to the right side of the centreline.
5.	Continue with the stake out of the other catch points each 5 m by using **CH+ (F4)**.
6.	As soon as you reach the area where the fill turns to a cut Road brings up a message box telling you that you are outside of the define slope and prompting if you want to continue with the last valid slope values. This is a useful feature if the design you get is not accurate enough and cuts/fills have to be extended.

35.13.6 Exercise 4: Checking Road Layer Surface

Description



- A common task on construction sites is the as-built check of the work already completed. Road offers you for each stake out method an equivalent check method. The major difference between stake out and check is, that checks are based on random chainages. Therefore no **Stake** page exists for the check methods. In this exercise you will check the 300 mm gravel layer of the of the street.
- When running checks with the layer method Road automatically detects the relevant part of the layer for the measured position. On the **Configuration**, **Stake** page you can choose if a warning should appear as soon as a point outside the defined limits is stored.

Preparation

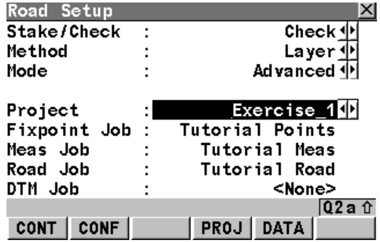
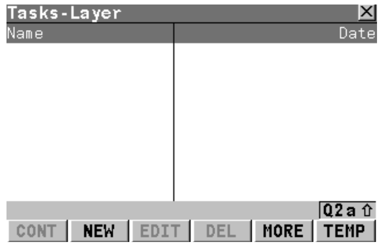
- To run this exercise you need an open space of about 30 x 30 m, 10 pegs and a tape.

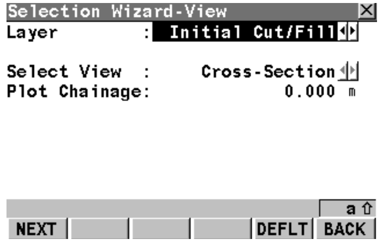
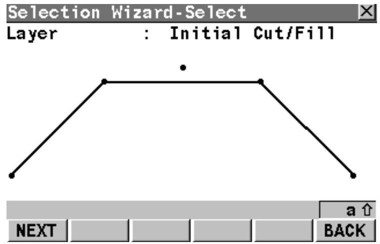
Uploading the data

- This exercise uses the tutorial data distributed with the Zoom80 release DVD.

- Copy all data from SampleData\Applications\Road\Tutorial to the CF card under \DBX\.
- If you continue from Exercise 1 you can use Exercise_1 as well.

Selecting the project and the task

Step	Description Option 1 - Continuing with Exercise 1
1.	Access **Road Setup**. In Exercise 1, a task was created for the stringline. In Exercise 3, a task was created for the slope. In Exercise 4, you will create a task for the layer.
2.	Select **<Stake/Check: Check>**, Select **<Method: Layer>**, Select **<Mode: Advanced>**, Ensure **<Project: Exercise_1>** is selected. Press **CONT (F1)** to access **Task Management**. 
3.	Press **NEW (F2)** to start the Selection Wizard. The selection wizard guides you through the selection of the new task. The new task is created when you reach the last screen of the Selection Wizard and end it with **FINSH (F1)**. 

Step	Description Option 1 - Continuing with Exercise 1
4.	Select **<Task Name: Init Cut/Fill>**, Select **<Shift Verticl: None>**. Press **NEXT (F1)** to continue. 
5.	Select **<Layer: Initial Cut/Fill>**, Select **<Select View: Cross-Section>**, Select **<Plot Chainage: 0.000>**. Press **NEXT (F1)** to continue. 
6.	The whole layer is shown. Press **NEXT (F1)** to continue. 

<table>
<tr><th>Step</th><th colspan="2">Description Option 1 - Continuing with Exercise 1</th></tr>
<tr><td>7.</td><td>Select <Exp endSlp: Yes>,

Select <Use Min/Max: No>,

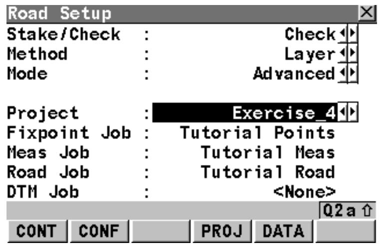
Press FINSH (F1) to confirm the changes, end the Selection Wizard and create the new task.
The new task you have created is stored with all the defined settings as part of the project. To run the stake out it is only necessary to call up the task again.</td><td>
</td></tr>
</table>

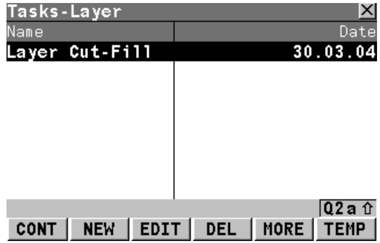
<table>
<tr><th>Step</th><th colspan="2">Description Option 2 - Starting with Exercise 4</th></tr>
<tr><td>1.</td><td colspan="2">Press CONT (F1) to access Road Setup.
(these steps continue from Exercise 1a)</td></tr>
<tr><td>2.</td><td>Select <Stake/Check: Check>,

Select <Method: Layer>,

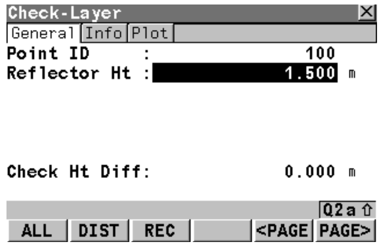
Select <Mode: Advanced>,

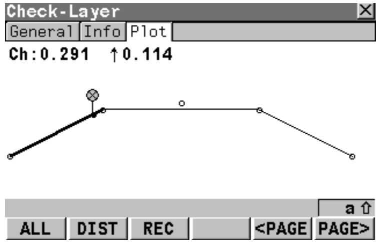
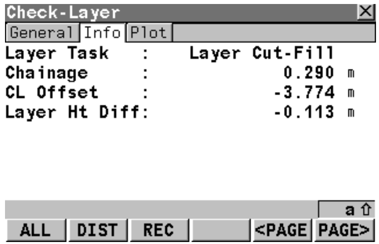
Ensure <Project: Exercise_4> is selected.

Press CONT (F1) to access Task Management.</td><td>
</td></tr>
</table>

Step	Description Option 2 - Starting with Exercise 4
3.	Highlight and select the task **Layer Cut-Fill**. Press **CONT (F1)**. 

Checking the layer

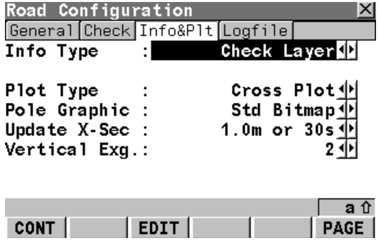
Step	Description
1.	The **General** page Enter the point ID **<Point ID:>,** Enter the reflector height **<Reflector Ht:>**. If the points to pick up are on a certain chainage, you would rather work with the stake out of layers which lets you define a chainage. Press **PAGE (F6)** to move to the **Plot** page. 

Step	Description
2.	The **Plot** page This page shows the measured position in relation to the cross section at the current chainage. Press **DIST (F2)** to populate the Plot page with the values for the current measured position. Bring the values **<ΔChainage:>** and **<ΔOffset:>** as close to zero as required. Mark the position of the catch point. Press **PAGE (F6)** to move to the **Info** page. 
3.	The **Info** page In addition to the values displayed on the Info page you are interested in the grade of the centreline. As the Info page is user defineable you will simply add it to the already displayed item. Press **SHIFT CONF (F2)** to access **Configuration**. 
4.	Choose **Road Config**. 

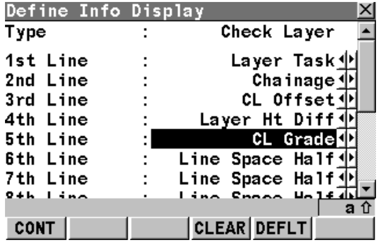
<table>
<tr><th>Step</th><th>Description</th></tr>
<tr><td>5.</td><td>Press PAGE (F6) to move to the Info&Plt page.

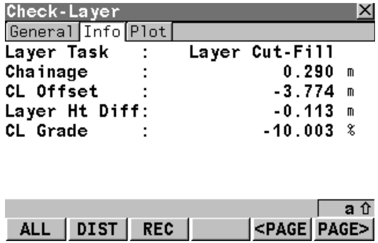
Select <Info Type: Check Layer>.

Press EDIT (F3) to access Define Info Display.


</td></tr>
<tr><td>6.</td><td>Scroll down to the next empty line with either Line Space Half or Line Space Full and relace it with CL Grade.

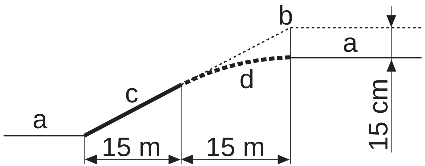
Press CONT (F1) twice to return to the Info page.


</td></tr>
<tr><td>7.</td><td>The field <CL Grade:> appears on the Info page


</td></tr>
</table>

35.13.7 Exercise 5: Shifting Design to Fit Existing Road Level

Description



a) Existing road level
b) Original design
c) Already built
d) Shifted design, with 15cm shift at chainage 0 and 0 cm at chainage 15.

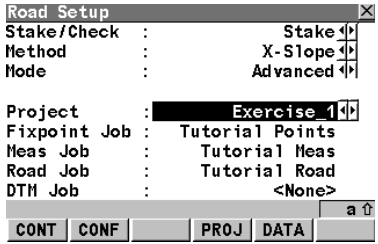
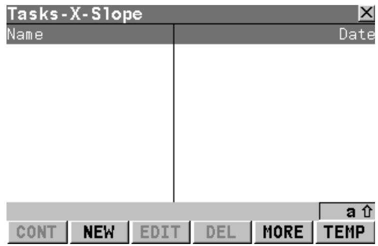
- While staking out the bike path you notice that the existing road level is 15 cm lower than it appears in the design you have received. The bike path is half finished, the construction team want to go on and do not want to remove the 15 m of gravel they have already placed. One way would be now to go back and change the complete vertical alignment of the bike path. Road offers you a much more efficient tool to deal with such every day construction task. After a short call the foreman agrees to your idea of simply shifting the remaining 17 m of the path to match the existing road level.
- In the following exercise you will create a new X-slope task that includes this shift. At chainage 0.000 the shift applied should be -15 cm to intersect with the existing road (a). To guarantee a smooth transition between the already finished part of the bike path (c) and the remaining part a linear shift will be used. This means the 15 cm difference are distributed linearly along the remaining 17 m of the bike path.

Uploading the data

- This exercise uses the tutorial data distributed with the Zoom80 release DVD.
- Copy all data from SampleData\Applications\Road\Tutorial to the CF card under \DBX\.

- If you continue from Exercise 1 you can use Exercise_1 as well.

Selecting the project and the task

Step	Description Option 1 - Continuing with Exercise 1
1.	Access **Road Setup**. In Exercise 1, a task was created for the stringline. In Exercise 3, a task was created for the slope. In Exercise 4, a task was created for the layer. In Exercise 5, you will create a task for the x-slope.
2.	Select **<Stake/Check: Stake>**, Select **<Method: X-Slope>**, Select **<Mode: Advanced>**, Ensure **<Project: Exercise_1>** is selected. Press **CONT (F1)** to access **Task Management**. 
3.	Press **NEW (F2)** to start the Selection Wizard. The selection wizard guides you through the selection of the new task. The new task is created when you reach the last screen of the Selection Wizard and end it with **FINSH (F1)**. 

<table>
<tr><th>Step</th><th>Description Option 1 - Continuing with Exercise 1</th></tr>
<tr><td>4.</td><td>


Enter a task name **<Task Name:>**.

Select **<Use Zig zag: Yes>**. As you want to switch between the left and right side of the X-slope you are staking turn on the zig zag mode. Road will automatically detect to which side of the X-slope you are closer to. This gives you additional flexibility during the stake-out.

Select **<Shift Horiztl: None>**. No horizontal shift should be applied to the X-slope.

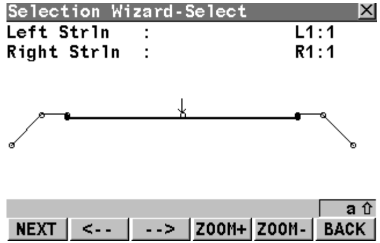
Select **<Shift Vertical: Linear>**. The 15 cm difference should be distributed linear along 17 m of the alignment, starting at chainage 0.000 with 15 cm and ending at chainage 17.000 with 0 cm.

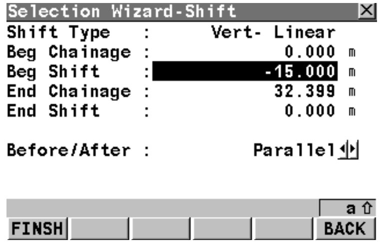
Press **NEXT (F1)** to continue.
</td></tr>
<tr><td>5.</td><td>


Select **<Layer: 300mm Gravel>**.

The default **<Plot Chainage:>** is by default the start chainage of the alignment.

Press **NEXT (F1)** to continue.
</td></tr>
</table>

Step	Description Option 1 - Continuing with Exercise 1
6.	Select **<Left Strln: L1:1>**, Select **<Right Strln: R1:1>**. Select this X-slope by using the **(F2)** and **(F3)** keys. Press **NEXT (F1)** to continue. 
7.	Select **<Reference Line: Left Strgln>**. All stake offsets and height differences applied would be relative to this stringline. Select **<Use Min/Max: No>**. Press **NEXT (F1)** to continue. 

Step	Description Option 1 - Continuing with Exercise 1
8.	The vertical shift should start at chainage 0.000 with 15 cm and should change back to the original design (shift = 0) at chainage 15.000. Select **<Before/After: Parallel>**. Press **FINSH (F1)** to confirm the changes, end the Selection Wizard and create the new task. The new task you have created is stored with all the defined settings as part of the project. To run the stake out it is only necessary to call up the task again. 
9.	The stake out for X-slopes works the same way as for slopes and stringlines. Move left and right of the centreline to see that the stringline you are staking out relative to changes depends on the side of the centreline you are. On the **Plot** page the position you are staking out relative to is always marked by a cross.

36 Roads - Tunnel

36.1 Introduction

36.1.1 Overview

Description

The Tunnel application is an "add-on" component to the Road application program. The tunnel application allows the user to perform tunnel specific survey tasks.

Functionality

The application consists of two main functions:

- **Check Tunnel** for checking a built or excavated tunnel with a tunnel design.
- **Stake Tunnel** for setting out tunnel features during construction.

Check Tunnel

Each function consists of two main tasks, in the case of Check Tunnel, these tasks are:

- **Check Profile** for measuring any point in the tunnel and comparing the measured point with the theoretical design point.
- **Scan Profile** for measuring profiles of the tunnel.

Stake Tunnel

The Stake Tunnel function consists of:

- **Stake Face**, a task that allows setting out at the point of excavation.
- **Stake Profile** for setting out any point of the tunnel at a given chainage.

LandXML data format

The centreline of the tunnel may be imported for use on-board the instrument using the industry standard LandXML data format or in formats exported from a number of other tunnel design packages using the Design to Field component of the GGO application.

Refer to chapter "Tunnel centreline" for more information regarding the import of centreline data.

Tunnel design profiles	Tunnel design profiles may be created using the tunnel profile editor PC application. This application is integrated into the Design to Field component.

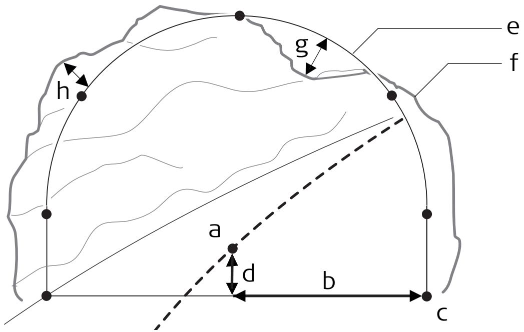
36.1.2 Basic Terms

Basics introduced

In order to make the following chapters on staking and checking tunnels easier to understand, the basics are introduced in this chapter.

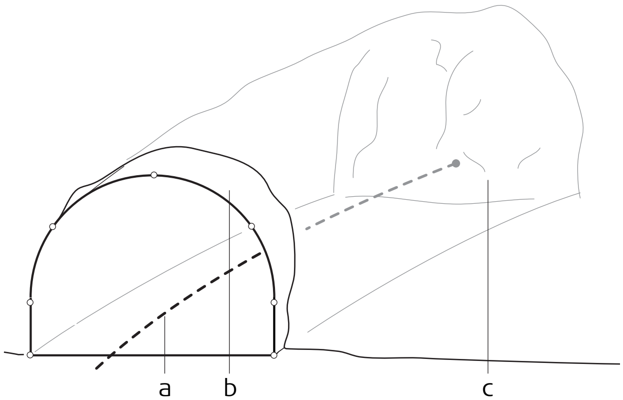
Please be aware that the terminology or workflow used on different construction sites may vary from the one used in this manual, however, basic principles remain the same.

Technical terms



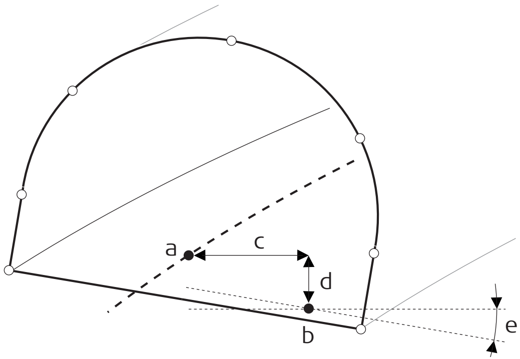
a) Centreline
b) Centreline offset
c) Point on design profile
d) Centreline height offset
e) Design profile
f) Excavated profile
g) Underbreak
h) Overbreak

3D view



a) Centreline or axis
b) Tunnel portal
c) Tunnel face

Superelevation



a) Centreline or axis
b) Rotation point
c) Centreline offset
d) Centreline height offset
e) Superelevation (Rotation)

Technical terms

Technical Term	Description
Centreline	Geometric alignment in two or three dimensions to which all design elements of the project are referenced.
Chainage or station	The cumulative distance along the centreline, frequently but not always starting at zero.
Design profile	Geometric description of the designed shape of the cross section of the tunnel. The design profile may contain straight or curve elements.
Excavated profile	Shape of the cross section of the tunnel that has been excavated.
Underbreak	When the excavated profile is inside the design profile, the underbreak is the perpendicular distance between the design profile and the excavated profile.
Overbreak	When the excavated profile is outside of the design profile, the overbreak is the perpendicular distance between the design profile and the excavated profile.
Tunnel portal	The open end of a tunnel.
Tunnel face	The point where the excavated tunnel meets existing terrain.
Superelevation (rotation)	Angle of rotation of a design profile, used to take into account the velocity of a moving vehicle through a curve.
Rotation point	The point about which the design profile is rotated. This point may or may not coincide with the centreline.

36.1.3 Elements for Tunnel Stake Out and Check Measurements

Basic stake out and check elements

In general there are two different basic stake out and check elements within a tunnel:

- Tunnel face
- Tunnel profile

Tunnel face

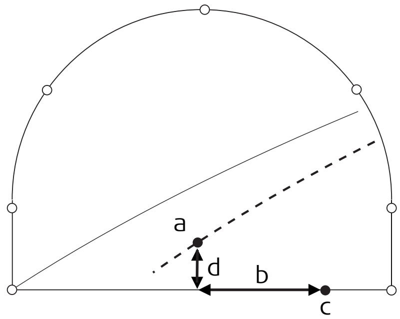
Staking Tunnel Faces

It is usually required to stake out the tunnel face to indicate the position to excavate when certain tunnelling methods are used, for example Drill and Blast or excavation using a roadheader.

The points to stake on the tunnel face may be defined in various ways:

Horizontal and vertical offsets

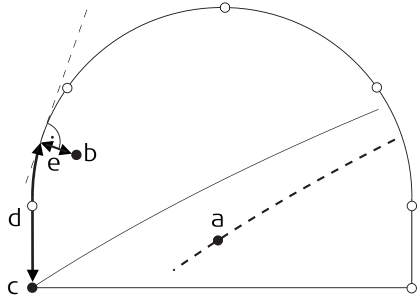
By horizontal and vertical offsets with respect to the centreline:



a) Centreline
b) Point on tunnel face to stake
c) Centreline offset
d) Centreline height offset

Distance along profile

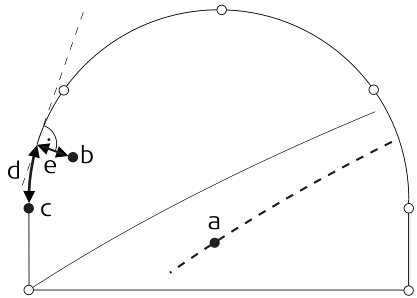
By the distance from the start of the design profile and an offset from the design profile.



a) Centreline
b) Point on tunnel face to stake
c) Point defining start of design profile
d) Distance from start of design profile
e) Offset perpendicular to design profile

Distance along a particular element

By the distance along a particular element of the design profile and an offset from the element.



a) Centreline
b) Point on tunnel face to stake
c) Element of design profile to stake
d) Distance from start of design profile element
e) Offset perpendicular to design profile

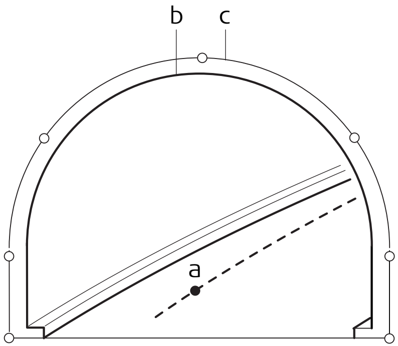
Tunnel profiles

Staking tunnel profiles

Tunnel profiles are normally staked after excavation to indicate the position of tunnel design elements or services such as lighting or ventilation.

Basic terms

Usually a tunnel under construction is designed and built in various stages such that a given chainage can have various design profiles, for example shotcrete, final lining... . Each design profile is called a layer.



a) Centreline or axis
b) Final lining
c) Shotcrete

Working arears

A tunnel profile is defined by its chainage and the design profile assigned to that chainage. Points to stake on any layer of the design profile may be defined using the same methods as those used to stake the tunnel face.

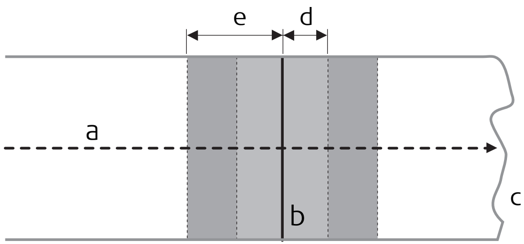
When staking out in a tunnel, it is normally the case that the excavated profile does not coincide exactly with the design profile. In these cases, the irregular form of the excavated profile may mean that it is not possible to stake a particular point at a particular chainage from a given instrument position, for example in a tight curve.

For this reason, a tight tolerance may be used to determine whether a staked point be accepted or not, the stake out process will stop once a measured point is within the tight tolerance limits.

In extreme cases where the instrument positions itself very far away from the point to stake, it may not be worth trying to stake the point. In this case a bailout tolerance may be introduced. If a measured point is outside of the bailout tolerance during the stake out iteration process, the stake out of the point is abandoned.

The bailout tolerance may also be exceeded if an obstruction such as plant machinery is situated between the measurement sensor and the point being measured.

Plan view



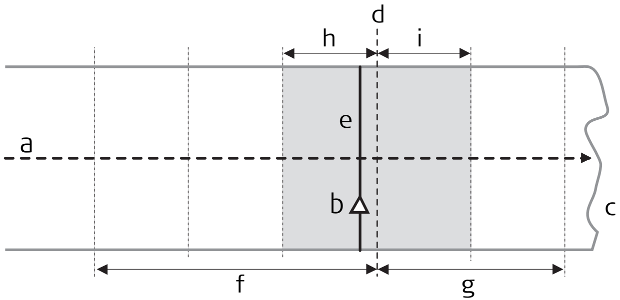
a) Centreline
b) Profile to stake
c) Tunnel face
d) Tight tolerance
e) Bailout tolerance

Measuring tunnel profiles

Tunnel profiles are normally measured after excavation to compare the excavated profile with the design profile during the excavation phase of the project or for quality control checks of the built tunnel.

When measuring tunnel profiles, it is possible to scan various profile from one instrument position. The profiles to scan are defined with respect to a defined chainage. Profiles may be scanned at a given forward and back interval within a given forward and back distance from the defined profile.

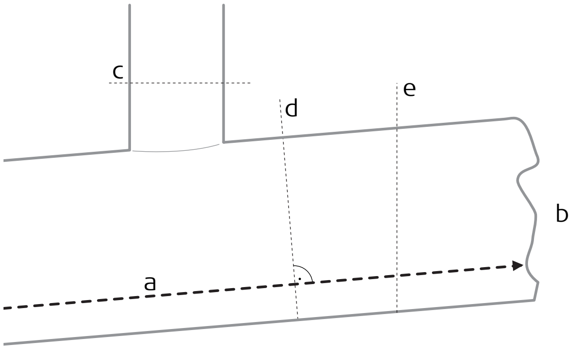
Plan view



a) Centreline
b) Instrument position
c) Tunnel face
d) Defined profile to scan
e) Instrument profile
f) Back distance
g) Forward distance
h) Back interval
i) Forward interval

Profile view

Tunnel profiles may be measured vertically, horizontally or perpendicular to the tunnel centreline.



a) Centreline
b) Tunnel face
c) Horizontal profile
d) Profile perpendicular to centreline
e) Vertical profile

36.1.4 Shifts

General

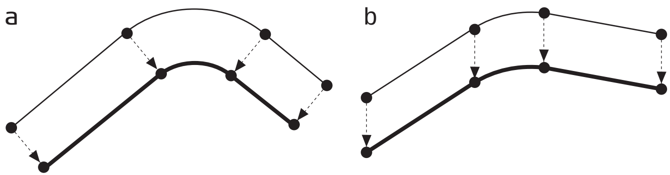
When working on site, it is often the case that design data does not match the measured data. For example, an existing road surface that should intersect with the design surface may be 15 cm higher than the plans indicate. To guarantee a smooth intersection, this difference has to be distributed over the remaining 100 m of paving. To handle these situations, Tunnel allows the possibility of adding shifts to the existing design data. A shift is applied when selecting the element to stake out/check.

☞ Shifts do not change the stored design. They are applied temporarily for stake out purposes.

Centreline shifts

Horizontal and vertical shifts

Horizontal shifts are always perpendicular to the centreline whereas vertical shifts are applied along the plumb line.



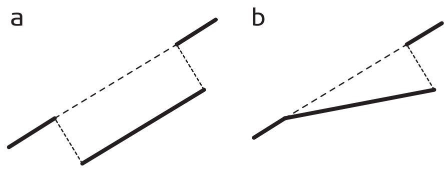
a) Horizontal alignment with constant shift (Plan View)
b) Vertical alignment with constant shift (Profile View)

Constant and linear shifts are supported

For both horizontal and vertical shifts two different types are available (can be applied):

Constant: The shift remain the same from its start chainage or station to the end chainage or station.

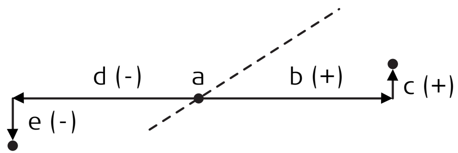
Linear: The shift is linearly interpolated along the chainage or station.



a) Constant shift
b) Linear shift

Sign convention

The sign convention for design shifts is identical to that used for centreline offset and height shifts difference.



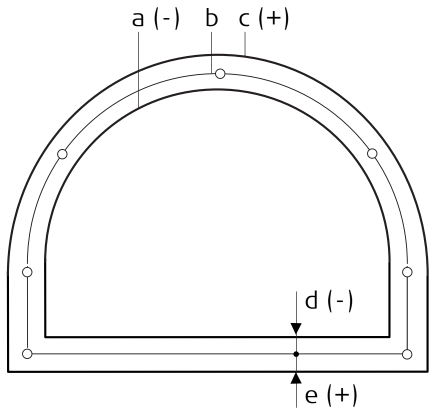
a) Centreline
b) Positive horizontal shift
c) Positive vertical shift
d) Negative horizontal shift
e) Negative vertical shift

Design profile shifts

Profile shift

A shift may be applied to the design profile. The shift is applied perpendicularly to the design profile at any point along the design profile.

A positive shift will increase the size of the profile, a negative shift will decrease the size of the profile.



a) Design profile with negative shift
b) Original design profile
c) Design profile with positive shift
d) Negative shift
e) Positive shift

36.2 Getting Started

36.2.1 Preparing Design Data

Downloads section

The tunnel design data may be imported for use on-board the instrument using the industry standard LandXML data format or in formats exported from a number of other design packages using the Design to Field component of the GGO PC application. Converters are available for more than 15 different design packages.

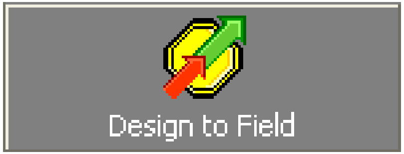
☞ The latest version of the Design to Field importers may be found in the Downloads section of the GeoMax web site.

Tunnel centreline

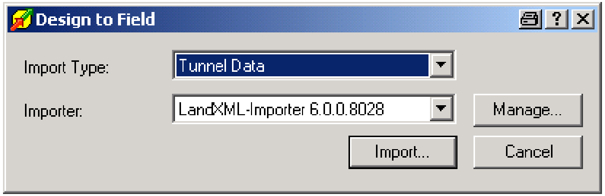
Basics

The tunnel centreline may be defined in two or three dimensions. A 3-dimensional centreline is required if design profiles are to be used.

Design to field



To import a centreline using the Design to Field component select the **Tools/Design to Field** option of the GeoMax PC application.

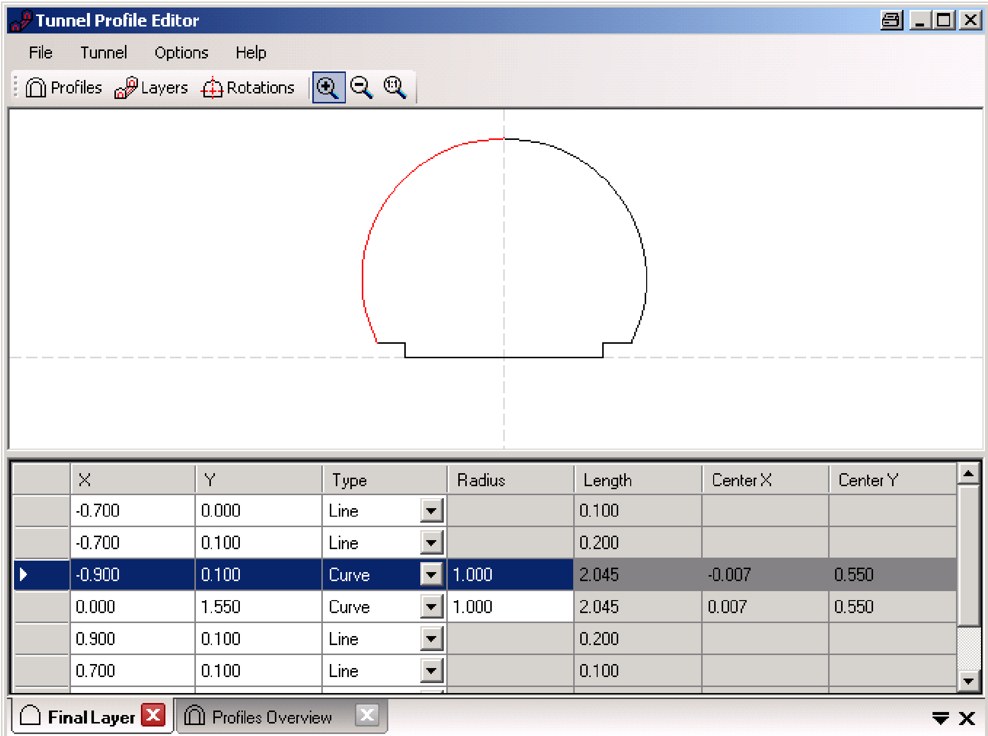


Design profiles

Tunnel design profiles

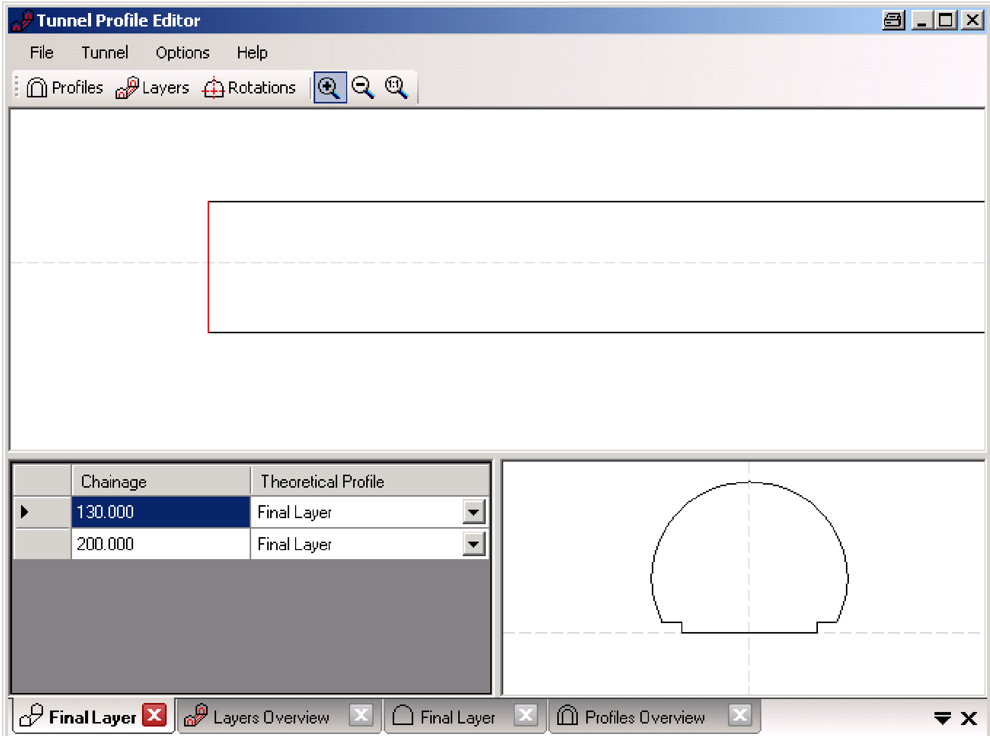
If tunnel design profiles are available, they may be created using the Tunnel Profile Editor PC application. This application is integrated in the Design to Field viewer. It allows to import or create tunnel data like profiles, layers and rotations. Refer to the Tunnel Profile Editor online help for more information.

Tunnel Profile Editor, Profile details view



	X	Y	Type	Radius	Length	Center X	Center Y
	-0.700	0.000	Line		0.100		
	-0.700	0.100	Line		0.200		
▸	-0.900	0.100	Curve	1.000	2.045	-0.007	0.550
	0.000	1.550	Curve	1.000	2.045	0.007	0.550
	0.900	0.100	Line		0.200		
	0.700	0.100	Line		0.100		

Tunnel Profile Editor, Layer details view



Data transfer to sensor

Getting data onboard

Once the design data have been converted, copy the database files to the DBX folder of the CompactFlash card that will be used on the sensor. The file names are "jobname.x??".

These files are: Fixpoint job
Meas job
Tunnel job

36.2.2 Using the On-Board Application

Installation and licencing

The Tunnel application is an "add-on" component of the Road application program. It is necessary that both the Road and Tunnel applications are loaded on the instrument before starting.

Both the Road and Tunnel applications are protected. They may be activated through a specific licence key. This licence key may be typed-in either through the Main Menu: Tools...\Licence Keys or, alternatively, the first time the application program is started.

Access

Select **Main Menu: Programs...\Road**.

OR

Press **PROG**. Highlight **Road**. **CONT (F1)**. Refer to "31.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

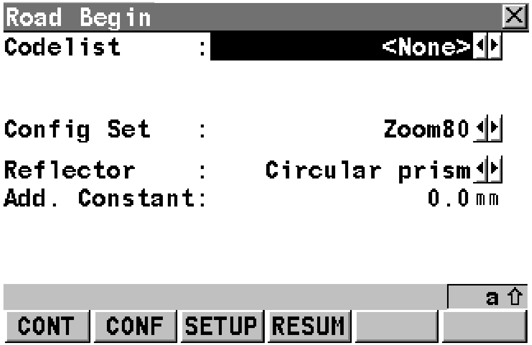
Press a hot key configured to access the screen **Road Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

Positioning the TPS

To select the codelist, configuration set and reflector for the survey.



CONT (F1)
To continue to the next screen.

CONF (F2)
To access the configuration settings. Refer to " View&Edit Data".

SETUP (F3)
To set up an instrument station by determining the station coordinates and orienting the horizontal circle.

RESUM (F4)
To resume the last used and stored task. This is a recommended feature when using Advanced mode.

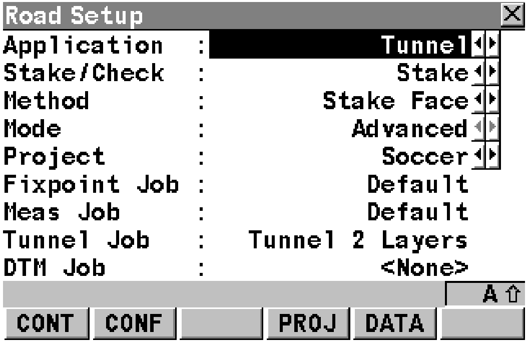
Description of fields

Field	Option	Description
<Codelist:>	Choicelist	The active codelist. All codelists from **Main Menu: Manage...\Codelists** can be selected.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from **Main Menu: Manage...\Reflectors** may be selected.

Field	Option	Description
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Road
Road Setup

An overview of the setup information selected for the survey.



CONT (F1)
To continue to the next screen.

CONF (F2)
To access the configuration settings. Refer to " View&Edit Data".

PROJ (F4)
To edit the currently selected project. Refer to "36.5 Project and Job Management".

DATA (F5)
To view/edit the data in the tunnel job. Refer to "36.6.4 Viewing and Editing the Design Data".

Description of fields

Field	Option	Description
<Application:>	Choicelist	To select the relevant application. This field lists all of the applications that have been loaded into the Road group. Ensure that **Tunnel** is selected.

Field	Option	Description
<Stake/ Check:>	Choicelist	To select either **Stake** or **Check** for the survey.
<Method:>		To select the relevant method for the survey. All stake/check methods are listed.
	Check Profile	For Check. To check any point, anywhere in the tunnel against the design values. If no design profile has been defined in the tunnel job, the measured point is analysed with respect to the horizontal and vertical alignment.
	Scan Profile	For Check. To measure profiles of the tunnel, perpendicular to the centre line. Various profiles may be measured from one instrument position.
	Stake Face	For Stake. To set out any point on the excavation face of the tunnel. The points to set out may be defined with respect to the horizontal and vertical alignment or to the design profile.
	Stake Profile	For Stake. To stake any point at a given chainage in the tunnel. The points to set out may be defined with respect to the horizontal and vertical alignment or to the design profile.

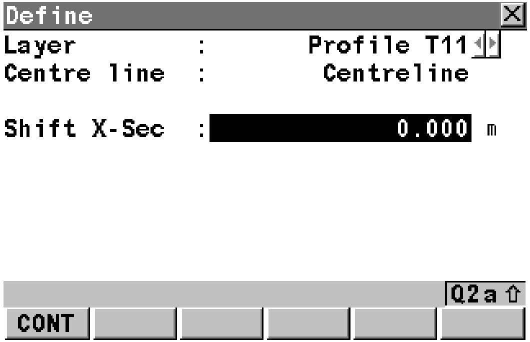
Field	Option	Description
<Mode:>	**Standard**	All of the tunnel element definitions for a survey are available in the Define page. The Define page is the page which is displayed before starting a stake/check survey in Standard mode. Layers contained in the active tunnel job can be selected from this page. These elements, combined with other settings on this page can easily be changed during the survey.
	Advanced	All of the tunnel element definitions for a survey are available from tasks, which are created and edited using the Selection Wizard. Tasks are an integral part of all stake/check surveys in Advanced mode. These elements, combined with other definitions can easily be changed during a survey.
<Project:>	Choicelist	To select the relevant project for the survey.
<Fixpoint Job:>	Output	The fixpoint job, as defined by the project.
<Meas Job:>	Output	The measure job, as defined by the project.
<Tunnel Job:>	Output	The tunnel job, as defined by the project.
<DTM Job:>	Output	The Digital Terrain Model job, as defined by the project.

Working in standard mode

Access

Select **<Mode: Standard>** in **Road Road Setup**.
Press **CONT (F1)** to continue to the next screen.

Screen



CONT (F1)
To continue to the next screen.

SHIFT CONF (F2)
To access the configuration settings. Refer to "36.7 Configuration".

Description of fields

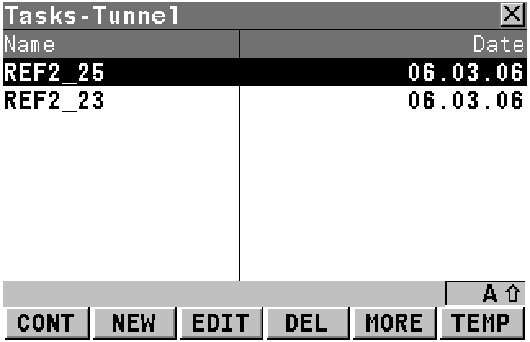
Field	Option	Description
<Layer:>	Choicelist	To select a layer in the active tunnel job.
<Centreline:>	Output	The name of the layer centreline.
<Shift X-Sec:>	User input	The tunnel profile can be shifted horizontally to define another tunnel with a constant offset from the centreline. The shape and the size of the tunnel profile will not be changed.

Working in advanced mode

Access

Select **<Mode: Advanced>** in **Road Road Setup**.
Press **CONT (F1)** to continue to the next screen.

Screen



CONT (F1)
Selects the highlighted task and proceeds to the next screen.

NEW (F2)
Starts the task wizard.

TEMP (F3)
Creates a temporary task.

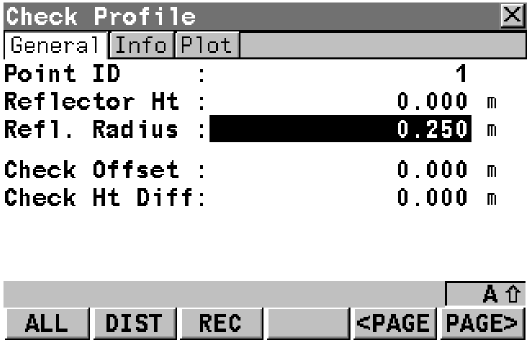
More information on creating tasks can be found in chapter "36.6.3 Tasks".

36.3 Checking and Measuring the Tunnel

36.3.1 Checking Profiles

Check Profile

Enter Information regarding the measured point in the **General** page.



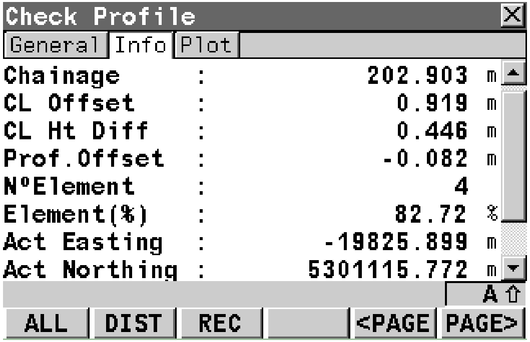
Description of fields

Field	Option	Description
<Point ID:>	User input	The measured point will be recorded with the point ID displayed on the screen.
<Reflector Height:>	User input	If a reflector is used, the vertical difference between the point to be measured and the point of the reflector pole should be entered.

Field	Option	Description
		☞ When using a reflector to check a design profile it is important to take into account the reflector radius parameter in the General page of the application configuration. If this parameter is set to Yes, the measured point will be projected by a distance equivalent to the radius of the reflector in a direction perpendicular to the tangent of the design profile. If this parameter is set to No, the design profile will be compared to the coordinates of the centre of the reflector at the measured position. If reflectorless measurements are used or no design profile has been defined, the reflector radius parameter will not be used in the calculation.
<Check Offset:>	User input	Applies a horizontal shift perpendicular to the centreline used for comparing to the measured point.
<Check Ht Diff:>	User input	Applies a vertical shift to the centreline used for comparing to the measured point.

Check Profile, Info page

The differences between the measured and design data may be viewed in **Check Profile**, **Info** page. The parameters viewed can be configured in the **Info&Plot** page of the application configuration.



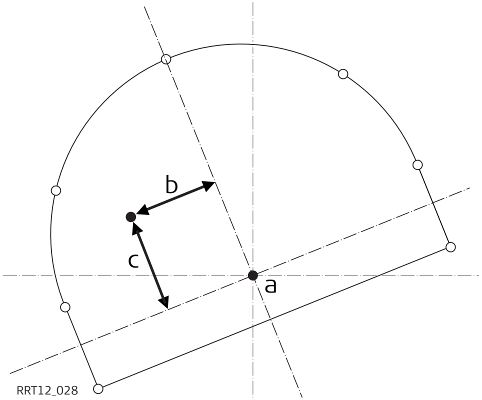
SHIFT CONF (F2)
To access the configuration settings. Refer to "36.7 Configuration".

Description of fields

In this screen the most important values for checking the measured point against the design are:

Field	Option	Description
<CL Offset:>	Output	The plan distance from the measured point to the horizontal alignment.
<CL Off Rot:>	Output	Perpendicular horizontal offset from the current position to the centreline, along the X-axis of the rotated tunnel profile.
<CL Ht Diff:>	Output	The vertical distance between the vertical alignment and the measured point.

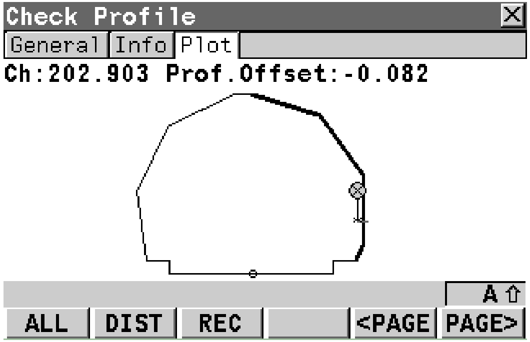
Field	Option	Description
<CL Ht DiffRot:>	Output	Height difference from the current position to the centreline along the Y-axis of the rotated tunnel profile.
<Prof.Offset:>	Output	The perpendicular distance between the measured point and the design profile. A measured point that is located inside of the design profile will always have a negative profile offset.

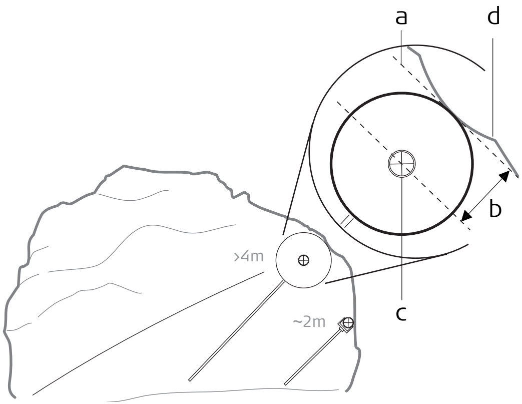


a) Centreline
b) Rotated centreline offset
c) Rotated centreline height difference

Check Profile, Plot page

The **Plot** screen of the **Check Profile** dialogue displays a plot of the measured point with respect to the design profile.



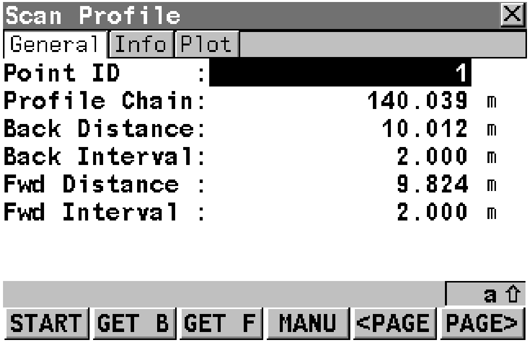


a) Tangent to design profile
b) Reflector radius
c) Reflector
d) Design profile

36.3.2 Scanning Profiles

Scan Profile

The limits for the profile measurements, forward distance and back distance, can be entered manually in the **General** page or can be measured using the **GET B** and **GET F** keys.



GET B (F2)
To measure a distance from the instrument position and to calculate the difference in chainage between the measured point and the chainage of the instrument position. The calculated difference is then set as the **<Back Distance:>**.

GET F (F3)
To measure a distance from the instrument position and to calculate the difference in chainage between the measured point and the chainage of the instrument position. The calculated difference is then set as the **<Fwd Distance:>**.

MANU (F4)
To define discrete points in the profile that should be measured at each chainage. Refer to "Defining discrete points to measure".

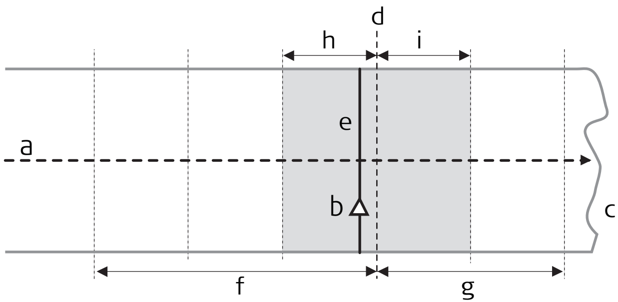
SHIFT LIMIT (F5)
To define scan limits. Refer to "Scan limits".

Description of fields

Field	Option	Description
<Point ID:>	User input	The point identifier of the point that will be scanned.
<Profile Chain:>	User input	When measuring tunnel profiles, it is possible to scan various profiles from one instrument position. The instrument will always measure the profile in the chainage where the instrument is stationed before measuring additional profiles. If it is required to measure more than one profile from an instrument position, the profiles to scan are defined with respect to a defined chainage. This defined chainage, **Profile Chain**, may or may not coincide with the chainage at which the instrument is stationed.
<Back Distance:>	User input	Profiles may be scanned within a given back distance from the defined profile. The measured point for a back distance must always be at a chainage less than the chainage of the instrument position.
<Fwd Distance:>	User input	Profiles may be scanned within a given forward distance from the defined profile.

Field	Option	Description
		The measured point for a forward distance must always be at a chainage greater than the chainage of the instrument poition.
<Back Interval:>	User input	Profiles may be scanned at a given back interval.
<Fwd Interval:>	User input	Profiles may be scanned at a given forward interval.
<Back Chainage:>	User input	Profiles may be scanned at a given back chainage.
<Fwd Chainage>	User input	Profiles may be scanned at a given forward chainage.

Planview of the parameters



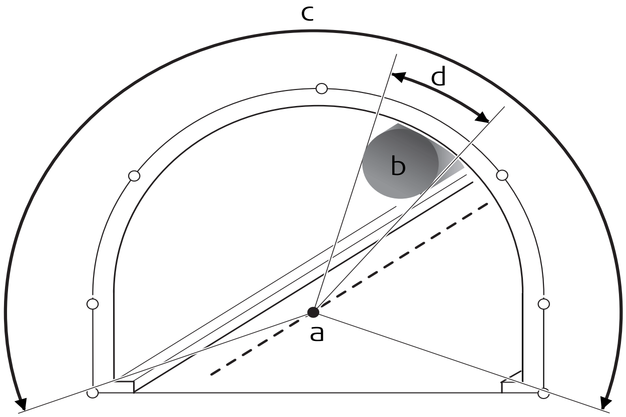
a) Centreline
b) Instrument position
c) Tunnel face
d) Defined profile to scan
e) Instrument profile
f) Back distance
g) Forward distance
h) Back interval
i) Forward interval

Scan limits

Definition

The scan limits are used to define the angular limits to be scanned in a plane perpendicular to the centreline. These limits normally define the starting point and end point of the profile to scan as well as any zone that should not be measured.

Limits are defined with respect to the instrument axis. In the following example a limit is defined that includes the entire area to be scanned (Limit 1) and an overlapping area (Limit 2) that should not be scanned because a ventilation shaft is obstructing a clear view of the tunnel surface.

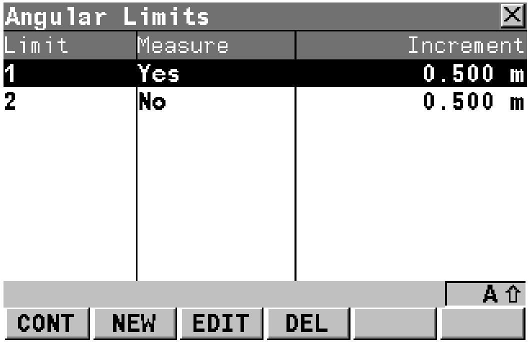


a) Instrument axis
b) Ventilation shaft
c) Include limit
d) Exclude limit

Access

Press **SHIFT LIMIT (F5)** in **Scan Profile**.

Screen



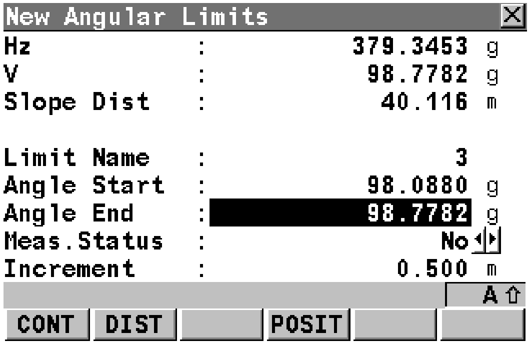
CONT (F1)
To return to **Scan Profile**.
NEW (F2)
To define new limits. Refer to "Define a limit step-by-step".
EDIT (F3)
To edit a limit.
DEL (F4)
To delete a limit.

Description of columns

Column	Description
Limit	Number of the defined limit. Any number of limits may be defined.
Measure	Defines if a limit is measured within the defined zone or not. If overlapping zones are defined, an exclude limit has priority over an include limit.
Increment	The approximate distance between points to be measured on the line increment.

Define a limit step-by-step

Step	Description
1.	Press **NEW (F2)** in **Scan Profile**.



CONT (F1)
To store the limit and to return to **Angular Limits**.

DIST (F2)
To measure a distance.

POSIT (F4)
To review the position of the limit once it has been defined. Placing the cursor on the **Angle Start** or **Angle End** line. The instrument will turn to the corresponding angle.

Step	Description
2.	Enter the **Limit Name** and place the cursor on the **Angle Start** line.
3.	Turn the instrument to point at the starting angle of the limit.
4.	Press the **DIST (F2)** key to measure the distance.
5.	Move the cursor to the **Angle End** line.
6.	Turn the instrument to point at the end angle of the limit.
7.	Press the **DIST (F2)** key to measure the distance.
8.	Decide on whether the limit is an include limit within which points should be measured (**<Meas.Status: Yes>**) or an exclude limit which should not be measured (**<Meas.Status: No>**).

Step	Description
9.	For **<Meas.Status: Yes>** enter the approximate distance between points to be measured on the line **Increment**.

Defining discrete points to measure

Definition

In addition to defining the chainage and the angular limits of the profiles to scan, it is also possible to define discrete points in the profile that should be measured at each chainage.

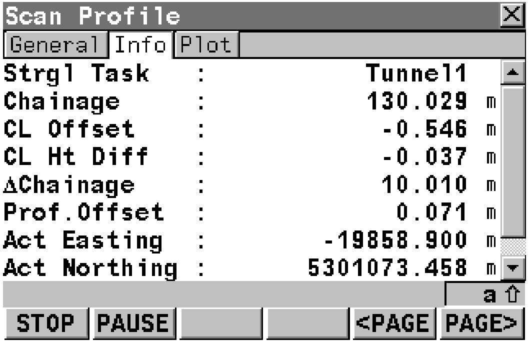
Discrete points could represent a breakpoint in the section, for example, or a point that is required for positioning services such as electricity cables.

Define a manual point step-by-step

Step	Description
1.	Press **MANU (F5)** in **Scan Profile**.
2.	Aim at the point to measure.
3.	Use **ALL (F1)**, **DIST (F2)** and **REC (F3)** to measure the point.
4.	Repeat the process for all of the manual points that are required to be added to the profile.

Making a scan

Once scanning has started, the values of the measured point may be viewed in **Scan Profile**, **Info** page. The values shown can be configured in the **Info&Plot** page of the application configuration. Refer to chapter "36.7 Configuration" for more information on modifying the **Info** page.



START (F1)
To start a scan if no manual points are required.

STOP (F1))
To abort the scan.

PAUSE (F2)
To pause the scan, for example to allow passing site traffic through.

RESUM (F2)
To continue the scan at the next position. Turn the instrument to skip a section of the profile if needed.

PROF+ (F3)
To skip the remaining points in the profile being measured and moves onto the next profile.

MANU (F4) and **AUTO (F4)**
To manually add a point measured to the measured profile and to resume the automatic scan.

SHIFT CONF (F2)
To open the **Tunnel configuration**, **Scan** page. Refer to " Tunnel Configuration, Scan page".

SHIFT EXTRA (F5)
To access method-specific additional functionality. Refer to "Profile viewer".

Whilst scanning, the application makes a series of checks based on the values entered in **Tunnel Configuration**, **Scan** page. These checks ensure that the measurements are within the required tolerance values.

If the difference between the measured values and the nominal values are greater than the chainage limit, the instrument iterates to a new position where its calculated point is likely to be.

This process is repeated until the measured point is within the chainage limit or the maximum number of iterations has been reached.

Should this happen, the user is advised that it has been unable to measure the point. This situation could occur, for example, in irregular tunnel surfaces, where the horizontal alignment is formed by a curve with a small radius or if the back distance or forward distance defined in **Scan Profile, General** page were too large.

Profile viewer

Availability

The data that can be viewed depends on those data available in the **<Meas Job:>**. It is independent of the currently measured **Scan Profile** points.

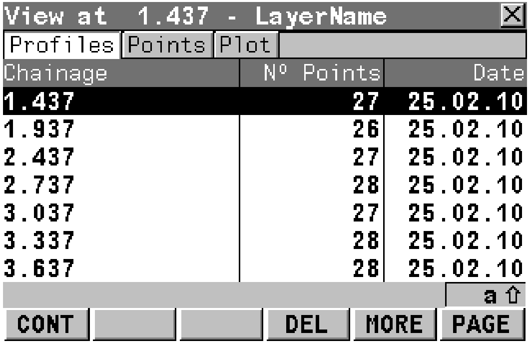
The measured profiles to be viewed must be saved in the **<Meas Job:>**.

Access

Press **SHIFT EXTRA** on the **Scan Profile** screen.

Select **Profile Viewer** and press **CONT (F1)**.

View at, Profiles page



CONT (F1)
: To confirm the settings and return to the **Scan Profile** screen.

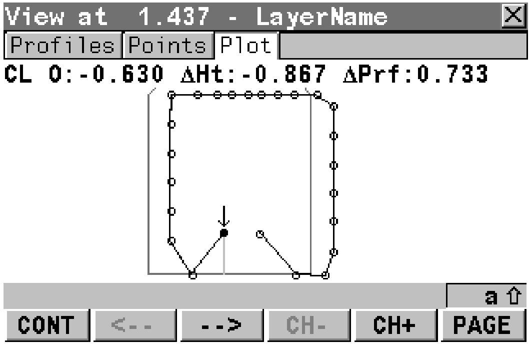
DEL (F4)
: To delete the highlighted profile.

MORE (F5)
: To display information about the time and the date of when the profile was stored.

Description of columns

Column	Description
Chainage	The chainage of the profile.
Nº Points	The number of points in the profile.
Time and Date	The time and the date of when the profile was stored.

View at, Plot page



CONT (F1)
To accept the settings and return to the **Scan Profile** screen.

<-- (F2) / **--> (F3)**
To select the relevant point in the plot. The information displayed shows the centreline offset, the delta height and delta profile of the point.

CH- (F4) / **CH+ (F5)**
To decrease/increase the chainage.

SHIFT FIT (F3)
To fit all displayable data into the screen area.

SHIFT POSIT (F4)
To position the total station to the defined point, including defined offsets.

36.4 Setting Out the Tunnel

36.4.1 Setting Out the Tunnel Face

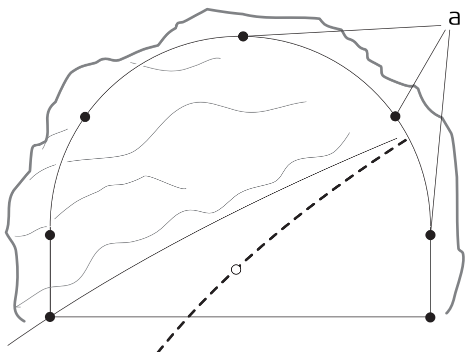
Overview

When excavating a tunnel, it is usually required to set out the tunnel portal before excavation can begin. In addition, for excavation methods other than those involving tunnel boring machines (TBM's), it is then usually required to set out the tunnel face at given intervals during the excavation.

The tunnel face can be set out at any time within the Tunnel application using the **Stake Face** function.

This function allows the setting out of a series of points perpendicular to the horizontal alignment that indicate the position of the design profile at the chainage of the tunnel face.

Cross section view

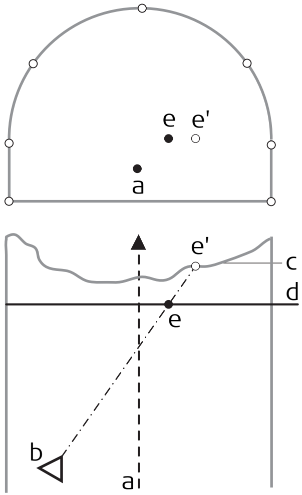


a Points to set out

Given that it is likely that a degree of rock debris is present at the tunnel face or that inexact excavation techniques such as blasting are used, it cannot be assumed that the tunnel face at any stage of the excavation is perpendicular to the horizontal alignment.
This in turn implies that we cannot set out a point on the tunnel face at a given chainage as the chainage of the tunnel face at any particular point is unknown. Iterative techniques are necessary to enable any defined point on the tunnel face to be set out accurately.

The **Stake Face** function involves setting out a point on the tunnel face at this unknown chainage. First of all the point to set out on the tunnel face is set out at an approximate chainage (e).
The point may be defined by offsets with respect to the centreline or by its position along the design profile and its offset from the profile. Given that the excavated tunnel face does not intersect the defined chainage, another point (e') is measured.

1st iteration

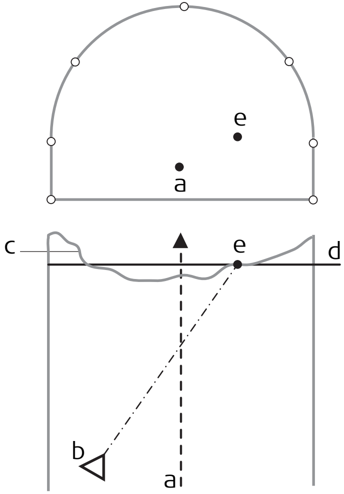


a) Centreline
b) Instrument position
c) Tunnel face
d) Approximate chainage to set out
e) Point to set out at approximate chainage
e' Point set out on tunnel face

The true chainage of the measured point of the first iteration (e') is then calculated and the defined point (e) is set out at the calculated chainage (d).

2nd iteration

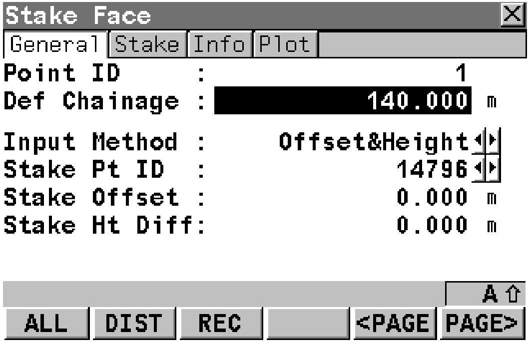
This process is repeated until the differences between set out point and the defined point are within a tolerance set by the user.



a) Centreline
b) Instrument position
c) Tunnel face
d) Calculated chainage from 1st iteration
e) Point to set out at calculated chainage

Stake Face, General page

The approximate chainage of the point to stake and the offsets from the centre-line can be defined.



ALL (F1), **DIST (F2)** and **REC (F3)**
Once the point to set out has been defined, the instrument can be positioned and the points can be measured manually using these keys.

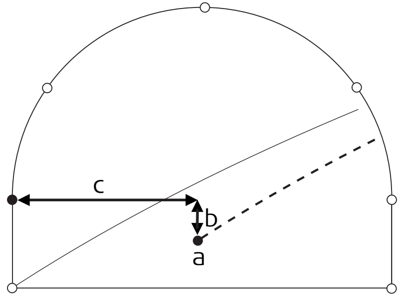
SHIFT POSIT (F5)
To stake the point automatically and to start the iterative setting out process. The instrument will set out the point according to the process described in chapter "36.4.1 Setting Out the Tunnel Face" until:

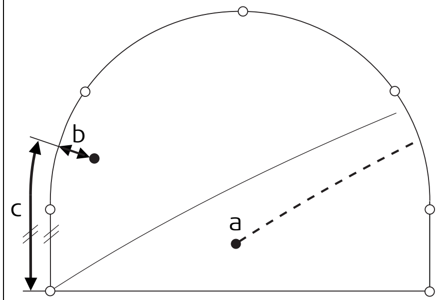
- the number of iterations set as the configuration parameter **Max Iteration** is reached, or
- the difference between the measured point and the design point is less than the value set as the configuration parameter **Position Tol**.

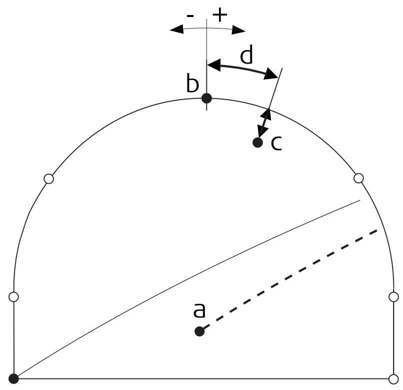
Description of fields

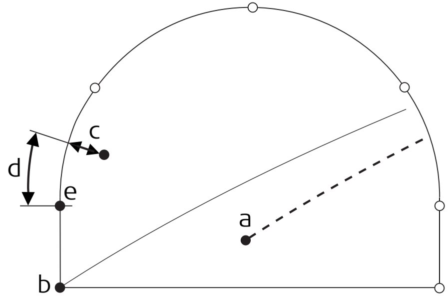
Field	Option	Description
<Point ID:>	User input	The point identifier of the point that will be set out.

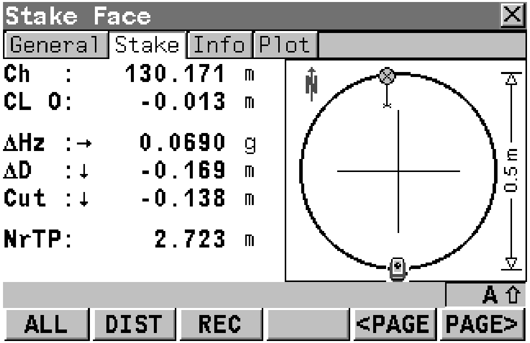
Field	Option	Description
<Def Chainage:>	User input	The defined or approximate chainage of the point to be set out.
<Input Method:>		Methods to define the position of the point to be set out.
	Offset & Height	The point is set out with a known perpendicular and vertical offset from the horizontal and vertical alignments respectively. The offsets of the point may be stored as coordinates in the fixpoint job. The **Stake Offset** may be stored as the X coordinate and the **Stake Height Difference** may be stored as the Y coordinate. To select a point stored in the fixpoint job, place the cursor on the **Stake Pt ID** and press the **ENTER** key.



Field	Option	Description
		a) Centreline b) Centreline height difference c) Centreline Offset
	ProfDist & Offset	The point is defined by the distance from the start of the profile and an offset perpendicular to the design profile. If this option is used, enter the distance **Along Profile** and the **Profile Offset** to define the point to be set out.  a) Centreline b) Profile offset c) Distance from start of design profile
	Dist from top&offset	The point is defined by the distance from the top of the tunnel and an offset perpendicular to the design profile.

Field	Option	Description
		 a) Centreline b) Top of profile c) Offset perpendicular to the profile segment d) Distance from the top of the profile
	Element & Offset	The point to set out is defined by the number of the element on which the point lies, the percentage of the distance along the element of the point to set out and the offset perpendicular to the design profile.

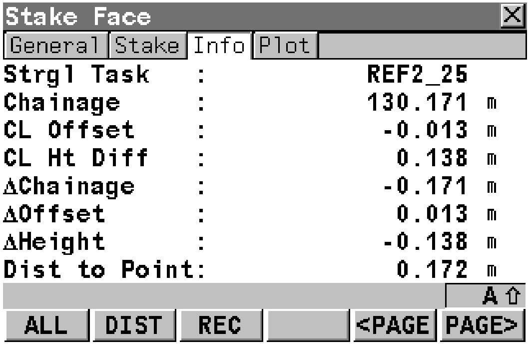
Field	Option	Description
		Element number 1 is the first element of the design profile. If the configuration parameter **Geometry** is set to **Clockwise** the number of each element increments in a clockwise direction. If this parameter is set to **CounterClockwise** the number of each element increments in a counter-clockwise direction.  a) Centreline b) Point defining start of design profile c) Offset perpendicular to profile segment d) Distance from start of Start point of segment e) Start point of segment



During stake out the differences between the measured point and the design point may be seen in the **Stake** page.

The layout of this page may appear with or without graphics depending upon the values set in the application configuration.

Refer chapter "36.7 Configuration" for more information on the configuration.



The **Info** page may be configured in the application configuration to display a series of values related to the setting out of the design point as required by the user.

Refer to chapter "36.7 Configuration" for more information on configuring the **Info** page.

Jumbo guidance

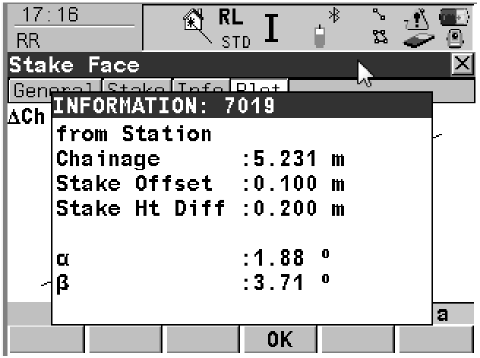
Description

This functionality helps to orientate the jumbo guidance when drilling holes are parallel to the tunnel axis or using a drilling pattern, that is manual entry of drill direction.

Jumbo guidance step-by-step with <Jumbo guidanc: Parallel to Algn>

Step	Description
1.	Make sure that **Tunnel - Stakeout** and **<Method to use: Stake face>** is selected.
2.	In **Tunnel Configuration, General** page, set **<Jumbo guidanc: Parallel to Algn>**. Refer to "Tunnel Configuration, General page".
3.	In the **Define** screen type in the value for **Drilling dist**.
4.	If **<Jumbo guidanc: Parallel to Algn>** was selected in **Tunnel Configuration, General** page and **<Check Jumbo: Yes>** was selected in the **Define** screen, then proceed to define the drill entry position on the tunnel face by entering the respective centreline offset in **Stake Face, General** page.
5.	In **Stake Face, General** page, enter the approximate tunnel face chainage. To position the laser pointer to the drill entry point press **SHIFT POSIT** to find the point.
6.	Position the drill bit to the laser point on the tunnel face.

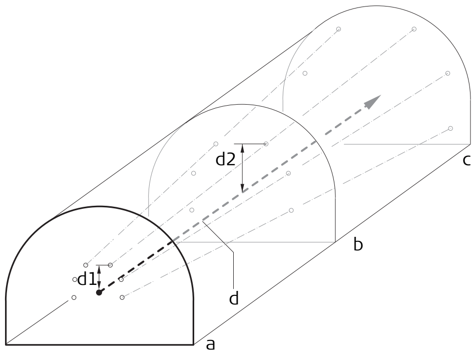
Step	Description
7.	Now the jumbo boom moves onto line between the laser point on wall and the telescope so that the laser now points at the back of the boom. Press **SHIFT EXTRA**. Select **Check Jumbo position** to get the delta angles which will be used by the drilling rig to move the boom parallel to the alignment. α Horizontal angle β Vertical angle



Jumbo guidance step-by-step with <Jumbo guidanc: Drill pattern>

Step	Description
1.	Make sure that **Tunnel - Stakeout** and **<Method to use: Stake face>** is selected.

Step	Description
2.	In **Tunnel Configuration, General** page, set **<Jumbo guidanc: Drill pattern>**. Refer to "Tunnel Configuration, General page".
3.	In the **Define** screen type in the value for **Drilling dist**.
4.	If **<Apply drill pattern from: Defined Chainage>** was selected, then proceed to define the drill entry position for the measured chainage by entering the defined chainage centreline offsets in the **Stake Face, General** page and the drill angles according to the defined chainage.
5.	In the **Stake Face, General** page, enter the defined chainage value in the **Stake chainage** editable field. To position the laser pointer correctly on the measured tunnel face press **SHIFT POSIT**. ☞ The delta chainage value after using **SHIFT POSIT** is the difference between the defined and measured chainage. It is normal if this is large. The delta position and delta height values after this step should equal zero.
6.	Position the drill bit to the laser point on the tunnel face.

Step	Description
	Example:  a Chainage 10 b Chainage 15 c Chainage 20 d Centreline d1 **Stake height diff** at defined chainage 10 d2 **Stake height diff** at defined chainage 15 ☞ Stake face point 1 at chainage 10 (point1). Stake face point 1 at chainage 15 as defined at chainage 10. Position and direction at chainage 15 are a result of the **Stake offset, Stake height diff** and drilling angles as defined for chainage 10.
7.	Now the jumbo boom moves onto line between the laser point on wall and the telescope so that the laser now points at the back of the boom. Press **SHIFT EXTRA**. Select **Check Jumbo position** to get the delta values which will be used by the drilling rig to move the boom for the correct drilling direction.

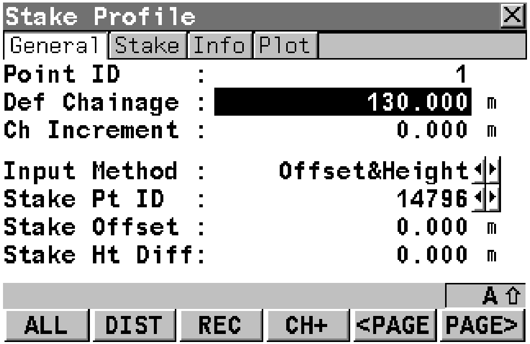
36.4.2 Setting Out a Tunnel Profile

Overview

The **Stake Profile** option allows any point at a given chainage in the tunnel to be set out. The points to set out may be defined with respect to the horizontal and vertical alignment or to the design profile.

Stake Profile, General page

The chainage of the point to stake and the offsets from the centreline can be defined.



ALL (F1), **DIST (F2)** and **REC (F3)**
Once the point to set out has been defined, the instrument can be positioned and the points can be measured manually using these keys.

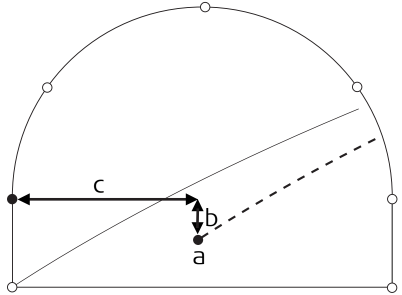
CH+ (F4)
To incremenmt the defined chainage by the chainage increment value.

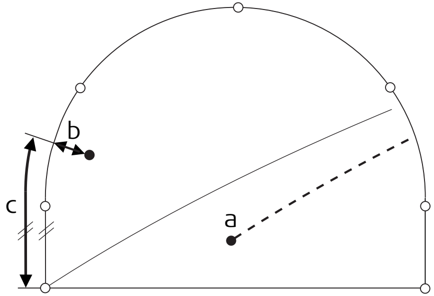
SHIFT POSIT (F5)
To stake the point automatically and to start the iterative setting out process. The sensor will aim towards the point at the given chainage and offsets and measure a distance. If this distance is not within the required tolerance an iterative process is started until:
- the number of iterations set as the configuration parameter **<Max Iteration:>** is reached, or

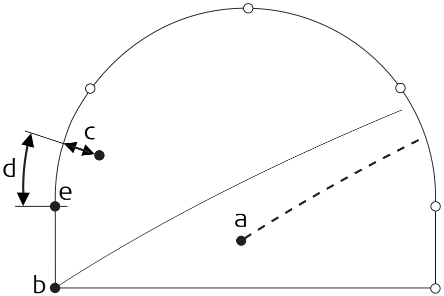
- the difference between the measured point and the design point is less than the value set as the configuration parameter **<Position Tol>**.

Description of fields

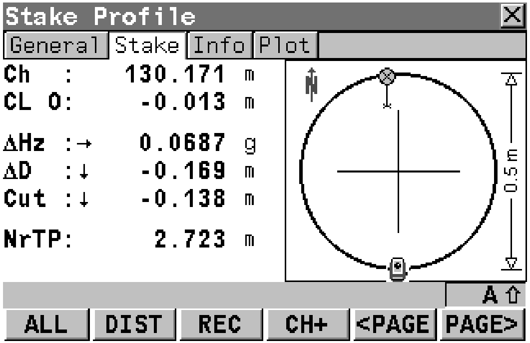
Field	Option	Description
<Point ID:>	User input	The point identifier of the point that will be set out.
<Def Chainage:>	User input	The defined or approximate chainage of the point to be set out.
<Ch Increment:>	User input	If a point is to be staked at more than one chainage, a chainage increment may be defined. Once a point is set out at the current defined chainage and **CH+ (F4)** is pressed, the defined chainage will be incremented by the chainage increment value to define a new point to set out with the same offsets at the incremented chainage.
<Input Method:>		Methods to define the position of the point to be set out.
	Offset & Height	The point is set out with a known perpendicular and vertical offset from the horizontal and vertical alignments respectively.

Field	Option	Description
		The offsets of the point may be stored as coordinates in the fixpoint job. The entered **<Def Chainge:>** is used as horizontal chainage even if the tunnel job has perpendicular profiles. The **<Stake Offset:>** may be stored as the X coordinate and the **<Stake Ht Difference:>** may be stored as the Y coordinate. To select a point stored in the fixoint job, place the cursor on the **<Stake Pt ID:>** and press the **ENTER** key.  a) Centreline b) Centreline height difference c) Centreline Offset

Field	Option	Description
	ProfDist & Offset	The point is defined by the distance from the start of the profile and an offset perpendicular to the design profile. The entered **<Def Chainge:>** is used as vertical chainage if the tunnel job has perpendicular profiles. If this option is used, enter the distance **<Along Profile:>** and the **<Profile Offset:>** to define the point to be set out.  a) Centreline b) Profile offset c) Distance from start of design profile

Field	Option	Description
	Element & Offset	The point to set out is defined by the number of the element on which the point lies, the percentage of the distance along the element of the point to set out and the offset perpendicular to the design profile. The entered **<Def Chainge:>** is used as horizontal chainage even if the tunnel job has perpendicular profiles. Element number 1 is the first element of the design profile. If **<Geometry: Clockwise:>** the number of each element increments in a clockwise direction. If **<Geometry: Counter-Clockwise>** the number of each element increments in a counter-clockwise direction. 

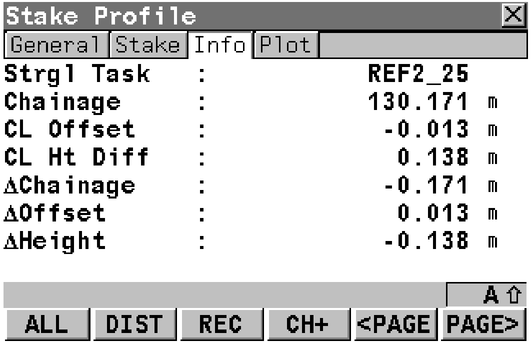
Field	Option	Description
		a) Centreline b) Point defining start of design profile c) Offset perpendicular to profile segment d) Distance from start of Start point of segment e) Start point of segment



During stake out the differences between the measured point and the design point may be seen in the **Stake** page.

The layout of this page may appear with or without graphics depending upon the values set in the application configuration.

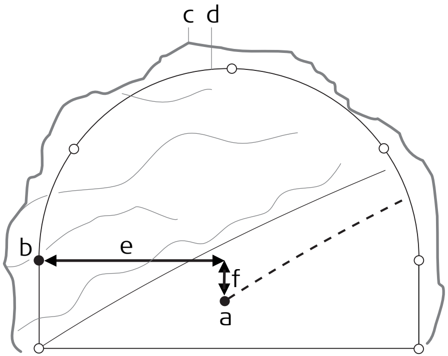
Refer chapter "36.7 Configuration" for more information on the configuration.



The **Info** page may be configured in the application configuration to display a series of values related to the setting out of the design point as required by the user.

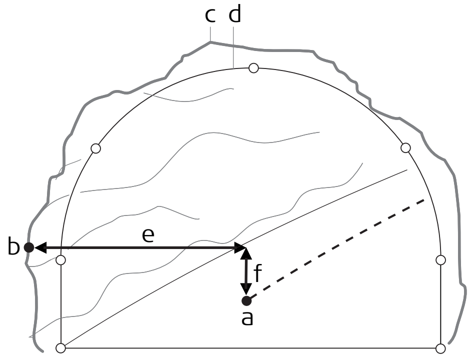
Refer to chapter "36.7 Configuration" for more information on configuring the **Info** page.

Stake point on surface



a) Centreline
b) Design point to set out
c) Excavated profile
d) Design profile
e) Centreline offset
f) Centreline height difference

If it is not possible to set out the defined point, as seen in the diagram, between successive iterations, the instrument will maintain the chainage and height difference from the vertical alignment fixed and modify the horizontal offset from the centreline to calculate the new position of the point. The point that will be set out will thus maintain the defined chainage and height difference but will have a modified offset value from the centreline.



a) Centreline
b) Design point to set out
c) Excavated profile
d) Design profile
e) Centreline offset
f) Centreline height difference

36.5 Project and Job Management

36.5.1 Overview

Project data

Working on a tunnel construction site implies working with various data such as:

- Control points
- Horizontal and vertical alignments
- Measurement data
- Tunnel Profile design
- Digital Terrain Models

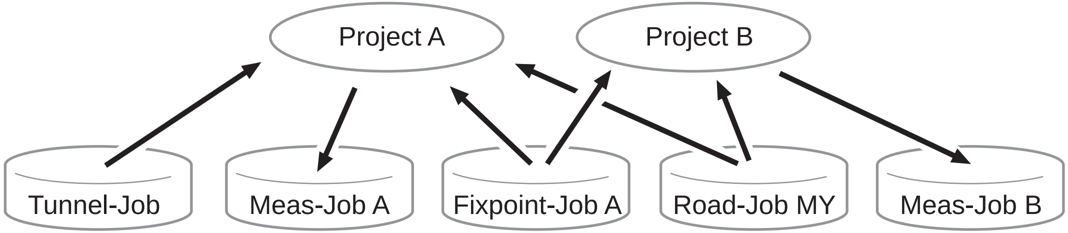
To avoid having to select individual data sets each time the application is used, data can be grouped into projects. This makes the selection much easier and reduces the risk of selecting wrong data set.

Project

A project consists of different kinds of jobs that are grouped together to form a project. By selecting a project automatically all referenced jobs are selected as well. A project can reference:

- one fixpoint job
- one measurement job
- one road job
- one tunnel job
- one DTM job.

Since jobs are only referenced by a project, they may be used in more than one Roads project, as well as in other applications. For example the same collection of control points may be used in two different projects.



Project A and Project B reference the same fixpoint job (**Fixpoint Job A**) and road job (**Road-Job MY**), however, their results are stored into different measurement jobs (**Meas-Job A**; **Meas-Job B**). In addition, Project A references the tunnel design data through a tunnel job (**Tunnel Job A**).

Fixpoint job	The Fixpoint job holds all control point information needed in the field. For example, control points, points with known coordinates used for a TPS set-up.
Measurement Job	The measurement job is where information generated in the field is recorded. All measurements, points and other values stored in the field are added to this job.
Road Job	All road design information for road data outside of the tunnel, either typed in manually or exported from a design package is stored in the road job. Like the fixpoint job, it is a source of information.

Tunnel Job	Contains information relating to the design of the tunnel. The centreline of the tunnel and the tunnel design profiles are stored in the tunnel job. As with a road job, the tunnel job is a read-only source of information. Refer to chapter "36.6 Tunnel Job".
DTM Job	Holds DTM or TIN data (Digital Terrain Model; Triangular Irregular Network). Like a fixpoint job or road job, the DTM job is a source of information. Refer to "35.8.6 Working with a DTM Job".

The same job can be used as a data and measurement job.

Road jobs, Tunnel jobs and DTM jobs cannot be selected as a data or a measurement job. When selecting a job, a filter is applied to show only the relevant jobs in the selection list.

36.5.2 Selecting a Project

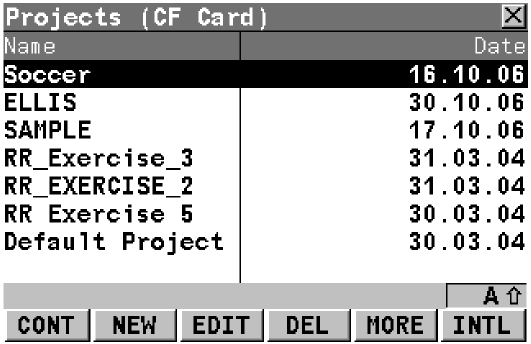
Overview

Upon starting the Road application program, there are two different ways of selecting a project:

- **Select from list:**
  Enter a list of projects stored on the CF Card or in the internal memory from the Road Setup screen.
- **Resume:**
  To resume the last task the project to which the task belongs to is selected automatically.

Browse for existing project

A list of all available projects in the internal memory or on the CF card will be opened when pressing **ENTER** on the Projects line of the Road Setup screen.



CONT (F1)
To select the highlighted project and to continue.

NEW (F2)
To create a new project. Refer to "36.5.3 Creating a New Project".

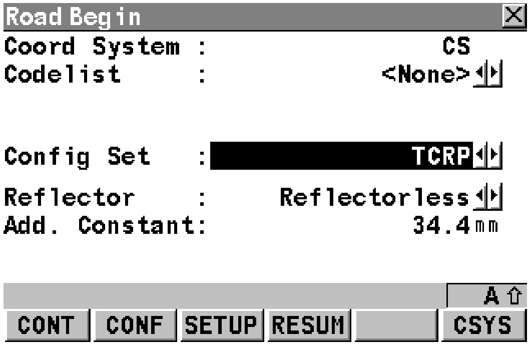
EDIT (F3)
To edit the highlighted project. This project also becomes the active project. Refer to "36.5.5 Editing a Project".

DEL (F4)
To delete the highlighted project. Refer to "36.5.4 Deleting a Project".

MORE (F5)
To toggle between the project date and project time.

CFCRD (F6) or **INTL (F6)**
To switch between the CompactFlash card and internal memory as the active device.

Resuming the last task



Road retains the last active task used on any project. When the application is resumed, the last active task may be accessed again using the **RESUM (F4)** key. This avoids the selection of project, method and task to be staked out or checked every time the application is started.

36.5.3 Creating a New Project

Access

Press **NEW (F2)** on the **Road Projects** screen.

Create a project step-by-step

Step	Description
1.	Press **NEW (F2)** in Projects Management.
2.	**New Project**, **General** page. Define the following: • **<Name:>** (This field is mandatory), • **<Description:>**, • **<Creator:>** and • **<Device:>** for the project.
3.	Press **PAGE (F6)** changes to the **Jobs** page.
4.	**New Project**, **Jobs** page. Choose the following jobs to be used in the new project: • **<Fixpoint Job:>**, • **<Meas Job:>**, • **<Road Job:>** • **<Tunnel Job:>** and • **<DTM Job:>**. It is possible to add or remove jobs to the project at a later stage.
5.	Press **STORE (F1)** to accept the changes and continue.

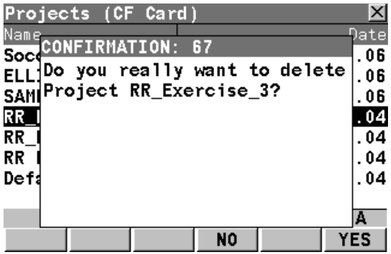
36.5.4 Deleting a Project

General

Deleting a project will not delete the measurement job, fixpoint job, road job, tunnel job and DTM job that it references.

If two projects use the same control points by referencing the same fixpoint job, deleting one project will not delete the control points for the other project.

Deleting project step-by-step

Step	Description
1.	Highlight the project to delete in the Projects screen.
2.	**DEL (F4)** to delete the project. 
3.	**YES (F6)** to confirm deletion, **NO (F4)** to return to the previous screen.
4.	**CONT (F4)** to return to the Road Start screen.

36.5.5 Editing a Project

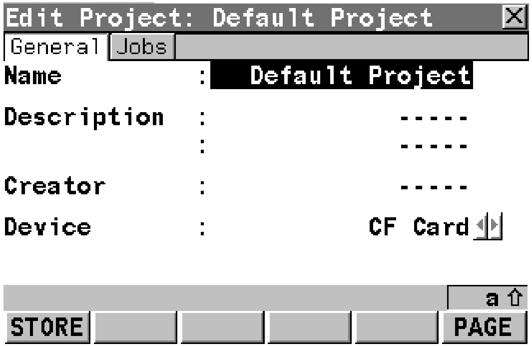
Access

Highlight the desired project and press **EDIT (F3)** on the **Road Projects** screen.

Description

The project details contain general information about the project as well as the list of jobs referenced by the project.

Edit Project Job Name, General page



STORE (F1)
To accept changes and continue.

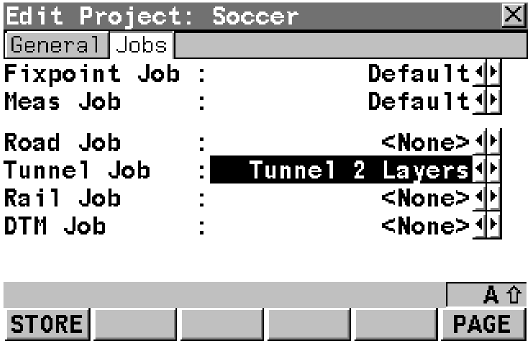
Description of fields

Field	Option	Description of Field
<Name:>	User input	Project name, must be unique. This field is mandatory.
<Description:>	User input	Two line description of the project.
<Creator:>	User input	Name of the creator of the project.
<Device:>	**CF Card**	The device on which the job is stored.

Next step

PAGE (F6) changes to the **Jobs** page.

Edit Project: Job Name, Jobs page



STORE (F1)
To accept changes and continue.

Description of fields

Field	Option	Description
<Fixpoint Job:>	Choicelist	The job that contains the point data to be used.
<Meas Job:>	Choicelist	The active job. Points which are occupied in staking out or check are stored in this job. The data from this job is shown in **MANAGE Data: Job Name**.
<Road Job:>	Choicelist	The active road job.
<Tunnel Job:>	Choicelist	The active tunnel job.

Field	Option	Description
<DTM Job:>	Choicelist	The active DTM job. DTM jobs may be created in GGO.

Next step

CONT (F1) to accept the changes and continue.

☞ Selecting a **<Fixpoint Job:>** and a **<Meas Job:>** is mandatory.

☞ Every job selection will bring up only the jobs that are valid. For example, the list of **<Road Job:>** is different to the one for **<Meas Job:>** and **<Fixpoint Job:>**.

36.6 Tunnel Job

36.6.1 Overview

General

Each tunnel job consists of two major parts

- **Design data**: Contains all the information about the tunnel design including the geometry of the centreline and the tunnel cross section.
- **Working tasks**: Tasks define how the design elements of the tunnel are staked out or checked in the field, they also define any offsets that should be applied to the design data. Refer to "36.6.3 Tasks" for more information on tasks.

36.6.2 Design Data

Horizontal and vertical alignments

All tunnel jobs must consist of at least a horizontal and a vertical alignment. These data may be converted from a road design package using the Design To Field component within the GGO application.

Design profiles

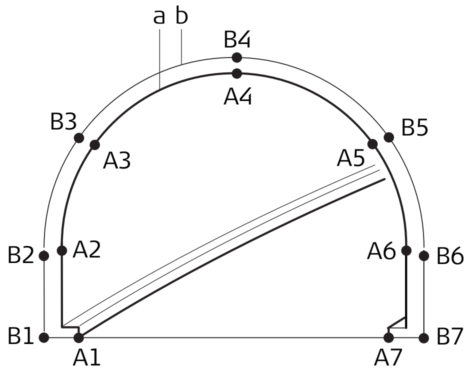
Depending on the complexity of the tunnel job, the design data may vary from being a single horizontal and vertical alignment to a design containing many different design profiles with dozens of defined vertices.

Design profiles may be defined and edited in the Profile Editor application that is integrated into the GGO application.

Layers

Tunnels generally consist of layers made of different materials, for example a shotcrete surface or a lining. At different times throughout a project it may be required to work with different layers of the tunnel.

Road allows the possibility of creating such layers by grouping together design profiles that will be used at the same chainage.



a) The vertices **A1**-**A7** could be grouped together in a layer (**a**) and represent the final lining of the tunnel.
b) The vertices **B1**-**B7** could be grouped together in a layer (**b**) and represent the inner shotcrete layer of the tunnel.

Design Profile Layers may be assigned to chainages along the centreline using the Profile Editor within GGO.

The layer of the tunnel to set out or check may be defined when creating a task.

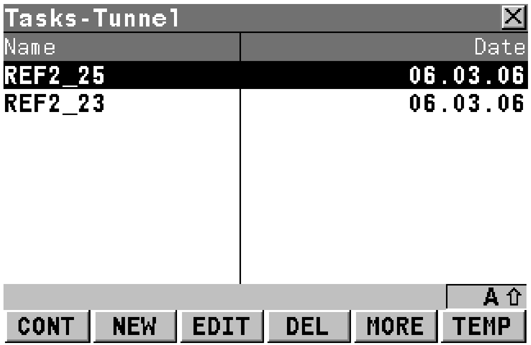
36.6.3 Tasks

Overview

When staking out or checking a tunnel, it is often the case that it is not possible to finish a particular task in one go. Tunnel allows the possibility of storing the element to be staked out or checked together with all defined settings as a work task. Tasks are stored as a part of the project.

A task defines the offsets required for setting out and checking as well as the layer of the design profile to use and the chainage limits within which the task applies.

When pressing **CONT (F1)** on the Road Setup screen a list of available tasks will be shown.



CONT (F1)
To select the highlighted task and continue.

NEW (F2)
To create a new task.

EDIT (F3)
To modify selected task.

DEL (F4)
To delete selected task.

MORE (F5)
To toggle between date and time info.

TEMP (F6)
To create a new temporary task. The task is created in the same way as an ordinary task but the task is not saved.

Creating a new task step-by-step

Step	Description
1.	**NEW (F2)** to create a new task.
2.	The **Selection Wizard-Start** screen defines the name of the task and whether shifts should be applied to the design data. Shifts are applied temporarily to the design data for the defined task, the original design data is not modified when a shift is applied. Refer to chapter "Working with shifts" for more information on applying shifts.  **NEXT (F1)** to move on to the next page of the selection wizard.
3.	The second page of the selection wizard defines the layer of the design profile to be used for the task.

Step	Description
	 **NEXT (F1)** to move on to the next page of the selection wizard.
4.	The next page of the wizard displays the horizontal alignment. Given that this is the only stringline available in a tunnel job, this page is purely informative.  **NEXT (F1)** to move on to the next page of the selection wizard.
5.	This page of the selection wizard defines whether the task should only be applied to a limited section of the alignment. If the defined chainage range is exceeded during stake out/check a warning appears.

Step	Description
	 **FINSH (F1)** to finish the selection wizard and return to the task selection page. **DEFLT (F5)** to set the chainage limits to the maximum and minimum chainage available in the tunnel job. **BACK (F6)** to go back to the previous page of the selection wizard.

Working with shifts

Overview

If a shift is defined on the first page of the selection wizard, the parameters associated with the shift must be entered after defining the chainage limits.

Two types of shifts may be applied:

- Constant or
- linear.

The application of the shift is dependent upon to which entity it should be applied:

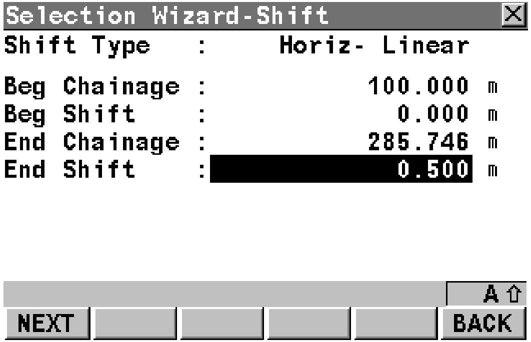
- Horizontal alignment,

- Vertical alignment or
- Design Profile.

Refer to chapter "36.1.4 Shifts" for more information on the type of shift for each entity.

For linear shifts

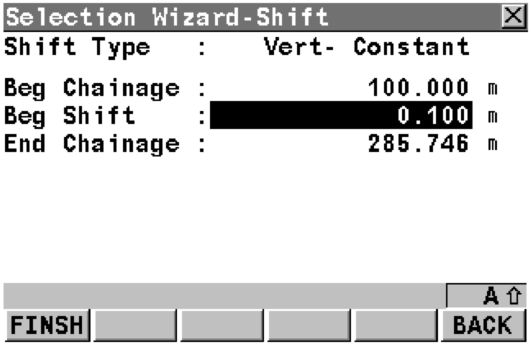
The parameters required for applying the shift are identical for all entities.



Field	Option	Description
<Beg Chainge:>	User input	Chainage from which the shift should be applied.
<Beg Shift:>	User input	Magnitude of the shift to apply at the begin chainage.
<End Chainge:>	User input	Chainage at which the shift should end.

Field	Option	Description
<End Shift:>	User input	Magnitude of the shift to apply at the end chainage.

For constant shifts

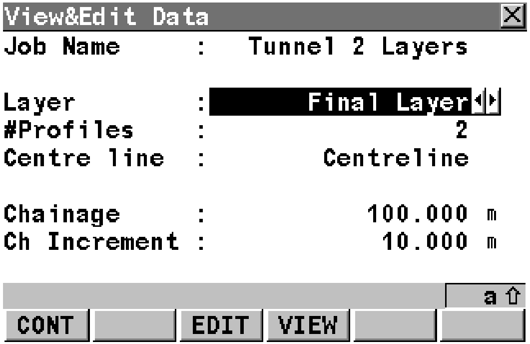


Field	Option	Description
<Beg Chainge:>	User input	Chainage from which the shift should be applied.
<Beg Shift:>	User input	Magnitude of the shift to apply at the begin chainage.
<End Chainge:>	User input	Chainage at which the shift should end.

36.6.4 Viewing and Editing the Design Data

View&Edit Data

The design data stored within the tunnel job contains all of the information about the tunnel design. This includes the stringlines and layers, for example, the geometry of the centreline or the layers of the different materials/surfaces which form the tunnel). The design data can be viewed and partially edited in these View and Edit screens.



CONT (F1)
To return to the **Road Tunnel Setup** screen.

EDIT (F3)
To edit the the general job details and the start chainage of the centreline of the selected layer.

VIEW (F4)
To view specific details of the layer centreline and cross section plots.

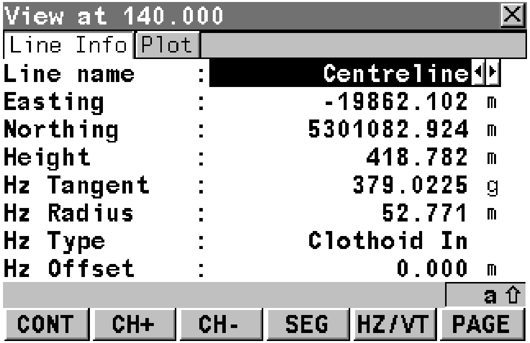
Description of fields

Field	Option	Description
<Job Name:>	User input	The name of the active tunnel job, as defined in the project.
<Layer:>	Choicelist	To select a layer from the active tunnel job. All of the layers within the active tunnel job can be selected.

Field	Option	Description
<#Profiles:>	User input	The number of profiles from the selected layer.
<Centreline:>	User input	The name of the layer centreline. ☞ If a centreline has not been defined, a start chainage cannot be entered and the field will be shown as "----". If a centreline has not been defined, a chainage increment cannot be entered and the field will be shown as "----".
<Chainage:>	User input	To enter a start chainage to use when viewing the data. The default value is the start chainage of the layer centreline.
<Ch Increment:>	User input	To enter a chainage increment to use when stepping through the data

View at, Line Info page

Geometrical details of the selected stringline at the selected chainage are displayed.



CONT (F1)
To return to the **View&Edit Data** screen.

CH+ (F2)
To increase the chainage by the chainage increment, as defined in the **View&Edit Data** screen.

CH- (F3)
To decrease the chainage by the chainage increment, as defined in the **View&Edit Data** screen.

SEG (F4)
To enter the **Segment Info** screen.

HZ/VT (F5)
To toggle between the vertical alignment data and the horizontal alignment data.

PAGE (F6)
To move to the next page.

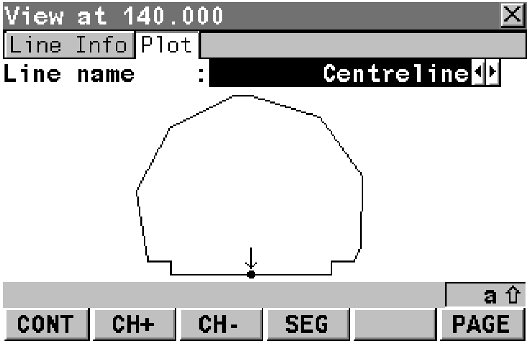
Description of fields

Field	Option	Description
<Line name:>	Choicelist	To select a stringline from the layer.
<Easting:>	Output	The East coordinate of the stringline.
<Northing:>	Output	The North coordinate of the stringline.
<Height:>	Output	The height of the stringline.
The following fields/values can be toggled, by using the **HZ/VT (F5)** softkey:		
<Hz Tangent/ Grade:>	Output	The tangent direction or grade of the string-line.

Field	Option	Description
<Hz/Vt Radius:>	Output	The horizontal/vertical radius of the stringline segment.
<Hz/Vt Type:>	Output	The horizontal/vertical segment type.
<Hz/Vt Offset:>	Output	The horizontal/vertical offset to the layer centreline.
☞ If a value has not been defined, the field will be shown as **-----**.		

View at, Plot page

A cross section view of the design data at the selected chainageis displayed. No selection or zoom/pan functionality is available.



CONT (F1)
To return to the **View&Edit Data** screen.

CH+ (F2)
To increase the chainage by the chainage increment, as defined in the **View&Edit Data** screen.

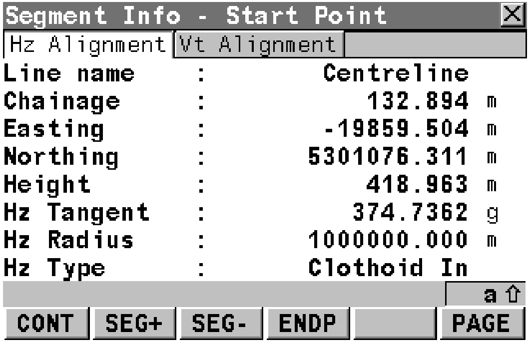
CH- (F3)
To decrease the chainage by the chainage increment, as defined in the **View&Edit Data** screen.

SEG (F4)
To enter the **Segment Info** screen.

PAGE (F6)
To move to the next page.

Segment Info - Start Point, Hz Alignment page

Detailed horizonal alignment information about the current stringline segment are displayed.



CONT (F1)
To return to the View screens.

SEG+ (F2)
To move to the next segment.

SEG- (F3)
To move to the previous segment.

ENDP/STRTP (F4)
To toggle between the start point and the end point of the segment.

PAGE (F6)
To move to the next page.

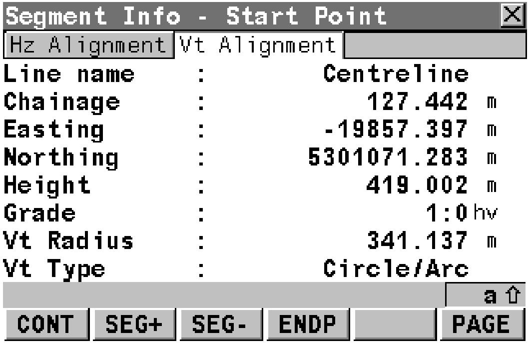
Description of fields

Field	Option	Description
<Line Name:>	Output	The name of the selected stringline.
The following fields/values can be toggled, by using the **ENDP/STRTP (F4)** softkey:		
<Chainage:>	Output	The chainage of start/end point of the segment.
<Easting:>	Output	The East coordinate of the start/end point of the segment.
<Northing:>	Output	The North coordinate of the start/end point of the segment.

Field	Option	Description
<Height:>	Output	The height of the start/end point of the segment.
<Hz Tangent:>	Output	The tangent direction at the start/end point of the segment.
<Hz Radius:>	Output	The radius at the start/end point of the segment (is not toggled).
<Hz Type:>	Output	The current segment type (is not toggled).
☞ If a value has not been defined, the field will be shown as **-----**.		

Segment Info - Start Point, Vt Alignment page

Detailed vertical alignment information about the current stringline segment is displayed.



CONT (F1)
To return to the View screens.

SEG+ (F2)
To move to the next segment.

SEG- (F3)
To move to the previous segment.

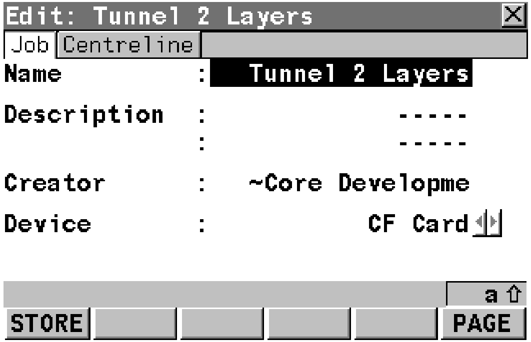
ENDP/STRTP (F4)
To toggle between the start point and the end point of the segment.

PAGE (F6)
To move to the next page.

Description of fields

Field	Option	Description
<Line Name:>	Output	The name of the selected stringline.
The following fields/values can be toggled, by using the **ENDP/STRTP (F4)** softkey:		
<Chainage:>	Output	The chainage of start/end point of the segment.
<Easting:>	Output	The East coordinate of the start/end point of the segment.
<Northing:>	Output	The North coordinate of the start/end point of the segment.
<Height:>	Output	The height of the start/end point of the segment.
<Grade:>	Output	The grade at the start/end poin of the segment (is not toggled).
<Vt Radius:>	Output	The radius at the start/end point of the segment (is not toggled).
<Vt Type:>	Output	The current segment type (is not toggled).
☞ If a value has not been defined, the field will be shown as ----.		

Edit, Job page



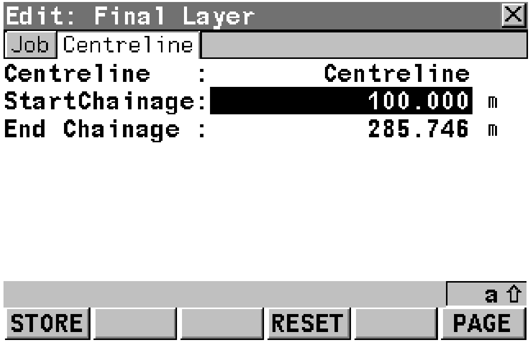
STORE (F1)
To return to the **View&Edit Data** screen.

PAGE (F6)
To move to the next page.

Description of fields

Field	Option	Description
<Name:>	User input	The unique name of the tunnel job. The name may be up to 16 characters long and may include spaces. This field is mandatory.
<Description:>	User input	A detailed description of the tunnel job (two lines are available). This field is optional.
<Creator:>	User input	The name of the person who created the tunnel job. This field is optional.
<Device:>	**CF Card** or **Internal Memory**	The device on which the tunnel job is stored.

Edit, Centreline page



STORE (F1)
To store data and return to the **View&Edit Data** screen.

RESET (F4)
To clear all changes made to the start chainage reset to the original start chainage.

PAGE (F6)
To move to the next page.

Description of fields

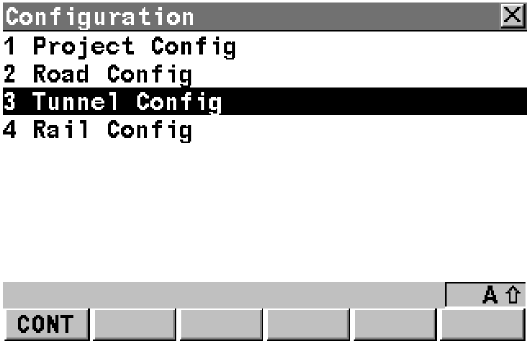
Field	Option	Description
<Centreline:>	User input	The name of the centreline.
<Start Chainage:>	User input	To enter a start chainage for the layer centre-line. By using the centreline length, the end chainage is automatically calculated.
<End Chainage:>	User input	The end chainage of the layer centreline, as calculated from the start chainage.

36.7 Configuration

Three parts of configuration

The configuration of the Road application program is divided into three parts:

- Project Configuration
- Road Configuration
- Tunnel Configuration
- Rail Configuration



Project and Road Configuration

The values in the **Project Configuration** are general parameters that apply to both Road and Tunnel projects. The values set in the **Road Configuration** apply only to Road projects and the values set in the **Tunnel Configuration** apply only to Tunnel projects.

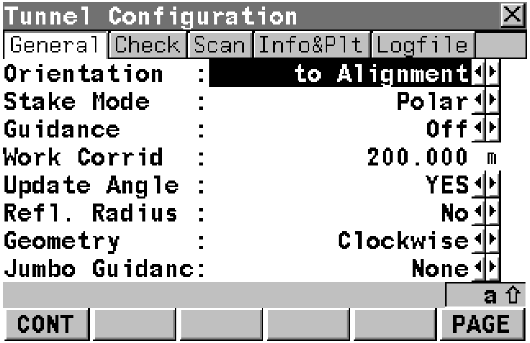
☞ Refer to "35.6 Configuring" for more information on the Project and Road Configuration.

Tunnel configuration

The Tunnel configuration consists of five pages where parameters relating to the configuration of the application may be modified.

Tunnel Configuration, General page

The **General** page allows parameters that will be used throughout the application to be set.



CONT (F1)
To confirm the changes and move to the previous screen.

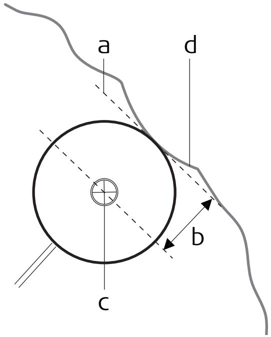
PAGE (F6)
To change to another page on this screen.

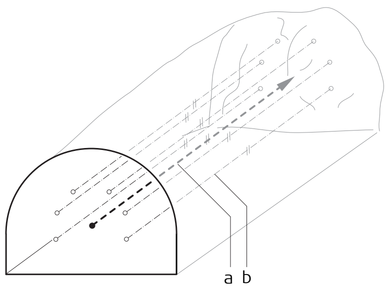
Description of fields

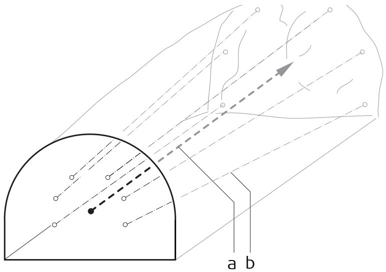
Field	Option	Description
<Orientation:>		The reference direction used to stake out points. The stake out elements and the graphics displayed are based on this selection:
	to Alignment	The position of the measured point and the calculated differences are displayed relative to the alignment.

Field	Option	Description
	to Station	The position of the measured point and the calculated differences are displayed relative to the position of somebody located at the measured point looking towards the sensor.
	from Station	The position of the measured point and the calculated differences are displayed relative to the position of somebody located at the sensor looking towards the measured point.
<Stake Mode:>		Available for **<Orientation: to Station>** or **<Orientation: from Station>**. The displayed differences between the measured point and the design point may be configured.
	Orthogonal	The differences are displayed as two orthogonal distances left/right and forward/back with respect to the line of sight.
	Polar	The differences are displayed as polar coordinates, angle and distance, with respect to the line of sight.
<Guidance:>		Indication of direction and distance from measured point to point to set out.
	Off	No graphical guidance is used, only numerical values are available on the screen.
	Polar	Forward/Back and Left/Right arrows are shown on the screen.

Field	Option	Description
	Graphics	A bulls-eye is shown on the screen.
	Arrows& Graphics	Forward/Back and Left/Right arrows and a bulls-eye are shown on the screen.
<Work Corridor:>	User input	Working corridor of tunnel job. If a measured point is further away from the working corridor distance, an error message is displayed.
<Update Angle:>		Update of vertical angle after a distance measurement.
	Yes	The measured point will be projected by a distance equivalent to the radius of the reflector in a direction perpendicular to the tangent of the design profile.
	No	Angles and stake out values are updated only after a distance measurement. All values are then frozen until the next distance is taken.
<Refl. Radius:>		When using a reflector to check a design profile it is important to take into account the reflector radius parameter in the **General** page of the application configuration.
	Yes	The measured point will be projected by a distance equivalent to the radius of the reflector in a direction perpendicular to the tangent of the design profile.

Field	Option	Description
	No	The design profile will be compared to the coordinates of the centre of the reflector at the measured position.  a) Tangent to design profile b) Reflector radius c) Reflector d) Design profile If reflectorless measurements are used or no design profile has been defined, the reflector radius parameter will not be used in the calculation.
<Geometry:>		Defines the sense in which the design profile is considered.

Field	Option	Description
	Clockwise	The design profile is defined in a clockwise direction. The number of each element also increments in a clockwise direction.
	Counter-Clockwise	The design profile is defined in a counter-clockwise direction. The number of each element also increments in a counter-clockwise direction.
<Jumbo Guidance:>	**Parallel to Algn**	Guides a jumbo to drill in the direction parallel to the alignment.  a) Alignment b) Drill direction
	Drill patter	Guides a jumbo to drill in the user defined direction. This must not be parallel to the alignment.

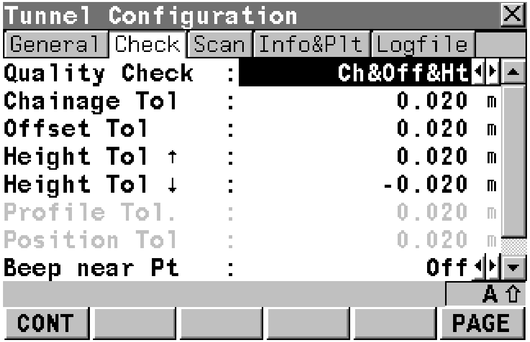
Field	Option	Description
		 a) Alignment b) Drill direction

Next step

PAGE (F6) changes to the **Check** page.

Tunnel Configuration, Check page

The **Check** page allows parameters that will be used during Tunnel Check to be set.



CONT (F1)
To confirm the changes and move to the previous screen.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Quality Check:>		To activate a position check when storing a staked or checked point. When the defined tolerance is exceeded, the stake out/check can be repeated, skipped or stored. Depending on this selection the lines below are enabled/disabled.
	NONE	No quality check during stake out/check of points.
	Ch&Off&Ht	Check for chainage, horizontal offset and height.

Field	**Option**	**Description**
	Ch&Off	Check for chainage and horizontal offset.
	Pos&Ht	Check for 2D position and height.
	Position	Check for 2D position.
	Height	Check for height.
	Profile	Check for distance from design profile.
Chainage Tol	From **0.001** to **100**	Maximum permitted difference in chainage.
Offset Tol	From **0.001** to **100**	Maximum permitted horizontal offset from defined position.
Height Tol	From **0.001** to **100**	Maximum permitted height difference.
Profile Tol	From **0.001** to **100**	Maximum permitted distance from design profile.
Position Tol	From **0.001** to **100**	Maximum permitted radial horizontal distance.
Beep near Pt	**On** or **Off**	Activates an acoustic warning signal when the horizontal radial distance from the current position to the point to stake out is equal or less than defined in **<Dist from Pt:>**.

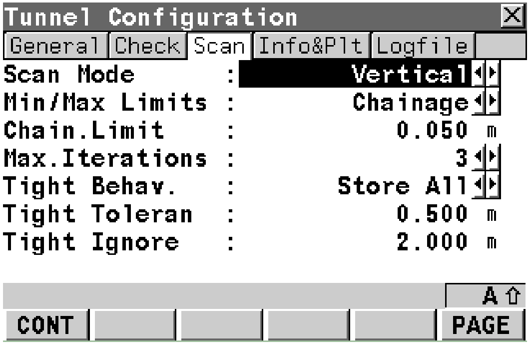
Field	Option	Description
Dist from Pt	User input	Available when **<Beep near Pt: On>** is selected. Defines the horizontal radial distance from the current position to the point to stake out within which the acoustic warning signal is active.

Next step

PAGE (F6) changes to the **Scan** page.

Tunnel Configuration, Scan page

The **Scan** page allows parameters that will be used when scanning profiles to be set.



CONT (F1)
To confirm the changes and move to the previous screen.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Scan Mode:>	**Vertical** and **Tilted**	To indicate the type of profile to be scanned.
<Min/Max Limits:>	**Distance** and **Chainage**	To define the limits of the scan.
<Chain.Limit:>	User input	To define the maximum difference in chainage with which a point will be recorded. It is also related to the **<Max.Iterations:>** parameter. When measuring parallel profiles it is necessary to check the measured chainage of a point against the nominal chainage. Since no information is avaialable regarding the tunnel surface before scanning, the theoretical position of the point is measured. If the difference between the measured values and the nominal values are greater than the chainage limit, the instrument iterates to a new position where its calculated point is likely to be.
<Max.Iterations:>	Choicelist	The maximum number of attempts that should be made in measuring a point when measuring parallel profiles.

Field	Option	Description
<Tight Behav.:>		To define the behaviour of the application when a measured point is outside of the defined **<Tight Toleran:>**.
	StoreAll	To store all measurements independent of whether they are within tolerance.
	Store Only-Valid	To store only the points that are within tolerance.
	Pause & Store	To store all measurements but if the point is out of tolerance, pause the scan.
	Pause	To pause the application if a point is out of tolerance.
<Tight Toleran:>	User input	Refers to the maximum permitted distance between the measured point from the design profile. If the distance between the measured point and the design profile is greater than the tight tolerance and less than the tight ignore value, the application will perform the action defined as the tight behaviour. For more information about thight tolerance refer to chapter "Tunnel profiles".

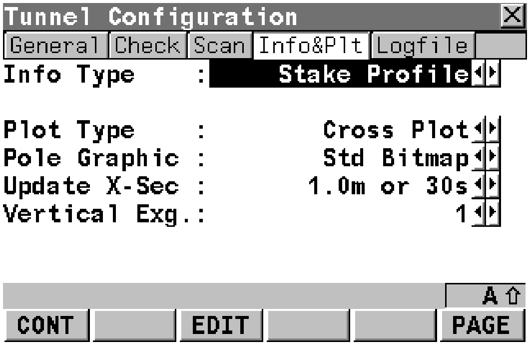
Field	Option	Description
<Tight Ignore:>	User input	If the distance between the measured point and the design profile is greater than the **<Tight Ignore:>** value, the measurement will be ignored and the values will not be stored.

Next step

PAGE (F6) changes to the **Info&Plt** page.

Tunnel Configuration, Info&Plt page

The **Info& Plt** page allows the definition of the parameters to be seen on the **Info** page whilst working with the application. It also allows the parameters to be used for plotting functions to be defined.



CONT (F1)
To confirm the changes and move to the previous screen.

EDIT (F3)
To edit parameters of current info page type. Refer to "Define Info Display" for more details.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Info Type:>	**Stake Face**, **Stake Profile**, **Check Profile** or **Scan Profile**	Defines the parameters to view on the **Info** page of the application. Different combinations of the parameters to view may be stored for the four main functions of the application.
<Plot Type:>		Defines the type of plot to be viewed on the **Plot** page.
	Cross Plot	To view measured point with respect to design profile.
	Plan View	To view position of measured point with respect to horizontal alignment.
	Profile View	To view position of measured point with respect to vertical alignment.
<Pole Graphic:>		Defines the graphical representation of the measured point on the **Plot** page.
	Std Bitmap	Standard bitmap image of a reflector and pole.
	Actual Height	Reflector pole is not shown and position of reflector denotes the actual measured postion.

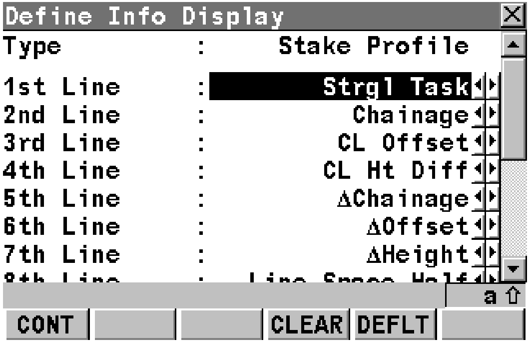
Field	Option	Description
Update X-Sec	**0.5m or 2s**, **0.5m or 10s**, **1.0m or 30s** or **5.0m or 1m**	Update frequency of the cross section view on the **Plot** page when working in tracking mode. Update the plot every x seconds or when the measured point is more than y meters from the previous plotted point.
Vertical Exg.		Vertical exaggeration for cross section plots. Vertical plot scale relative to horizontal.
	0.5	Ratio of vertical to horizontal scale 1:2.
	1	Ratio of vertical to horizontal scale 1:1.
	2	Ratio of vertical to horizontal scale 2:1.
	5	Ratio of vertical to horizontal scale 5:1.
	10	Ratio of vertical to horizontal scale 10:1.

Next step

Press **EDIT (F3)** to access **Define Info Display**.

Define Info Display

Define which parameter should be viewed on each line on the **Info** page. Up to 16 lines of parameters can be defined. A maximum of nine lines may be viewed at any one time. It is necessary to scroll with the arrow keys to view additional lines.



CONT (F1)
To confirm the changes and to move to the previous screen.

CLEAR (F4)
To clear all parameters from all lines.

DEFLT (F5)
To set the default value for all lines.

Description of fields

Field	Option	Description
<Type:>	**Stake Face**, **Stake Profile**, **Check Profile** or **Scan Profile**	Different combinations of the parameters to view may be stored for the four main functions of the application.

Field	Option	Description
<1st Line:> to **<16th Line:>**		To modify the selection on any particular line, place the cursor on the line to modify using the arrow keys and press the **ENTER** key. Use the arrow keys to select the required parameter and press the **ENTER** key to confirm the choice. It is also possible to search for a parameter by entering the first character of the parameter name.
	Strgl Task	Name of the current task.
	ΔOffset	Distance from the measured point to the point to set out in a direction perpendicular to the horizontal alignment.
	ΔHeight	Height difference between the measured point and the point to set out.
	ΔChainage	Chainage difference between the measured point and the point to set out.
	Chainage	Chainage of the measured point.
	Strgl Offset	Distance between the measured point and the shifted horizontal alignment when a shift is used.
	Strgl Ht Diff	Height difference between the measured point and the shifted vertical alignment when a shift is used.
	Strgl Name	Name of the centreline.

Field	Option	Description
	CL Ht Diff	Height difference between the measured point and the height of the vertical alignment at the same chainage.
	CL Off Rot	Perpendicular horizontal offset from the current position to the centreline, along the X-axis of the rotated tunnel profile
	Strgl Task	Name of the current task.
	ΔOffset	Distance from the measured point to the point to set out in a direction perpendicular to the horizontal alignment.
	ΔHeight	Height difference between the measured point and the point to set out.
	ΔChainage	Chainage difference between the measured point and the point to set out.
	Chainage	Chainage of the measured point.
	Strgl Offset	Distance between the measured point and the shifted horizontal alignment when a shift is used.
	Strgl Ht Diff	Height difference between the measured point and the shifted vertical alignment when a shift is used.
	Strgl Name	Name of the centreline.

Field	Option	Description
	CL Ht Diff	Height difference between the measured point and the height of the vertical alignment at the same chainage.
	CL Off Rot	Perpendicular horizontal offset from the current position to the centreline, along the X-axis of the rotated tunnel profile
	CL Height	Height of the vertical alignment at the chainage of the measured point.
	CL Radius	Radius of the horizontal alignment at the at the chainage of the measured point.
	CL Type	Curve type of the horizontal alignment at the chainage of the measured point.
	CL Offset	Distance between the measured point and the horizontal alignment in a direction perpendicular to the horizontal alignment.
	CL Ht DiffRot	Height difference from the current position to the centreline along the Y-axis of the rotated tunnel profile
	CL Tangent	Direction of the tangent to the horizontal alignment at the at the chainage of the measured point.
	Near Tang Pt	Distance along the horizontal alignment from the measured point to the nearest tangent point.

Field	Option	Description
	Near Vt Tan Pt	Distance to the nearest vertical tangent point of the design.
	CL Grade	Grade of the vertical alignment at the chainage of the measured point.
	Dirc to Point	Direction from the point to the point to set out.
	Dist to Point	Distance from the point to the point to set out.
	Def Easting	Easting of the point to set out.
	Def Northing	Northing of the point to set out.
	Def Height	Height of the point to set out.
	Act Easting	Easting of the measured point.
	Act Northing	Northing of the measured point.
	Act Height	Height of the measured point.
	Quality 3D	Standard deviation of the point measurement.
	Line Space Half/Full	Empty line.
	Prof.Offset	Distance from the design profile to the measured point.

Field	Option	Description
	Prof.NºEle ment	Element number of the closest design profile element to the measured point.
	Prof.Eleme nt(%)	Distance in percentage terms of the measured point along the design profile element.
	DistAlong-Prof	Distance of the measured point along the design profile.
	Dist-FromTop	Distance of the measured point along the design profile starting at the top of the profile.
	Vert Chainage	Chainage of the measurend point projected perpendicular to the vertical component of the centreline.
	Vert Sqr Off	Offset perpendicular to the vertical component of the centreline.

Next step
CONT (F1) to return to **Tunnel Configuration**, **Info&Plt** page.
PAGE (F6) changes to the **Logfile** page.

Tunnel Configuration, Logfile page

CONT (F1)
To confirm the changes and move to the previous screen.

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	Activates the generation of a logfile using the selected **<Format File:>** and the storage of measured points. The logfile is generated when the application program is exited.

Field	Option	Description
<File Name:>	User input	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile has the extension *.log and is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **MANAGE Format Files** where an existing format file can be selected or deleted.

Next step

CONT (F1) to accept the changes and continue.

37 Reference Line

37.1 Overview

Description

The Reference Line application program can be used to set out or measure points relative to a reference line or a reference arc.

Tasks

The Reference Line application program can be used for the following tasks:

- Measuring to a line/arc where the position of a target point can be calculated from its position relative to the defined reference line/arc.
- Staking to a line/arc where a target point is known and instructions to locate the point are given relative to the reference line/arc.
- Gridstaking a line/arc where a grid can be staked relative to a reference line/arc.
- Staking to a polyline. Refer to "37.8 Staking to Polyline".

Other functionality available includes:

- Offsetting the reference line/arc horizontally or vertically. The radius of the arc changes with the horizontal offset.
- Shifting the reference line with parallel offsets or rotating to match predefined setting out instructions.
- Measuring points and staking points on slopes related to a reference line/arc.

Activating the program

The Reference Line application program must be activated via a licence key. Refer to "26 Tools...\Licence Keys" for information on how to activate the application program.

Point types

Reference lines/arcs can be created from points stored as local grid.
Heights and positions are always taken into account. Points must have full coordinate triplets.

Properties of measured points

The properties stored with staked points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **RefLine (Grid)**, **RefLine (Meas)**, **RefLine (Stake)** or **RefLine (Poly)**
- Instrument source: **TPS**

Deleting points

A point that is used to define a reference line/arc can be deleted. A reference line/arc can still be used if one or more points defining the reference line/arc have been deleted. Within **REFLINE Edit Reference Line** and **REFLINE Edit Reference Arc** the deleted point field is shown in grey. Within MapView the reference line is still displayed but the deleted point or points is/are not.

Terms

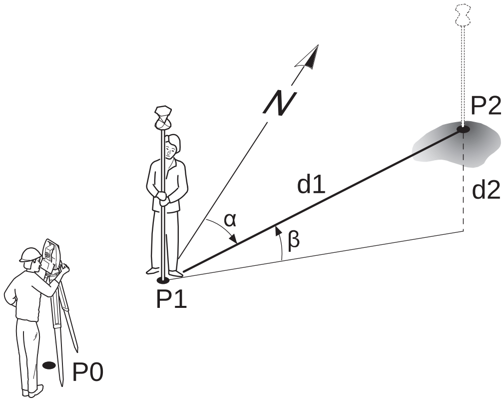
Reference point:	The term "reference point" is used in this chapter to refer to the point from which the perpendicular offset from the reference line/arc, to the target point, is measured. Refer to paragraph "Defining a reference line/arc" and the diagrams for further explanation.
Target point:	The design point. • For measuring to a reference line, this is the point with the coordinates of the current position and the designed or calculated height. • For staking or grid staking to a reference line, this is the point to be staked.

Measured point:	The current position.

Defining a reference line/arc

A reference line can be defined in the following ways:

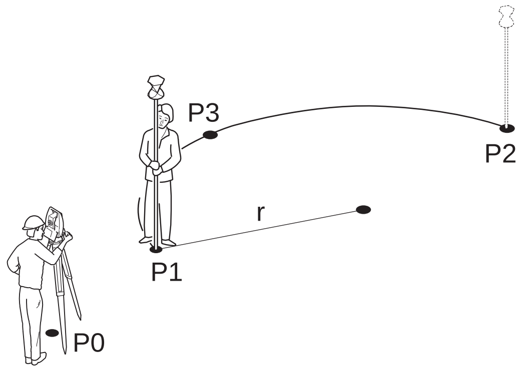
- Two known points
- One known point, an azimuth, a distance and a gradient
- One known point, an azimuth, a distance and a difference in height
- Polylines can be imported from a DXF job and selected from a list or on the **Map** page. Refer to "37.8.1 Overview".



P0	Instrument station
P1	Start point
P2	End point
d1	Known distance
d2	Difference in height, ΔHt
α	Azimuth
β	Elevation angle between the start point and the end point

A reference arc can be defined in the following ways:

- Two known points and a radius
- Three known points



P0	Instrument station
P1	Start point
P2	End point
P3	Known point
r	Radius of arc

Defining chainage

The chainage of the start point of a reference line/arc can be defined.

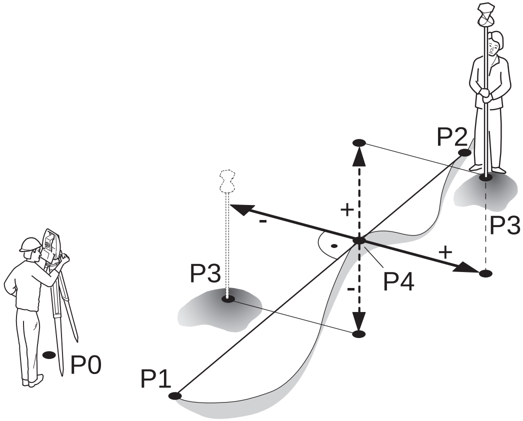
☞ It is possible to define an arc that has an opening angle of more than 180°.

☞ **<Azimuth:>** is used throughout this chapter. This can also mean **<Bearing:>**.

☞ When describing screens with a title that changes depending on whether a line or an arc was chosen, the terms "line" and "arc" are replaced by XX.

Direction of values

The following diagram shows the direction of positive and negative values for distance and height differences between the target point and the reference point for reference lines.



P0 Instrument station
P1 Start point
P2 End point
P3 Target point
P4 Reference point

37.2 Accessing Reference Line

Access

Select **Main Menu: Programs...\Reference Line**.

OR

Press **PROG**. Highlight **Reference Line**. **CONT (F1)**.

Refer to "31.2 Accessing the Programs Menu" for information on the **PROG** key.

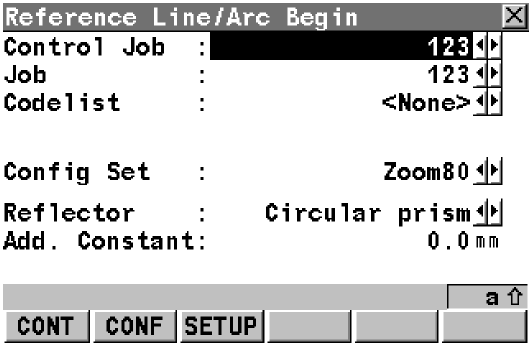
OR

Press a hot key configured to access the screen **REFLINE Reference Line/Arc Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

REFLINE Reference Line/Arc Begin



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

CONF (F2)
To configure the Reference Line application program. Refer to "37.3 Configuring Reference Line".

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

Description of fields

Field	Option	Description
<Control Job:>	Choicelist	The original points to be staked and the reference lines/arcs are stored in this job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Job:>	Choicelist	The active job. Polylines are stored in this job. All jobs from **Main Menu: Manage...\Jobs** can be selected. Points which are occupied after staking out are stored in this job. The original points to be staked are not copied to this job.
<Codelist:>	Choicelist	No codes are stored in the selected **<Job:>**. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.
<DTM Job:>	Choicelist	Available for **<Heights: Use DTM Model>** in **REFLINE Configuration**, **Heights** page. To select a DTM to be staked. Heights are then staked out relative to the selected DTM.

Field	Option	Description
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Reference Line application program	THEN
is to be accessed	**CONT (F1)** accepts the changes and accesses the Reference Line application program. Refer to "37.4 Starting Reference Line".
is to be configured	**CONF (F2)**. Refer to "37.3 Configuring Reference Line".

37.3 Configuring Reference Line

Description

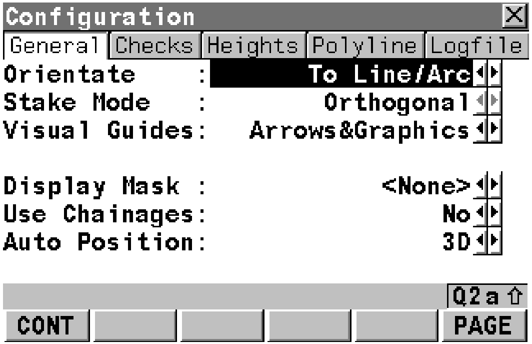
Allows options to be set which are used within the Reference Line application program. These settings are stored within the configuration set.

Access step-by-step

Step	Description
1.	Refer to "37.2 Accessing Reference Line" to access the Begin screen.
2.	**CONF (F2)** to access **REFLINE Configuration**.

REFLINE Configuration, General page

This screen consists of the **General** page, the **Checks** page, the **Heights** page, the **Polyline** page and the **Logfile** page. The explanations for the softkeys given below are valid as indicated.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
To edit the display mask currently being displayed. Accesses **CONFIGURE Define Display Mask n**. Available when **<Display Mask:>** is highlighted on **General** page. Refer to "15.2 Display Settings".

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the application program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Orientate:>		The reference direction to be used to stakeout points. The stakeout elements and the graphical display shown in the Reference Line application program are based on this selection.
	To Line/Arc	The direction of the orientation is parallel to the reference line or the reference arc.
	To Station	The direction of the orientation is from the measured point to the instrument station.
	From Station	The direction of the orientation is from the instrument station to the measured point.
	To Arrow	The direction of the orientation is from the current position to the point to be staked. The graphical display shows an arrow pointing in the direction of the point to be staked.

Field	Option	Description
<Stake Mode:>		The method of staking out.
	Polar	Available for **<Orientate: From Station>** or **<Orientate: To Station>**. The horizontal distance and angle between the current position and the point to be staked, the height difference as defined in **REFLINE Configuration**, the height of the point to be staked and the check distances are displayed.
	Orthogonal	The distances along and perpendicular to the orientation line between the current position and the point to be staked, the height difference as defined in **REFLINE Configuration**, the height of the point to be staked and the check distances are displayed.
Visual Guides		Selects the visual guides displayed while staking points to lead to the point to be staked out.
	Off	Available unless **<Orientate: To Arrow>**. No symbols or graphics are displayed.
	Arrows	Available unless **<Orientate: To Arrow>**. Arrows are displayed. The arrows show the direction of the difference in distance between the current position and the point to be staked parallel and perpendicular to the reference object.

Field	Option	Description
	Graphics	A graphical display shows the instrument station, the current position and the point to be staked.
	Arrows&Graphics	Arrows and graphics are displayed.
<Display Mask:>	Choicelist	The user defined display mask to be shown in **REFLINE XX Points**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.
<Use Chainages:>	**Yes** or **No**	Activates the use of chainages within the reference line application program.
<Chain Format:>		Available for **<Use Chainages: Yes>**. Selects display format for all chainage information fields.
	+123456.789	Default chainage display form.
	+123.4+56.789	Separator between tens and hundreds with additional decimal point.
	+123+456.789	Separator between hundreds and thousands.
	+1234+56.789	Separators between tens and hundreds.

Field	Option	Description
		☞ The distance units **<Int Ft/Inch (fi)>**, **<US Ft/Inch (ft)>**, **<Kilometres (km)>** and **<US Miles (mi)>** are only supported by the first chainage format. All other chainage formats are restricted to the base units **<Metre (m)>**, **<Int Ft (fi)>** and **<US Ft (ft)>**.
<Auto Position:>	**2D**	Instrument positions horizontally to the point to be staked out.
	3D	Instrument positions horizontally and vertically to the point to be staked out.
	Off	Instrument does not position to the point to be staked out.
<Update Angle:>	**Yes**	Angles are updated with telescope movement after a distance was measured.
	No	Angles and stakeout values are updated after a distance measurement. Then all values are frozen until the next distance is taken. When **<Automation: Track360:>** and locked to a target the values do not change.

Next step

PAGE (F6) changes to the **Checks** page.

REFLINE Configuration, Checks page

Description of fields

Field	Option	Description
<Pos Check:>	**Yes** or **No**	Allows a check to be made on the horizontal coordinate difference between the staked point and the point to be staked. If the defined **<Pos Limit:>** is exceeded, the stakeout can be repeated, skipped or stored.
<Pos Limit:>	User input	Available for **<Pos Check: Yes>**. Sets the maximum horizontal coordinate difference which is accepted in the position check.
<Height Check:>	**Yes** or **No**	Allows a check to be made on the vertical difference between the staked point and the point to be staked. If the defined **<Height Limit:>** is exceeded, the stakeout can be repeated, skipped or stored.
<Height Limit:>	User input	Available for **<Height Check: Yes>**. Sets the maximum vertical difference accepted in the height check.
<Beep near Pt:>	**Yes** or **No**	The instrument beeps when the horizontal radial distance from the current position to the point to be staked is equal to or less than defined in **<Dist from Pt:>**.

Field	Option	Description
<Dist from Pt:>	User input	Available for **<Beep near Pt: Yes>**. The horizontal radial distance from the current position to the point to be staked when a beep should be heard.

Next step

PAGE (F6) changes to the **Heights** page.

REFLINE Configuration, Heights page

Description of fields

Field	Option	Description
<Heights:>	Choicelist	Available if this screen was accessed from **REFLINE Reference Line/Arc Begin**. Depending on the task chosen this parameter controls the following. • When measuring to a line/arc, it determines the delta height value which is displayed when points are being measured. • When staking to or gridstaking a line/arc, it determines the height value to be staked out.
	Use Ref Line	Heights are computed along the reference line/arc.
	Use Start Point	Heights are computed relative to the height of the starting point.

Field	Option	Description
	Use DTM Model	The stake out height is computed from the DTM being used.
	Output	Available unless this screen was accessed from **REFLINE Reference Line/Arc Begin**.
<Edit Height:>	**No**	The field **<Height:>** for the height of the current position is displayed in **REFLINE Measure Points**, **Ref XX** page**, REFLINE Enter Offset Values**, **REFLINE XX Stakeout**, **Ref XX** page and **REFLINE +yyy.yy +xxx.xx**, **Stake** page. The value for **<Height:>** cannot be changed.
	Yes	The field **<Design Ht:>** is displayed in **REFLINE Measure Points**, **Ref XX** page**, REFLINE Enter Offset Values**, **REFLINE XX Stakeout**, **Ref XX** page, **REFLINE +yyy.yy +xxx.xx**, **Stake** page and **REFLINE Results**, **General** page. The design height is the height of the point to be staked. The initial value is as configured in the **<Heights:>** field. The value for **<Design Ht:>** can be changed.

Next step
PAGE (F6) changes to the **Polyline** page.

REFLINE Configuration, Polyline page

Description of fields

Field	Option	Description
<Stake Points:>	Choicelist	Sets the type of horizontal points to be staked. Refer to "37.8.4 Staking Operation" for a graphic and an explanation of the abbreviations.
	PC, PT, AP	Only these horizontal key points are calculated for staking, skipping the radius and midpoints of arcs and the angle bisector point on lines.
	PC, PT, AP, BP	Only these horizontal key points are calculated for staking, skipping the radius point and midpoint of all arcs.
	PC, PT, AP, RP, MCP	Only these horizontal key points are calculated for staking, skipping the angle bisector point.
	ALL	All horizontal key points are available for stakeout. Refer to "37.8.4 Staking Operation" for a list of all keypoints.
<Auto Increment:>		Sets behavior of the stationing after a point is stored.
	<None:>	Does not change the station after a point is stored.
	Previous	Proceeds to the next key point down station after each stored staked point.

Field	Option	Description
	Next	Proceeds to the next key point up station after each stored staked point.
<Ref. Tangent:>	**Back** or **Forward**	Sets the tangent to be used when staking items in void areas.
<Densify Arc:>	**Yes** or **No**	Option to use a different station increment along a curve.
<Small Radius:>	User input	Available for **<Densify Arc: Yes>**. Defines the threshold value of a small radius curve, for example curve of radius smaller than this value uses the station increment defined in the following field.
<Curve Inc.:>	User input	Available for **<Densify Arc: Yes>**. Station increment to be used along the small radius curve.

Next step

PAGE (F6) changes to the **Logfile** page.

REFLINE Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file.

Field	Option	Description
		Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

CONT (F1) returns to the screen from where this screen was accessed.

37.4 Starting Reference Line

37.4.1 Manually Entering a Reference Line/Arc

☞ This chapter does not apply for staking to polylines.

Description

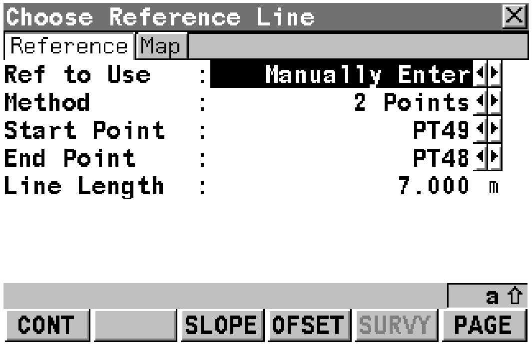
- A reference line/arc can be defined by manually entering known parameters.
- The line/arc is only temporary and is not stored when the program is quit or closed.

Access step-by-step

Step	Description
1.	Refer to "37.2 Accessing Reference Line" to access the Begin screen.
2.	**CONT (F1)** to access **REFLINE Reference Task Menu**.
3.	**REFLINE Reference Task Menu** This screen defines the task to be performed. **Measure to Line** or **Measure to Arc**: Calculates the coordinates of a point from its position relative to the reference line/arc. **Stake to Line** or **Stake to Arc**: Allows points to be staked relative to the reference line/arc. **Gridstake Line** or **Gridstake Arc**: Allows a grid to be staked out relative to the reference line/arc.
4.	**CONT (F1)** to access **REFLINE Choose Reference Line**.
5.	**REFLINE Choose Reference Line**, **Reference** page. Select **<Ref to Use: Manually Enter>.**

**REFLINE
Choose Reference Line,
Reference page**

- This screen contains the **Reference** page and the **Map** page. The explanations for the softkeys given below are valid as indicated. The fields available depend on the options chosen for the task and **<Method:>** in this screen.
- For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.



CONT (F1)
To accept changes and continue with the subsequent screen.

SLOPE (F3)
To set a slope from a defined reference line/arc. Cut/Fill values can then be displayed to the slope when measurements are taken along the reference line/arc.

OFSET (F4)
To set horizontal and vertical offsets, shifts and rotations on the defined reference line or to set horizontal and vertical offsets on a defined reference arc.

SURVY (F5)
Available for **<Ref to Use: Manually Enter>** when a point field is highlighted. To measure a point.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure the reference line/arc.

Description of fields

Field	Option	Description
<Method:>		The method by which the reference line/arc will be defined.
		• For task **XX Line**
	2 Points	Uses two known points to define the reference line.
	Pt/Brg/Dst / Grade	Defines the reference line using a known point, a distance, an azimuth and the gradient of the line.
	Pt/Brg/Dst /ΔHt	The same as above but uses the difference in height instead of the gradient.
		• For task **XX Arc**
	3 Points	Defines the reference arc using three known points.
	2 Points/ Radius	Defines the reference arc with two known points and a known radius.
<Start Point:>	Choicelist	The start point of the reference line/arc. All points from **REFLINE Data: Job Name** can be selected.
<Second Point:>	Choicelist	Available for **<Method: 3 Points>**. The second point of the reference arc. All points from **REFLINE Data: Job Name** can be selected.

Field	Option	Description
<End Point:>	Choicelist	Available for **<Method: 2 Points>**, **<Method: 3 Points>** and **<Method: 2 Points/Radius>**. The end point of the reference line/arc. All points from **REFLINE Data: Job Name** can be selected.
<Line Length:>	Output	Available for **<Ref to Use: Manually Enter>** with **<Method: 2 Points>**. The horizontal grid distance between **<Start Point:>** and **<End Point:>** of the line. ----- is displayed if the distance cannot be calculated.
<Azimuth:>	User input	Available for **<Method: Pt/Brg/Dst/Grade>** and **<Method: Pt/Brg/Dst/ΔHt>**. The azimuth of the reference line.
<Horiz Dist:>	User input	Available for **<Method: Pt/Brg/Dst/Grade>** and **<Method: Pt/Brg/Dst/ΔHt>**. The horizontal distance from the start point to the end point of the reference line.
<Grade:>	User input	Available for **<Method: Pt/Brg/Dst/Grade>**. The gradient of the line from the start point to the end point of the reference line.

Field	Option	Description
<ΔHeight:>	User input	Available for **<Method: Pt/Brg/Dst/ΔHt>**. The difference in height from the start point to the end point of the reference line.
<Radius:>	User input	Available for **<Method: 2 Points/Radius>**. The radius of the reference arc.
<Arc Dist:>	Output	The horizontal grid distance along the arc between **<Start Point:>** and **<End Point:>** of the arc. ----- is displayed if the distance cannot be calculated. ----- is displayed if the distance cannot be calculated.

Next step

PAGE (F6) changes to the **Map** page.

REFLINE Choose Reference Line, Map page

The **Map** page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

IF the selected task is	THEN
Measure to Line/Arc	**CONT (F1)** accepts the changes and accesses **REFLINE Measure Points**. Refer to "37.5 Measuring to a Reference Line/Arc".
Stake to Line/Arc	**CONT (F1)** accepts the changes and accesses **REFLINE Enter Offset Values**. Refer to "37.6 Staking to a Reference Line/Arc".
Gridstake Line/Arc	**CONT (F1)** accepts the changes and accesses **REFLINE Define Grid**. Refer to "37.7 Gridstaking to a Reference Line/Arc".
Stake to Polyline	**CONT (F1)** accepts the changes and accesses **REFLINE Choose Polyline**. Refer to "37.8 Staking to Polyline".

37.4.2 Selecting an Existing Reference Line/Arc

☞ This chapter does not apply for staking to polylines.

Description

- Reference lines/arcs can be created, edited, stored and deleted in the **<Control Job:>**.

Access step-by-step

Step	Description
1.	Refer to "37.2 Accessing Reference Line" to access the Begin screen.
2.	**CONT (F1)** to access **REFLINE Reference Task Menu**.
3.	**REFLINE Reference Task Menu** This screen defines the task to be performed. For a description of the tasks refer to "37.4.1 Manually Entering a Reference Line/Arc". Select a task except **Stake to Polyline**.
4.	**CONT (F1)** to access **REFLINE Choose Reference Line**.
5.	**REFLINE Choose Reference Line**, **Reference** page. Select **<Ref to Use: Select from Job>**.

REFLINE Choose Reference Line, Reference page

This screen contains the **Reference** page and the **Map** page. The explanations for the softkeys and the fields are as for manually entering a reference line. All line definition fields are outputs, all other differences are described below.
The fields shown depend on:

- the task selected in **REFLINE Reference Task Menu**.

AND

- the option chosen for **<Method:>** in **REFLINE New Reference XX**.

Refer to paragraph "Creating a reference line/arc step-by-step".

Description of fields

Field	Option	Description
<Ref Line:>	Choicelist	Available for the tasks **XX Line** in **REFLINE Reference Task Menu**. The reference line to be used. Accesses **REFLINE Manage Reference Lines**.
<Ref Arc:>	Choicelist	Available for the tasks **XX Arc** in **REFLINE Reference Task Menu**. The reference arc to be used. Accesses **REFLINE Manage Reference Arcs**.

Next step

PAGE (F6) changes to the **Map** page.

REFLINE Choose Reference Line, Map page

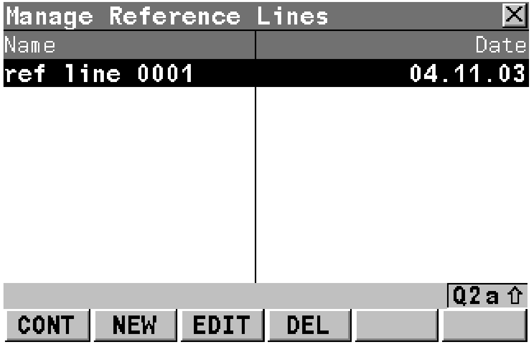
The **Map** page provides an interactive display of the data. The reference line/arc can be viewed but not defined using this page. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

IF	THEN
the desired reference line/arc needs to be created, edited or selected	highlight **<Ref Line:>** or **<Ref Arc:>** and press **ENTER** to access **REFLINE Manage Reference XX**.
the desired reference line/arc has been selected	• for the task **Measure to XX**: **CONT (F1)** to access **REFLINE Measure Points**, **Ref XX** page. Refer to "37.5 Measuring to a Reference Line/Arc". • for the task **Stake to XX**: **CONT (F1)** to access **REFLINE Enter Offset Values**. Refer to "37.6 Staking to a Reference Line/Arc". • for the task **Gridstake XX**: **CONT (F1)** to access **REFLINE Define Grid**. Refer to "37.7 Gridstaking to a Reference Line/Arc".
offsets are to be defined	**OFSET (F4)** to access **REFLINE Define Offsets**.

REFLINE Manage Reference Lines

The screen name will be either **REFLINE Manage Reference Lines** for the tasks **XX Line** or **REFLINE Manage Reference Arcs** for the tasks **XX Arc**. Apart from the screen name the appearance of the screen and the functionality of the softkeys is the same.



CONT (F1)
To select the highlighted reference line/arc and to return to the screen from where this screen was accessed.

NEW (F2)
To create a reference line/arc. Refer to paragraph "Creating a reference line/arc step-by-step".

EDIT (F3)
To edit a reference line/arc. Refer to paragraph "Editing a reference line/arc step-by-step".

DEL (F4)
To delete a reference line/arc.

Description of columns

Column	Description
Name	Names of all the reference lines/arcs available in the **<Control Job:>**.
Date	Date that the reference line/arc was created.

Next step

IF a reference line/arc	THEN
is to be selected	highlight the desired reference line/arc. **CONT (F1)** closes the screen and returns to **REFLINE Choose Reference Line**.
is to be created	**NEW (F2)**. Refer to paragraph "Creating a reference line/arc step-by-step".
is to be edited	highlight the reference line/arc and **EDIT (F3)**. Refer to paragraph "Editing a reference line/arc step-by-step".

Creating a reference line/arc step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing Reference Line" to access **REFLINE Reference Line/Arc Begin**.	
2.	**CONT (F1)** to access **REFLINE Reference Task Menu**.	
3.	**REFLINE Reference Task Menu** This screen defines the task to be performed.	37.4.1
	Select a task except **Stake to Polyline**.	
4.	**CONT (F1)** to access **REFLINE Choose Reference Line**, **Reference** page.	
5.	**REFLINE Choose Reference Line**, **Reference** page	

Step	Description	Refer to chapter
	Select **<Ref to Use: Select from Job>.**	
6.	Highlight **<Ref Line:>** or **<Ref Arc:>** and press **ENTER** to access **REFLINE Manage Reference XX**.	
7.	**NEW (F2)** to access **REFLINE New Reference XX**, **Input** page.	
8.	**REFLINE New Reference XX**, **Input** page **<Ref ID:>** The ID of the new reference line/arc. The other fields available depend on the option chosen in **REFLINE Reference Task Menu** and for **<Method:>** in this screen. • For task **XX Line** **<Method:>** The method by which the reference line will be defined. **<Method: 2 Points>** uses two known points to define the reference line. **<Method: Pt/Brg/Dst/Grade>** defines the reference line using a known point, a distance, a bearing and the gradient of the line. **<Method: Pt/Brg/Dst/ΔHt>** is the same as above but uses the difference in height instead of the gradient. **<Line Length:>** Available for **<Method: 2 Points>**. The horizontal grid distance between **<Start Point:>** and **<End Point:>** of the line. ----- is displayed if the distance cannot be calculated.	37.4.1

Step	Description	Refer to chapter
	• For task **XX Arc** **<Method:>** The method by which the reference arc will be defined. **<Method: 3 Points>** defines the reference arc using three known points. **<Method: 2 Points/Radius>** defines the reference arc with two known points and a known radius. **<Arc Dist:>** The horizontal grid distance along the arc between **<Start Point:>** and **<End Point:>** of the arc. ----- is displayed if the distance cannot be calculated. Choose the method by which to define a reference line/arc and enter the appropriate parameters.	
☞	**SURVY (F5)** available for **<Start Point:>, <Second Point:>** and **<End Point:>**. To measure a known point.	
☞	For all point fields, the MapView interactive display on the **Map** page can be used to select the desired point.	30
9.	**PAGE (F6)** to access **REFLINE New Reference XX**, **Map** page.	
10.	**REFLINE New Reference XX**, **Map** page MapView displays the reference line/arc as a solid line.	30.5
11.	**STORE (F1)** to store changes and return to **REFLINE Manage Reference XX**.	

Editing a reference line/arc step-by-step

Step	Description
1.	Refer to "37.4.2 Selecting an Existing Reference Line/Arc" to access **REFLINE Manage Reference XX**.
2.	**EDIT (F3)** to access **REFLINE Edit Reference XX**, **Input** page.
3.	All the following steps are identical with the creation of a new reference line/arc except for the following differences. • All fields except **<Ref ID:>** are output fields. • **SURVY (F5)** is not available. • A **Plot** page replaces the **Map** page. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available. Refer to paragraph "Creating a reference line/arc step-by-step". Follow the instructions from step 8. onwards.

37.4.3 Defining the Offsets related to a Reference Line/Arc

☞ This chapter does not apply for staking to polylines.

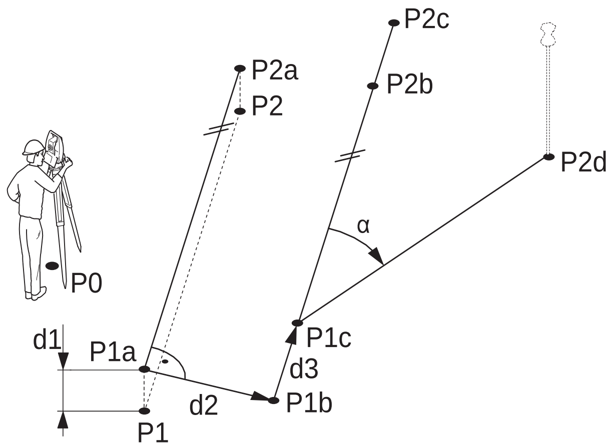
Description

A reference line can be offset, shifted and rotated, a reference arc can be offset.

Access step-by-step

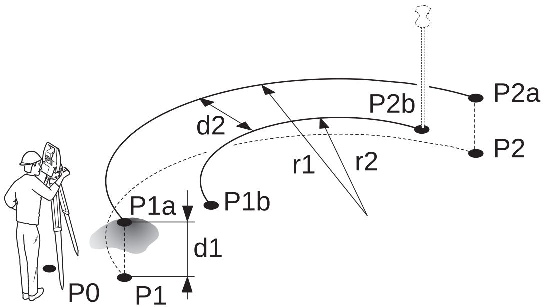
Step	Description
1.	Refer to "37.2 Accessing Reference Line" to access the Begin screen.
2.	**CONT (F1)** to access **REFLINE Reference Task Menu**.
3.	**REFLINE Reference Task Menu** This screen defines the task to be performed. Select a task except **Stake to Polyline**.
4.	**CONT (F1)** to access **REFLINE Choose Reference Line**.
5.	**OFSET (F4)** to access **REFLINE Define Offsets**.

Diagram



Reference line offsets

P0 Instrument station
P1 Start point
P2 End point
P1a Start point with **<Height Offset:>**
P2a End point with **<Height Offset:>**
P1b Start point with **<Offset Line:>**
P2b End point with **<Offset Line:>**
P1c Start point with **<Shift Line:>**
P2c End point with **<Shift Line:>**
P2d End point with **<Rotation Line:>**
d1 **<Height Offset:>**
d2 **<Offset Line:>**
d3 **<Shift Line:>**
α **<Rotation Line:>**

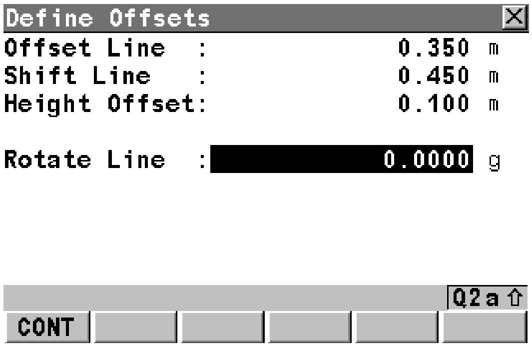


Reference arc offsets

P0 Instrument station
P1 Start point
P2 End point
P1a Start point with **<Height Offset:>**
P2a End point with **<Height Offset:>**
P1b Start point with **<Offset Arc:>**
P2b End point with **<Offset Arc:>**
d1 **<Height Offset:>**
d2 **<Offset Arc:>**
r1 Radius before offset
r2 Radius after offset

REFLINE Define Offsets

This screen contains different fields depending on the options chosen for **<Heights:>** in **REFLINE Configuration**, **Heights** page, and the selected task.



CONT (F1)
To confirm the selections and to return to the previous screen.

SHIFT CONF (F2)
To configure the reference line/arc. Refer to "37.3 Configuring Reference Line".

Description of fields

Field	Option	Description
<Offset Line:> or **<Offset Arc:>**	User input	Distance to horizontally offset reference line/arc to the left or right. ☞ When an offset is applied to an arc the radius of the arc changes.
<Shift Line:>	User input	Available for task **XX Line** unless **<Heights: Use Ref Line>** in **REFLINE Configuration, Heights** page. Distance to horizontally shift reference line forward or back.
<Height Offset:>	User input	Available for **<Heights: Use Start Point>** and **<Heights: Use Ref Line>**. The vertical offset of the reference line/arc.
<DTM Offset:>	User input	Available for **<Heights: Use DTM Model>**. The vertical offset of the DTM model.
<Rotate Line:>	User input	Available for task **XX Line** unless **<Heights: Use Ref Line>** in **REFLINE Configuration, Heights** page. Angle by which to rotate the reference line.

Next step

CONT (F1) closes the screen and returns to **REFLINE Choose Reference Line**.

37.4.4 Defining the Slope related to a Reference Line/Arc

☞ This chapter does not apply for staking to polylines.

Description

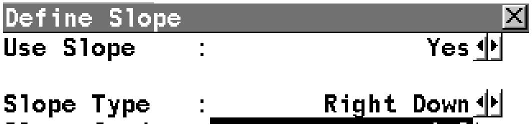
- It is possible to measure points and stake points on slopes related to a reference line/arc. A slope can be defined and cut/fill values can then be displayed to the slope when measuring along the reference line/arc. The slope is a plane from the reference line/arc and extends along the length of the reference line/arc.
- Slopes can be used when measuring to a reference line/arc, staking a point relative to a reference line/arc or performing a grid stakeout relative to a reference line/arc.

Access step-by-step

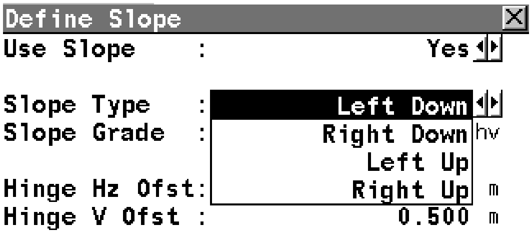
Step	Description
1.	Refer to "37.2 Accessing Reference Line" to access the Begin screen.
2.	**CONT (F1)** to access **REFLINE Reference Task Menu**.
3.	**REFLINE Reference Task Menu** This screen defines the task to be performed. Select a task except **Stake to Polyline**.
4.	**CONT (F1)** to access **REFLINE Choose Reference Line**.
5.	**SLOPE (F3)** to access **REFLINE Define Slope**.

Step 1)
Activating the slope method

Step	Description
1.	Ensure that **<Use Slope: Yes>** is selected.

Step	Description
	

Step 2) Defining the slope parameters

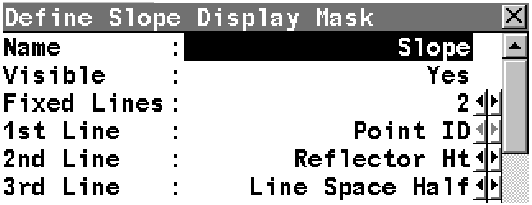
Step	Description
1.	**Defining the slope type**. Defining a slope type of **<Slope Type: Left Down>** creates a downward plane extending to the left of the defined reference line/arc. Defining a slope type of **<Slope Type: Right Down>** creates a downward plane extending to the right of the defined reference line/arc. Defining a slope type of **<Slope Type: Left Up>** creates an upward plane extending to the left of the defined reference line/arc. Defining a slope type of **<Slope Type: Right Up>** creates an upward plane extending to the right of the defined reference line/arc. 

Step	Description
2.	**Defining the slope grade**. The inclination of the slope is defined by the slope grade. The units for slope grade are defined in the **CONFIGURE**, **Units & Formats** screen. Use Slope : Yes Slope Type : Right Down Slope Grade : 1:2 hv

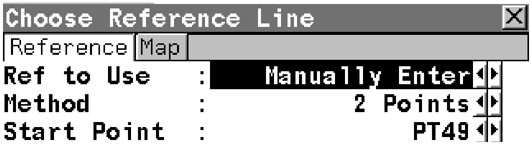
Step 3) Defining any necessary offsets

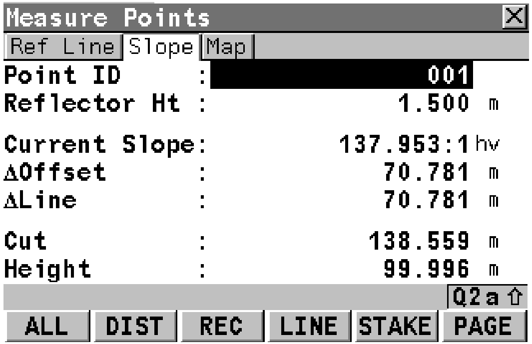
Step	Description
1.	The slope is always defined as starting from a 'hinge line'. The hinge line can be horizontally and/or vertically offset from the reference line/arc. The direction of the reference line/arc is always from the starting point. The offsets are always relative to the direction of the reference line/arc. When **<Hinge Hz Ofst: 0>** and **<Hinge V Ofst: 0>**, then the hinge line is the reference line/arc. Slope Grade : 1:2 hv Hinge Hz Ofst: 1.250 m Hinge V Ofst : 0.500 m

Step 4) Defining the display mask

Step	Description
1.	Press **DMASK (F3)** in the Define Slope screen to access the display mask settings This display mask is available when using the slope method. It is user configurable and describes the current reflector position in relation to the defined slope and defined reference line/arc. 

Step 4) Measuring the points

Step	Description
1.	Press **CONT (F1)** to close the **Define Slope** screen.
2.	Choose the appropriate Task and choose the relevant reference line/arc. 
3.	Press **CONT (F1)** to access the **Measure Points** screen, move to the **Slope** page.

Step	Description
	

Description of all fields from the Slope Display Mask

Field	Description
<Chainage:>	Displays the current chainage.
<Current Slope:>	Displays the current slope of the reflector position to the hinge.
<Design Slope:>	Displays the slope grade as defined by the user.
<East:>	Displays the Easting coordinate of the current reflector position.
<Height:>	Displays the Height value of the current reflector position.

Field	Description
<North:>	Displays the Northing coordinate of the current reflector position.
<Point ID:>	To enter the point ID.
<Reflector Ht:>	To enter the reflector height.
<SD to Hinge:>	Displays the slope distance offset from the hinge to measured point.
<SD to Line:>	Displays the slope distance offset from line/arc to measured point.
<Slope Cut/Fill:>	Displays the value of the difference between the actual reflector elevation to the slope elevation at that position. A cut is above the slope. A fill is below the slope.
<Start Chainage:>	Displays the starting chainage as defined by the user.
<ΔHeight Hinge:>	Displays the delta height from the current position to the hinge.
<ΔHeight Line:>	Displays the delta height from the current position to the line/arc.
<ΔLine/Arc:>	Displays the horizontal distance from the start point of the line/arc to the base point of the measured point, along the line/arc.
<ΔLine/Arc-End:>	Displays the horizontal distance from the end point of the line/arc to the base point of the measured point, along the line/arc.

Field	Description
<ΔOffset:>	Displays the perpendicular offset from the line/arc to measured point.
<ΔOffset Hinge:>	Displays the perpendicular offset from the hinge to measured point.

37.5 Measuring to a Reference Line/Arc

37.5.1 Measuring the Points

☞ This chapter does not apply for staking to polylines.

Description

The horizontal and vertical position of a measured point can be calculated relative to the defined reference line/arc.

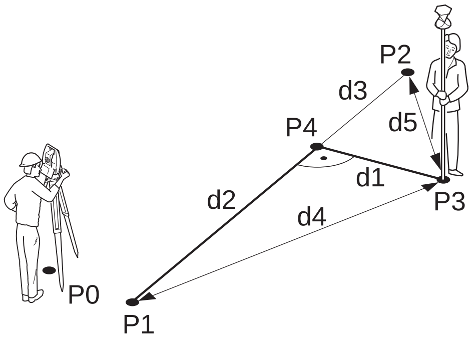
Access

Select the task **Measure to XX** in **REFLINE Reference Task Menu** and press **CONT (F1)** twice to access **REFLINE Measure Points**.

OR

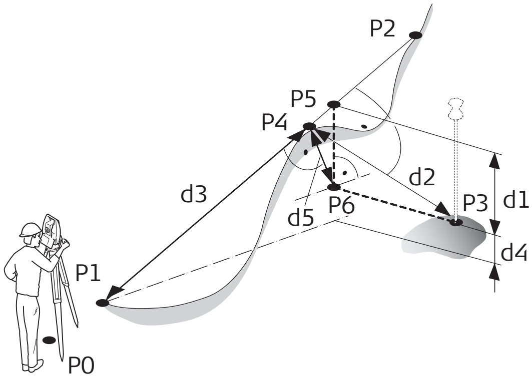
Press **SURVY (F5)** in **REFLINE XX Stakeout** to access **REFLINE Measure Points**. Refer to "37.6 Staking to a Reference Line/Arc" to access **REFLINE XX Stakeout**.

Measure to line - horizontal measurements



P1	Start point
P2	End point
P3	Measured point
P4	Reference point
d1	**<ΔOffset:>**
d2	**<ΔLine:>**
d3	**<ΔLine-End:>**
d4	**<Check Dist 1:>**
d5	**<Check Dist 2:>**

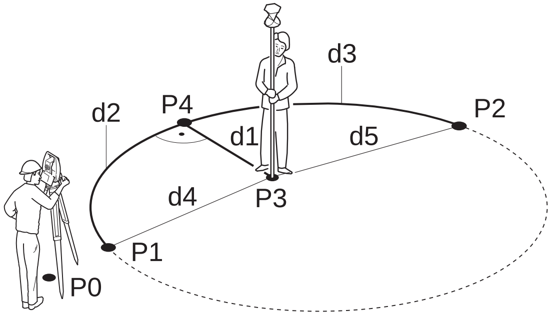
Measure to line - vertical measurements



P0 Instrument station
P1 Start point
P2 End point
P3 Measured point
P4 Temporary point
P5 Reference point
P6 Horizontal base point
d1 **<ΔHt-Line:>**
d2 **<ΔPerp Dist:>**
d3 **<ΔSpat Dist:>**
d4 **<ΔHt-Start:>**
d5 **<ΔPerp Hgt:>**

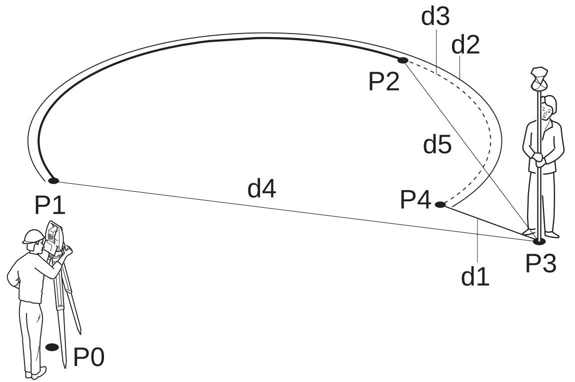
Measure to arc - horizontal measurements

Target point inside arc



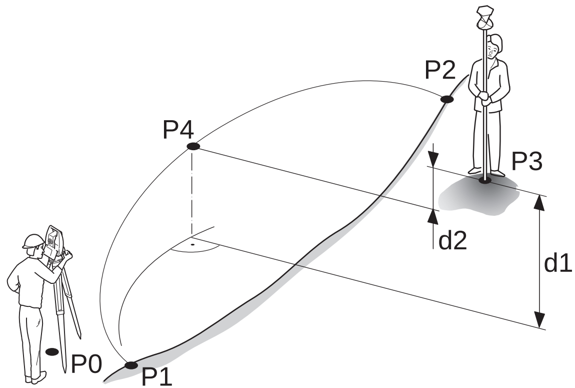
P0 Instrument station
P1 Start point
P2 End point
P3 Measured point
P4 Reference point
d1 **<ΔOffset:>**
d2 **<ΔArc:>**
d3 **<ΔArc-End:>**
d4 **<Check Dist 1:>**
d5 **<Check Dist 2:>**

Target point outside arc



P0 Instrument station
P1 Start point
P2 End point
P3 Measured point
P4 Reference point
d1 **<ΔOffset:>**
d2 **<ΔArc:>**
d3 **<ΔArc-End:>**
d4 **<Check Dist 1:>**
d5 **<Check Dist 2:>**

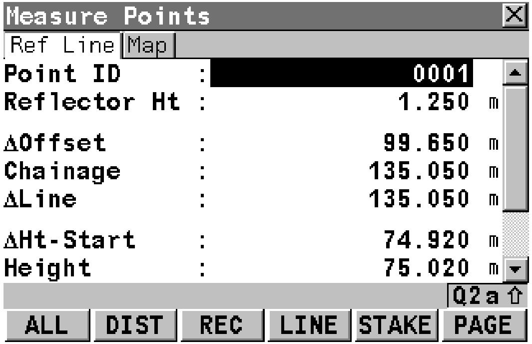
Measure to arc - vertical measurements



P0 Instrument station
P1 Start point
P2 End point
P3 Measured point
P4 Reference point
d1 **<ΔHt-Start:>**
d2 **<ΔHt-Arc:>**

REFLINE Measure Points, Ref Line page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.



ALL (F1)
To measure and record the current position. The point ID is incremented according to the configured point ID template.

DIST (F2)
To measure and display distances. The difference between the current position and the point being staked is displayed.

REC (F3)
To record displayed values. The point ID is incremented according to the configured point ID template.

LINE (F4)
To define/select a reference line/arc. Accesses **REFLINE Choose Reference Line, Reference** page.

STAKE (F5)
To define reference line offsets to be staked out in relation to the reference line. Accesses **REFLINE Enter Offset Values**. Refer to "37.6 Staking to a Reference Line/Arc".

SHIFT CONF (F2)
Available unless **SHIFT AVGE (F2)** is active. To configure a reference line/arc. Accesses **REFLINE Configuration**. Refer to "37.3 Configuring Reference Line".

SHIFT 2FACE (F4)
To take a measurement in Face I and Face II. The point stored is an average of the two measurements.
When using instruments fitted with Aim360, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.
This hotkey is only available for <**EDM Mode**: **Standard**> and <**EDM Mode**: **Fast**> and in the Survey, Reference Line and Stakeout programs.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates".

The fields available depend on the options chosen for **<Heights:>** and **<Edit Height:>** in **REFLINE Configuration**, **Heights** page and the task selected in **REFLINE Reference Task Menu**. The following fields are always available:

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the point to be measured.
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing **REFLINE Measure Points, Ref XX** page. An individual reflector height can by typed in.
<Chainage>	Output	Chainage of the current position along the line/arc. This is the chainage of the start of the reference line/arc plus **<ΔLine:>**/**<ΔArc:>**.
<ΔOffset:>	Output	Perpendicular offset from the reference line/arc calculated from the reference point to the measured point. For reference arcs, **<ΔOffset:>**, **<ΔArc:>** and **<ΔArc-End:>** values are always calculated so as to produce the smallest **<ΔOffset:>** possible. To ensure this the arc will be extended if necessary. Refer to paragraph "Measure to arc - horizontal measurements".
<Check Dist 1:>	Output	Horizontal distance from start point to measured point.
<Check Dist 2:>	Output	Horizontal distance from end point to measured point.

For task Measure to Line

Description of fields

Field	Option	Description
<ΔLine:>	Output	Horizontal distance along the reference line from the start point to the reference point.
<ΔLine-End:>	Output	Horizontal distance along the reference line from the end point to the reference point.

For task Measure to Arc

Description of fields

Field	Option	Description
<ΔArc:>	Output	Horizontal distance along the reference arc from the start point to the reference point.
<ΔArc-End:>	Output	Horizontal distance along the reference arc from the reference point to the end point.

For task Measure to XX, <Heights: Use Start Point> and <Edit Height: No>

Description of fields

Field	Option	Description
<ΔHt-Start:>	Output	Height difference between the start point and the measured point.

Field	Option	Description
<Height:>	Output	Height of measured point.

For task Measure to Line, <Heights: Use Ref Line> and <Edit Height: No>

Description of fields

Field	Option	Description
<ΔHt-Line:>	Output	Height difference between the temporary point on the reference line and the measured point.
<Height:>	Output	Height of measured point.
<ΔPerp Dist:>	Output	Slope distance between the reference point and the measured point, perpendicular to the reference line.
<ΔPerp Hgt:>	Output	Slope distance between the reference point and the horizontal base point.
<ΔSpatial Dist:>	Output	Slope distance between the start point and the reference point.

For task Measure to Arc, <Heights: Use Ref Line> and <Edit Height: No>

Description of fields

Field	Option	Description
<ΔHt-Arc:>	Output	Height difference between the reference point on the arc and the measured point.
<Height:>	Output	Height of measured point.

For task Measure to XX, <Heights: Use DTM Model> and <Edit Height: No>

Description of fields

Field	Option	Description
<ΔHt-DTM:>	Output	Height difference between the measured point and the DTM.
<Height:>	Output	Height of measured point.

For task Measure to XX, <Heights: XX> and <Edit Height: Yes>

Description of fields

Field	Option	Description
<Design Ht:>	User input	Allows input of the design height of the target point. The suggested value for the **<Design Ht:>** is as configured in the **<Heights:>** field in **REFLINE Configuration, Heights** page.

Field	Option	Description
<ΔHt-Design:>	Output	Height difference between the **<Design Ht:>** and the height of the measured point.

Next step

PAGE (F6) changes to the **Map** page.

REFLINE Measure Point Map page

The **Map** page provides an interactive display of the data. Displayed is also

- the horizontal distance along the reference line/arc from the start point to the reference point.
- the perpendicular offset from the reference line/arc measured from the reference point to the measured point.

Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

37.5.2 Working Example

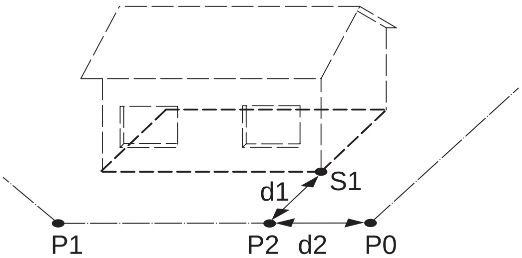
☞ This chapter does not apply for staking to polylines.

Description

Application: The positions of stakes, indicating the corners of a house that is to be built, need to be measured relative to the title boundary of the property that the house is to be built on.
This is done to check that the house is not being built too close to the title boundary in keeping with council regulations.

Reference line/arc: The title boundary is used to define a reference line.

Diagram



P0	Start point
P1	End point
P2	Reference point
S1	Point to be measured
d1	**<ΔOffset:>**
d2	**<ΔLine:>**

Requirements

- The reference line does not need to be stored.
- **<Write Logfile: Yes>** in **REFLINE Configuration**, **Logfile** page.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing Reference Line" to access **REFLINE Reference Line/Arc Begin**.	
2.	**REFLINE Reference Line/Arc Begin** Select a job and a configuration set with the settings mentioned above.	37.2
3.	**CONT (F1)** to access **REFLINE Reference Task Menu**.	
4.	**REFLINE Reference Task Menu** Select **Measure to Line**.	
5.	**CONT (F1)** to access **REFLINE Choose Reference Line, Reference** page.	
6.	**REFLINE Choose Reference Line**, **Reference** page **<Ref to Use: Manually Enter>** **<Method: 2 Points>**	37.4.1
7.	Highlight **<Start Point:>**.	
8.	**SURVY (F5)** to measure P2.	
9.	Highlight **<End Point:>**.	
10.	**SURVY (F5)** to measure P3.	
☞	The **Map** page provides an interactive display of the defined reference line.	30

Step	Description	Refer to chapter
11.	**CONT (F1)** to access **REFLINE Measure Points**.	
12.	Walk to the first point to be measured.	
13.	**REFLINE Measure Points** **<Point ID: S1>**	37.5
14.	**ALL (F1)** measures and stores the point.	
☞	The results are displayed on the screen. The values in the fields indicate the position of the measured point relative to the reference line.	
☞	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	
15.	Are more points to be measured? • If **yes**, continue with step 16. • If **no**, continue with step 18.	
16.	Walk to the next point	
17.	Repeat steps 13. to 15.	

Step	Description	Refer to chapter
☞	The **Map** page provides an interactive display of the defined reference line and the points measured relative to it. Displayed is also • the horizontal distance along the reference line/arc from the start point to the reference point. • the perpendicular offset from the reference line/arc measured from the reference point to the measured point.	30
18.	**SHIFT QUIT (F6)** returns to **Zoom80 Main Menu**.	
☞	The results are written to the logfile.	

37.6 Staking to a Reference Line/Arc

37.6.1 Staking the Points

☞ This chapter does not apply for staking to polylines.

Description

Allows for the position of a point to be defined relative to a reference line/arc and then staked.

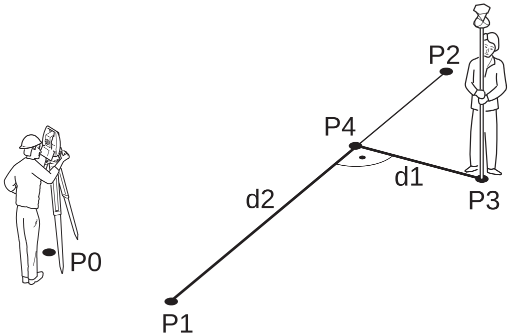
Access

Select the task **Stake to XX** in **REFLINE Reference Task Menu** and press **CONT (F1)** twice to access **REFLINE Enter Offset Values**.

OR

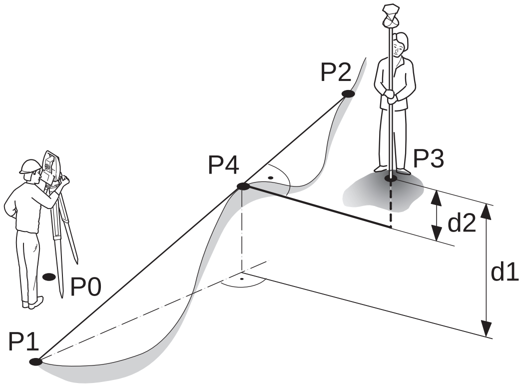
Press **STAKE (F5)** in **REFLINE Measure Points**. Refer to "37.5 Measuring to a Reference Line/Arc" to access **REFLINE Measure Points**.

Stake to line - horizontal measurements



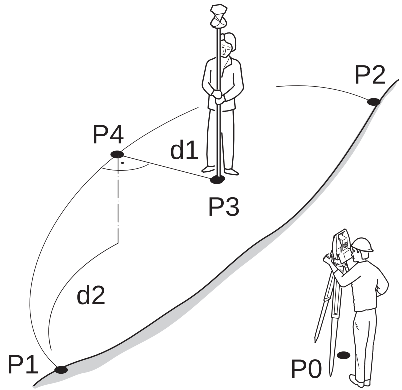
P0 Instrument station
P1 Start point
P2 End point
P3 Target point
P4 Reference point
d1 **<Stake Offset:>**
d2 **<Along Line:>**

Stake to line - vertical measurements



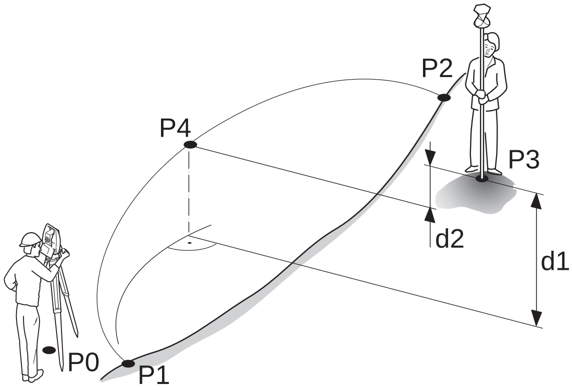
P0 Instrument station
P1 Start point
P2 End point
P3 Target point
P4 Reference point
d1 **<Height Offset:>** for **<Heights: Use Start Point>**
d2 **<Height Offset:>** for **<Heights: Use Ref Line>**

Stake to arc - horizontal measurements



P0 Instrument station
P1 Start point
P2 End point
P3 Target point
P4 Reference point
d1 **<Stake Offset:>**
d2 **<Along Arc:>**

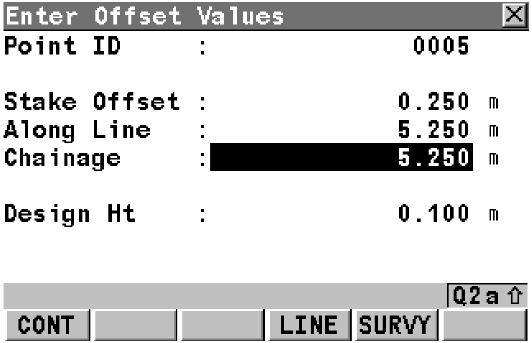
Stake to arc - vertical measure-ments



P0 Instrument station
P1 Start point
P2 End point
P3 Target point
P4 Reference point
d1 **<Height Offset:>** for **<Heights: Use Start Point>**

REFLINE Enter Offset Values

This screen is for typing in the stakeout values for a point relative to the reference line/arc. The screen contains different fields depending on the options chosen for **<Heights:>** and **<Edit Height:>** in **REFLINE Configuration**, **Heights** page and the task selected in **REFLINE Reference Task Menu**. The explanations for the softkeys given below are valid in all cases.



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

LINE (F4)
To define/select a reference line/arc. Accesses **REFLINE Choose Reference Line**.

SURVY (F5)
To measure a point relative to the reference line/arc.

SHIFT CONF (F2)
To configure the reference line/arc. Refer to "37.3 Configuring Reference Line".

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the target point to be staked.
<Stake Offset:>	User input	The offset from the reference point to the target point.

Field	Option	Description
<Along Line:>	User input	Available for task **Stake to Line**. Horizontal distance from the start point to the reference point along the reference line.
<Along Arc:>	User input	Available for task **Stake to Arc**. Horizontal distance from the start point to the reference point along the reference arc.
<Chainage:>	User input	Chainage along the line/arc. This is the chainage of the start of the reference line/arc plus **<Along Line:>**/**<Along Arc:>**.
<Height Offset:>	User input	Available for **<Edit Height: No>** unless **<Heights: Use DTM Model>** in **REFLINE Configuration**. The height offset of the target point. • For **<Heights: Use Start Point>** The height of the target point is calculated as the height of the start point plus **<Height Offset:>**. • For **<Heights: Use Ref Line>** The height of the target point is calculated as the height of the reference point plus **<Height Offset:>**.
<Design Ht:>	User input	Available for **<Edit Height: Yes> in REFLINE Configuration, Heights** page. The design height of the target point.

Field	Option	Description
		• For **<Heights: Use Start Point>** The height of the target point can be input. The suggested height is the height of the start point. • For **<Heights: Use Ref Line>** The height of the target point can be input. The suggested height is the height of the reference point.

Next step

CONT (F1) to accept changes and continue to **REFLINE XX Stakeout**.

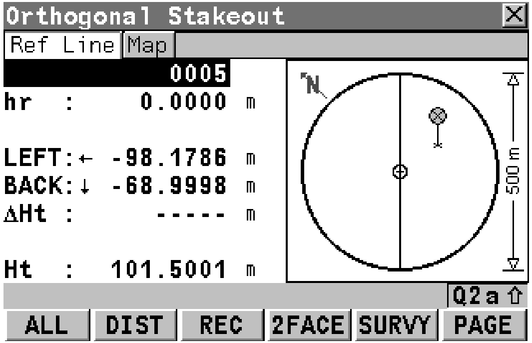
REFLINE Orhtogonal Stakeout, Ref Line page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.

Refer to "41.4.1 Elements of the Graphical Display in the Stakeout" for an explanation of the appearance of the elements of the graphical display within this screen. The display changes depending on what option is chosen for **<Orientate:>** in **REFLINE Configuration, General** page.

This screen contains different fields depending on the options chosen for **<Stake Mode:>** in **REFLINE Configuration, General** page. The explanations for the fields and softkeys given below are valid as indicated.

If **<Auto Position: Yes>** in **STAKEOUT Configuration, General** page the instrument will position the telescope to the point to be staked automatically.



ALL (F1)

To measure the point being staked and return to the **REFLINE Enter Offset Values** screen. The last used values are displayed. The point ID is incremented according to the configured point ID template.

DIST (F2)

To measure and display distances. The difference between the current position and the point being staked is displayed.

REC (F3)

To record displayed values.

2FACE (F4)

To take a measurement in Face I and Face II. The point stored is an average of the two measurements.

When using instruments fitted with Aim360, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.

This hotkey is only available for <**EDM Mode**: **Standard**> and <**EDM Mode**: **Fast**> and in the Survey, Reference Line and Stakeout programs.

SURVY (F5)

To measure a point. Accesses **REFLINE Measure Points**. Refer to "37.5 Measuring to a Reference Line/Arc".

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure a reference line/arc. Accesses **REFLINE Configuration**. Refer to "37.3 Configuring Reference Line".

SHIFT POS2D (F3)
To position the telescope (X,Y) onto the point to be staked.

SHIFT POS3D (F4)
To position the telescope (X,Y,Z) onto the point to be staked.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the target point to be staked.
<Reflector Ht:> or **<hr:>**	User input	The default reflector height as defined in the active configuration set is suggested.

Field	Option	Description
<ΔHt-Line:>, **<ΔHt-Start:>**, **<Δ**Ht-DTM:>, **<Δ**Ht-Design:> or **<ΔHt:>**	Output	Displays the difference between the measured height and the height to be staked.
<Height:> or **<Ht:>**	Output	Available for **<Edit Height: No>** in **REFLINE Configuration**, **Heights** page. The height of the measured point is displayed.
<Design Ht:> or **<D Ht:>**	User input	Available for **<Edit Height: Yes>** in **REFLINE Configuration**, **Heights** page. The design height as shown in **REFLINE Enter Offset Value**.
<Check Dist 1:>	Output	Available for **<Visual Guides: Off>** and **<Visual Guides: Arrows>**. Horizontal distance from start point to target point.
<Check Dist 2:>	Output	Available for **<Visual Guides: Off>** and **<Visual Guides: Arrows>**. Available for horizontal distance from end point to target point.

For <Stake Mode: Polar>

Description of fields

Field	Option	Description
<ΔHz:>	Output	Horizontal angle between the point to be staked and the current position as seen from the instrument station. ☞ For **<Orientate: From Station>** and **<Orientate: To Station>** the value is calculated and displayed permanently. For other orientation methods, the distance must be measured before the value can be displayed.
<ΔDistance:> or **<ΔDst:>**	Output	Horizontal distance from the current position to the point to be staked along the line between the instrument and the current position.

For <Orientate: To Line/Arc> and <Stake Mode: Orthogonal>

Description of fields

Field	Option	Description
<ΔOffset:> or **<ΔOff:>**	Output	Horizontal distance from the point to be staked to the current position perpendicular to the reference line/arc.

Field	Option	Description
<ΔLine:>, **<ΔLne:>** or **<ΔArc:>**	Output	Horizontal distance from the point to be staked to the current position along the reference line/arc.

For <Orientate: To Station>, <Orientate: From Station> or <Orientate: To Arrow> and <Stake Mode: Orthogonal>

Description of fields

Field	Option	Description
<LEFT:> or **<RGHT:>**	Output	Offset from the point to be staked out to the current position, perpendicular to the orientation line. If **<Orientate: From Station>**, this value is positive when the point to be staked is to the right of the line of orientation when looking from the instrument station towards the current position. If **<Orientate: To Station>**, this value is positive when the point to be staked is to the right of the line of orientation when looking from the current position towards the instrument station. If **<Orientate: To Arrow>** this value is always zero.

Field	Option	Description
<FORW:> or **<BACK:>**	Output	Horizontal distance between the point to be staked and the current position along the orientation line. If **<Orientate: From Station>**, this value is positive when the point to be staked is behind the current position when looking from the instrument station towards the current position. If **<Orientate: To Station>**, this value is positive when the point to be staked is between the current position and the instrument station.

Next step

PAGE (F6) changes to the **Map** page.

REFLINE Orthogonal Stakeout Map page

The **Map** page provides an interactive display of the data. Displayed is also

- the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line.
- the difference between the measured height and the height to be staked.

Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

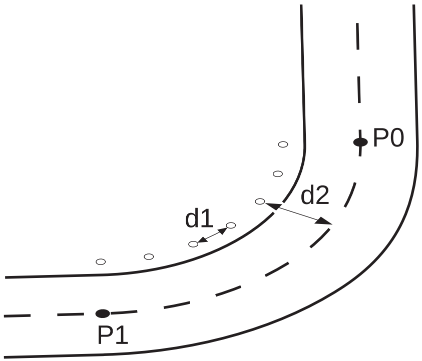
37.6.2 Working Example

This chapter does not apply for staking to polylines.

Description

Application:	A curb is to be defined using offsets from the centreline of a road that is being built.
Reference line/arc:	The defined centreline of the curve is used as a reference arc.
Working technique:	set **<EDM Mode: Tracking>** and **<Automation: Track360>** in **CONFIGURE EDM & Aim360 Settings**.

Diagram



P0 Start point
P1 End point
d1 **<Along Arc:>**
d2 **<Stake Offset:>**

Requirements

- The reference arc is already defined and saved in a job.
- **<Write Logfile: Yes>** in **REFLINE Configuration**, **Logfile** page.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing Reference Line" to access **REFLINE Reference Line/Arc Begin**.	
2.	**REFLINE Reference Line/Arc Begin** Select a job and a configuration set with the settings mentioned above.	37.2
3.	**CONT (F1)** to access **REFLINE Reference Task Menu**.	
4.	**REFLINE Reference Task Menu** Select **Stake to Arc**.	
5.	**CONT (F1)** to access **REFLINE Choose Reference Line, Reference** page.	
6.	**REFLINE Choose Reference Line**, **Reference** page **<Ref to Use: Select from Job>**	37.4.2
7.	Highlight **<Ref Arc:>**.	
8.	**ENTER** to access **REFLINE Manage Reference Arcs**.	
9.	**REFLINE Manage Reference Arcs** Select the correct reference arc.	37.4
10.	**CONT (F1)** returns to **REFLINE Choose Reference Line**, **Reference** page.	

Step	Description	Refer to chapter
☞	The **Map** page provides an interactive display of the defined reference arc.	30
11.	**CONT (F1)** to access **REFLINE Enter Offset Values**.	
12.	**REFLINE Enter Offset Values** **<Point ID: CL1>** **<Stake Offset: 5.20000>** **<Along Arc: 2.0000>** **<Height Offset: 0.0000>**	37.6
13.	**CONT (F1)** to **REFLINE XX Stakeout, Ref XX** page.	
14.	**REFLINE XX Stakeout**, **Ref XX** page Depending on the configuration of the staking options in **REFLINE Configuration**, **General** page, the graphical display and the values in the fields indicate how to find the point to be staked. The values are updated constantly.	
15.	**ALL (F1)** measures and stores the point.	
☞	The results are displayed on the screen.	
☞	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	
16.	Are more points to be staked?	

Step	Description	Refer to chapter
	• If **yes**, continue with step 17. • If **no**, continue with step 19.	
17.	**REFLINE Enter Offset Values** Enter the parameters of the next point to be staked.	37.6
18.	Repeat steps 13. to 16.	
☞	The **Map** page provides an interactive display of the defined reference arc and the points that have been staked out. Displayed is also • the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line. • the difference between the measured height and the height to be staked.	30
19.	**SHIFT QUIT (F6)** returns to **Zoom80 Main Menu**.	
☞	The results are written to the logfile.	

37.7 Gridstaking to a Reference Line/Arc

37.7.1 Gridstaking the Points

☞ This chapter does not apply for staking to polylines.

Description

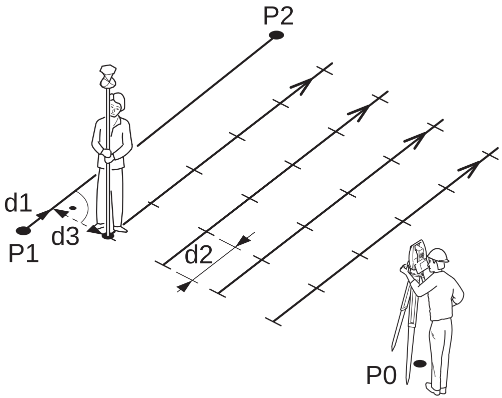
A grid can be defined relative to a reference line/arc and points staked out in that defined grid.

Access step-by-step

Step	Description
1.	Refer to "37.2 Accessing Reference Line" to access the Begin screen.
2.	**CONT (F1)** to access **REFLINE Reference Task Menu**.
3.	**REFLINE Reference Task Menu** Select **Gridstake XX**.
4.	**CONT (F1)** to access **REFLINE Choose Reference Line**.
5.	**REFLINE Choose Reference Line, Reference** page
6.	**CONT (F1)** to access **REFLINE Define Grid**.

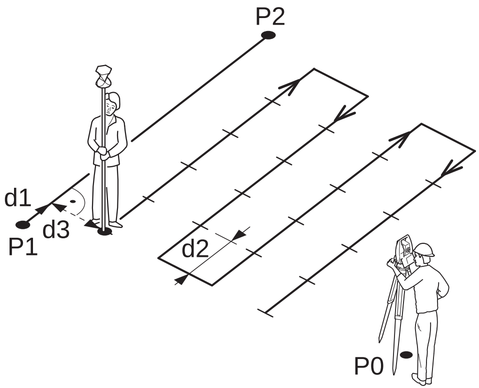
Gridstake line methods

Start at Begin



P0 Instrument station
P1 Start point
P2 End point
d1 **<Begin at Stn:>**
d2 **<Increment:>**
d3 **<Line Offsets:>**

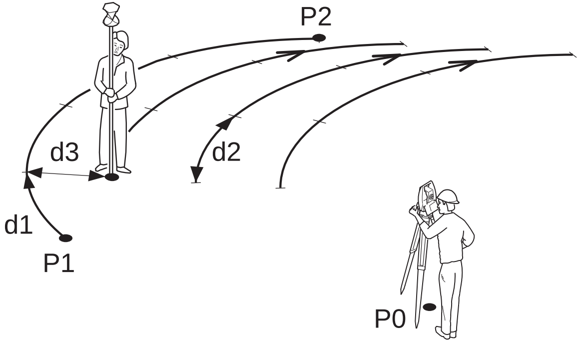
Current Station



P0 Instrument station
P1 Start point
P2 End point
d1 **<Begin at Stn:>**
d2 **<Increment:>**
d3 **<Line Offsets:>**

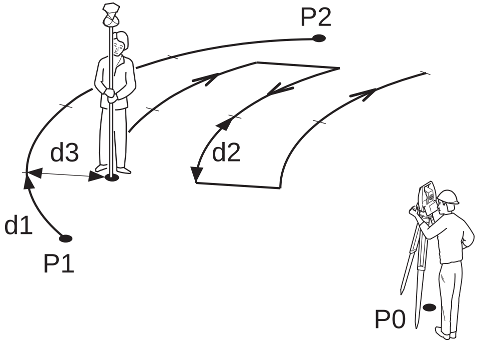
Gridstake arc methods

Start at Begin



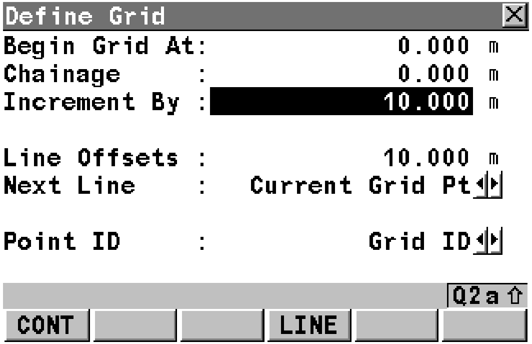
P0 Instrument station
P1 Start point
P2 End point
d1 **<Begin at Stn:>**
d2 **<Increment:>**
d3 **<Line Offsets:>**

Current Station



P0 Instrument station
P1 Start point
P2 End point
d1 **<Begin at Stn:>**
d2 **<Increment:>**
d3 **<Line Offsets:>**

REFLINE
Define Grid



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

LINE (F4)
To define/select a reference line/arc. Accesses **REFLINE Choose Reference Line**.

SHIFT CONF (F2)
To configure the reference line/arc. Refer to "37.3 Configuring Reference Line".

Description of fields

Field	Option	Description
<Begin Grid at:>	User input	Distance along the reference line/arc from the start point to the first target point to be staked.
<Chainage:>	User input	Chainage of the first target point to be staked along the line/arc. This is the chainage of the start of the reference line/arc plus **<Begin Grid At:>**.
<Increment by:>	User input	Spacing between points on the grid line.
<Line Offsets:>	User input	Spacing between grid lines.
<Next Line:>		Method by which the grid will be staked out.

Field	Option	Description
	Start at Begin	Each new grid line is started at the same end as where the previous grid line started.
	Current Grid Pt	Each new grid line is started at the same end as where the previous grid line finished.
<Point ID:>		Determines the format of the point ID for grid points.
	Grid ID	Point ID is shown as the position of the grid being staked where +yyy.yy is the station position along the grid line and +xxx.xx is the grid line offset.
	Pt ID Template	The point ID template as defined in the active configuration set is used. The point ID template can be defined for **<Survey Pts:>** in **CONFIGURE ID Templates**. Refer to "15.1 ID Templates".

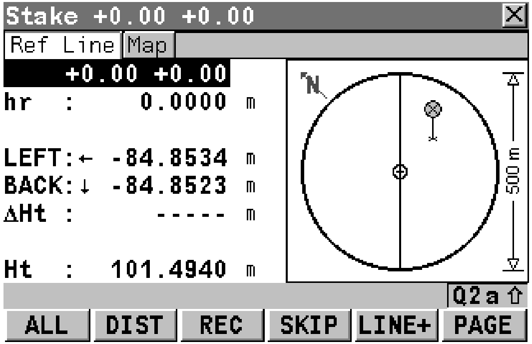
Next step

CONT (F1) to accept changes and continue to **REFLINE Stake +yyy.yy +xxx.xx**, **Ref XX** page.

REFLINE Stake, Ref Line page

The title of this screen indicates the position of the grid being staked where +yyy.yy is the station position along the grid line and +xxx.xx is the grid line offset.

The functionality of this screen is very similar to **REFLINE XX Stakeout, Ref XX** page. Differences between the two screens are outlined below.



SKIP (F4)
To skip the currently displayed station and increment to the next station.

LINE+ (F5)
To start staking the next grid line. The position of the first point on the new line is determined by the option selected for **<Next Line:>.**

Description of fields

Field	Option	Description
<Point ID:>	User input	The point ID of the grid point to be staked. The point ID is based on the selection for **<Point ID:>** in **REFLINE Define Grid**. If a different point ID is typed in, the next point ID will still be shown as the next automatically computed point ID.
<Design Ht:> or **<D Ht:>**	User input	Available for **<Edit Height: Yes>** in **REFLINE Configuration**, **Heights** page.

Field	Option	Description
		To type in the design height. If a design height has been entered and **SKIP (F4)** or **LINE (F5)** is used the true grid height for the next point is shown as the suggested height.

Next step

PAGE (F6) changes to the **Map** page.

REFLINE Stake, Map page

The **Map** page provides an interactive display of the data. Displayed is also

- the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line.
- the difference between the measured height and the height to be staked.

Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

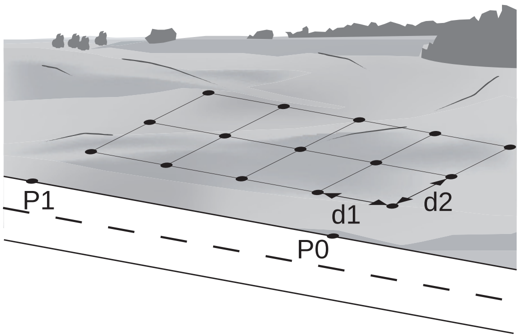
37.7.2 Working Example

☞ This chapter does not apply for staking to polylines.

Description

Application:	The positions of bore-holes need to be staked out in a regular grid over the area of a site to be used for landfill.
Reference line/arc:	Two known points on the site can be used to define the reference line.
Working technique:	set **<EDM Mode: Tracking>** and **<Automation: Track360>** in **CONFIGURE EDM & Aim360 Settings**.

Diagram



P0 Start point
P1 End point
d1 **<Increment By:>**
d2 **<Line Offsets:>**

Requirements

- A new reference line needs to be created and saved with the job.
- **<Write Logfile: Yes>** in **REFLINE Configuration**, **Logfile** page.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Refer to "37.2 Accessing Reference Line" to access **REFLINE Reference Line/Arc Begin**.	
2.	**REFLINE Reference Line/Arc Begin** Select a job and a configuration set with the settings mentioned above.	37.2
3.	**CONT (F1)** to access **REFLINE Reference Task Menu**.	
4.	**REFLINE Reference Task Menu** Select **Gridstake Line**.	
5.	**CONT (F1)** to access **REFLINE Choose Reference Line, Reference** page.	
6.	**REFLINE Choose Reference Line**, **Reference** page **<Ref to Use: Select from Job>**	37.4.1
7.	Highlight **<Ref Line:>**.	
8.	**ENTER** to access **REFLINE Manage Reference Lines**.	
9.	**NEW (F2)** to access **REFLINE New Reference Line**, **Input** page.	

Step	Description	Refer to chapter
10.	**REFLINE New Reference Line**, **Input** page **<Ref ID: Line001>** **<Method: 2 Points>** Select the appropriate points from the choicelist.	37.4.1
	The **Map** page provides an interactive display of the defined reference line.	30
11.	**STORE (F1)**.	
12.	**CONT (F1)** returns to **REFLINE Choose Reference Line**, **Reference** page.	
	The **Map** page provides an interactive display of the defined reference line.	30
13.	**CONT (F1)** to access **REFLINE Define Grid**.	
14.	**REFLINE Define Grid** **<Begin Grid at: 0>** **<Increment by: 20>** **<Line Offsets: 20>** **<Next Line: Current Grid Pt>** **<Point ID: Grid ID>**	37.7
15.	**CONT (F1)** to access **REFLINE Stake +yyy.yy +xxx.xx, Ref XX** page.	

Step	Description	Refer to chapter
16.	**REFLINE Stake +yyy.yy +xxx.xx**, **Ref XX** page Depending on the configuration of the staking options in **REFLINE Configuration**, **General** page, the graphical display and the values in the fields indicate how to find the point to be staked. The values are updated constantly.	37.7
17.	**ALL (F1)** measures and stores the point.	
☞	The results are displayed on the screen.	
☞	It may happen that a point with the same point ID exists in the job. If the codes and/or attribute values of the new and the existing point do not match, a screen opens where they can be corrected.	
18.	Repeat steps 16. and 17. until all grid points have been staked.	
☞	The **Map** page provides a graphical view of the defined reference line and the points that have been staked out. Displayed is also • the horizontal distance from the current position to the point to be staked along the line between the instrument and the current position or along the orientation line. • the difference between the measured height and the height to be staked.	30
19.	**SHIFT QUIT (F6)** returns to **Zoom80 Main Menu**.	

Step	Description	Refer to chapter
☞	The results are written to the logfile.	

37.8 Staking to Polyline

37.8.1 Overview

Description

The reference line task **Staking to a Polyline** allows points to be staked relative to a polyline. This option makes use of line and area data from CAD as simple as possible.

Preparing the data

Line data can be created by one of the following methods:

Method	Description
Data from CAD	Selecting the polylines in the drawing that you want to stake in the field and saving them into a DXF file.
Manually creating lines with existing points	In some cases electronic DXF files are not available to create lines and areas. If this is the case, the lines can be created from uploaded points using the line management function. Refer to "7.4.3 Editing a Line/Area".

Method	Description
Measuring lines in the field	It is also possible to create the lines to be staked by measuring points in the field. Lines can be made using the linework commands in the **Survey** page. Also, taking measurements with line objects open as well using the **MANAGE Data**, **Lines** page or line codes can create lines. Refer to "7.4.4 Working Example". Any line that is listed in the **MANAGE Data**, **Lines** page can be used for staking in this application program.
Using Design to Field	Using the Design to Field tool of GGO, the user has the ability to bring in lines from multitudes of formats including XML, DXF, Microstation XML and many more. Refer to GGO Online Help for information on Design to Field.
Using Alignment Tool Kit	Using the ATK application, a simple centreline alignment can be created and be imported in **Staking to Polyline**. ☞ Only straight and curve elements are supported. The alignment created with the ATK application has to be converted to a Road Job.
Creating Lines in GGO	It is possible as well to create the necessary lines in GGO. Refer to GGO Online Help.

Options to convert the DXF file to a job

To facilitate the electronic transfer of lines from the plans to the surveying instrument, different tools have been created to read DXF format into a job.

DXF Import: Copy the DXF files to the \DATA directory on the CompactFlash card of the Zoom80 instrument. Once the card is back in the instrument the DXF import program can be used to bring the lines into the job. Refer to "14.5 Importing Data in DXF Format".

Design to Field: This module is included in GGO and allows the conversion of DXF files into a job. This method makes the task of transferring several lines into a single job quick and efficient.

☞ Refer to "Appendix C Directory Structure of the Memory Device" for the placements of the data files on the CompactFlash card.

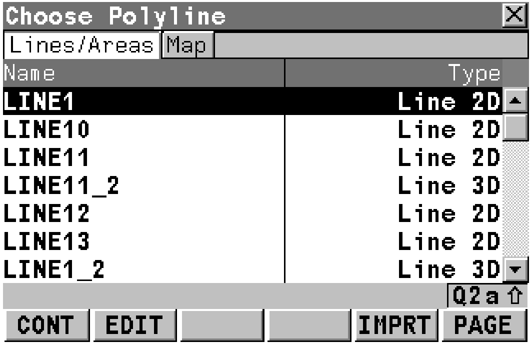
37.8.2 Accessing Staking to Polylines & Choosing a Polyline

Access step-by-step

Select the task **Stake to Polyline** in **REFLINE Reference Task Menu** and press **CONT (F1)** to access **REFLINE Choose Polyline**.

REFLINE Choose Polyline, Lines/Areas page

The **Lines/Areas** page allows for a tabular selection of a polyline. Lines can be either 2D or 3D depending on the input data and are shown as such.



CONT (F1)
To select the highlighted polyline and to continue with the subsequent screen.

EDIT (F2)
To change the start or end chainage value of the selected line. If **<Strt Chainage:>** is edited then the **<End Chainage:>** is computed from the new input plus the length.

IMPRT (F5)
To import lines or Road objects from another job.

PAGE (F6)
To change to another page on this screen.

Next step

PAGE (F6) changes to the **Map** page.

REFLINE Choose Polyline, Map page

The **Map** page allows a selection of the line to be staked in the graphical view with the **<-- (F2)** or **--> (F3)** keys or by mean of the stylus. Only visible lines can be selected.

The selected line is highlighted and its name shown in the upper left corner of the screen.

37.8.3 Stake Parameters

Description

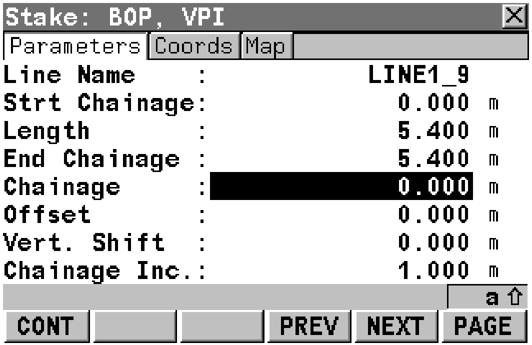
This screen allows defining operating parameters while the **Coords** and **Map** pages allow validating the points to be staked.

Access

CONT (F1) in **REFLINE Choose Polyline**.

REFLINE Stake, Parameters page

Operating parameters are defined on this page.
This screen contains the **Parameters** page, the **Coords** page and the **Map** page. The explanations for the softkeys are valid for all three pages. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.



CONT (F1)
To accept the parameters and to continue with the subsequent screen.

PREV (F4)
To decrease the chainage value, down chainage, by the defined chainage interval **<Chainage Inc.:>**.

NEXT (F5)
To increase the chainage value, up chainage, by the defined chainage interval **<Chainage Inc.:>**.

PAGE (F6)
To change to another page on this screen.

SHIFT BOP (F4)
To return the chainage value to the beginning of the project.

SHIFT EOP (F5)
To send the chainage value to the end of project.

Description of fields

Field	Option	Description
<Line Name:>	Output	The name of the selected polyline.
<Strt Chainage:>	Output	The beginning chainage of the line. ☞ The start chainage can be edited from **REFLINE Choose Polyline** with **EDIT (F2)**.
<Length:>	Output	The length of the line.
<End Chainage:>	Output	The chainage of the end of the line.
<Chainage:>	User input	The chainage to be staked initially. Any chainage can be entered.
<Offset:>	User input	The distance to stake off the line. Any value between -2000 m and 2000 m can be entered.
<Vert. Shift:>	User input	To shift the line vertically. The best example of the use of this feature is a situation where all grades of the line are finish grade but the stakes are set referenced to sub-grade.

Field	Option	Description
<Chainage Inc.:>	User input	The interval at which chainages will be staked. Incrementing begins from **<Chainage:>** set above.

Next step

PAGE (F6) changes to the **Coords** page.

REFLINE Stake, Coords page

This page allows to validate the coordinate values of the point to be staked.

Next step

PAGE (F6) changes to the **Maps** page.

REFLINE Stake, Map page

This page allows to visualize the position of the points. Top line shows the current horizontal geometry as well as any horizontal or vertical key points.

Next step

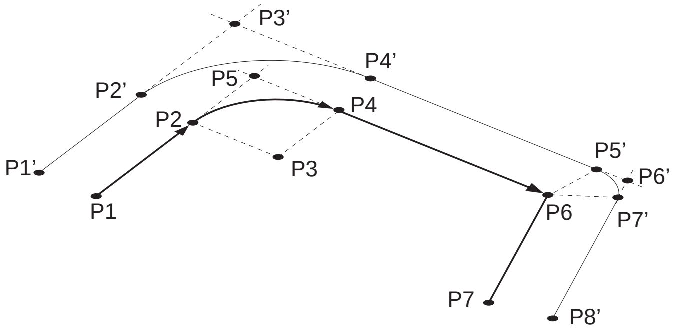
CONT (F1) changes to **REFLINE Stakeout**.

37.8.4 Staking Operation

Description

Once in the Staking screens, the user is guided to reach design positions.

Basic rules for polyline stakeout



P1 BOP - Beginning of project
P2 PC - Beginning of curve
P3 RP - Radius point
P4 PT - End of curve
P5 PI - Point of intersection
P6 AP - Angle point
P7 EOP - End of project
P1' BOP - Beginning of project
P2' PC - Beginning of curve
P3' PI - Point of intersection
P4' PT - End of curve
P5' AP-B - Angle point, back tangent
P6' BP - Bisected point
P7' AP-F - Angle point, forward tangent
P8' EOP - End of project

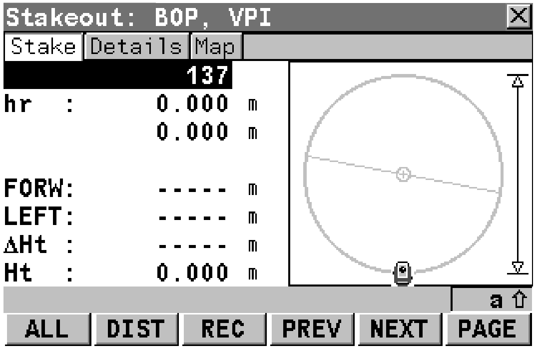
General terms:
Curve - Curve segment
Extension - Line xtension
MCP - Mid curve point
Straight - Straight segment

Access

CONT (F1) in **REFLINE Stake**.

REFLINE Stakeout, Stake page

The explanations for the softkeys given below are valid for all pages.



ALL (F1)
To measure a distance and store distance and angles. Accesses **REFLINE Results**.

DIST (F2)
To measure a distance.

REC (F3)
To store angles and distance. Distance must be measured before.

PREV (F4)
To decrease the chainage value, down chainage, by the defined chainage interval **<Chainage Inc.:>**.

NEXT (F5)
To increase the chainage value, up chainage, by the defined chainage interval **<Chainage Inc.:>**.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure reference line. Refer to "37.3 Configuring Reference Line".

SHIFT POS2D (F3)
To position the telescope (X,Y) onto the point to be staked.

SHIFT POS3D (F4)
To position the telescope (X,Y,Z) onto the point to be staked.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates".

Description of fields

Field	Option	Description
First line on screen	User input	The point ID of the point to be staked. Editable.
<hr:>	User input	The default reflector height as defined in the active configuration set is suggested.
Third line on screen	User input	The current chainage to be staked. Editable.
<FORW:>	Output	The horizontal distance along the line defined by station and reflector from the current position to the point to be staked. ↓ or ↑ to move towards the station depending on the selection for **<Visual Guides:>** in **REFLINE Configuration**, **General** page.

Field	Option	Description
<BACK:>	Output	The horizontal distance in reverse direction from the line defined by station and reflector from the current position to the point to be staked. ↑ or ↓ to move away from the station depending on the selection for **<Visual Guides:>** in **REFLINE Configuration**, **General** page.
<RGHT:>	Output	The direction depends on **<Stake Mode:>** in **REFLINE Configuration**, **General** page. The horizontal distance orthogonal to the right of the line defined by station and reflector from the current position to the point to be staked. → to move to the right of the line defined in **<Visual Guides:>**, ← to move to the left of the line defined in **<Visual Guides:>**.
<LEFT:>	Output	The direction depends on **<Stake Mode:>** in **REFLINE Configuration**, **General** page. The horizontal distance from the current position to the point to be staked orthogonal to the left of the line defined by station and reflector. ← to move to the left of the line defined in **<Visual Guides:>**, → to move to the right of the line defined in **<Visual Guides:>**.

Field	Option	Description
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked. Move down.
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked. Move up.
<ΔHt:>	Output	Displays the difference between the height of the current position and the height to be staked.
<Ht:>	Output	The orthometric height of the current position is displayed.

Next step

PAGE (F6) changes to the **Details** page.

REFLINE Stakeout, Details page

This page shows a live version of more information regarding the staked point.

Description of fields

Field	Option	Description
<Design Sta:>	User input	Current chainage to be staked. Editable.
<Design Offset:>	User input	Current offset being staked. Editable.
<Design Ht:>	User input	The design height, which is the orthometric height of the point to be staked, is displayed.

Next step

PAGE (F6) changes to the **Map** page.

REFLINE Stakeout, Map page

The **Map** page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

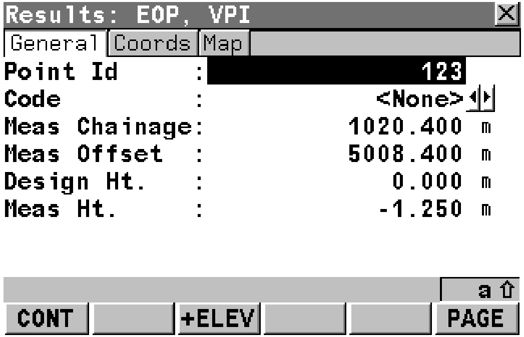
ALL (F1) changes to **REFLINE Results**.

37.8.5 Results of Stakeout

Access

ALL (F1) in **REFLINE Stakeout**.

REFLINE Results, General page



CONT (F1)
To return to **REFLINE Stakeout**.

+ELEV (F3)
To add a vertical offset to the design height and to display the new height.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Point ID:>	Output	The point ID of the point staked.
<Code:>	User input	**With codelist:** Select a code from the choicelist. Only point codes are available for selection. **<None>** to store a point without code or to perform Linework without coding.

Field	Option	Description
		Without codelist: Type in a code. **-----** to store a point without code or to perform Linework without coding.
<Meas Chainage:>	Output	The chainage measured at the staked point.
<Meas Offset:>	Output	The offset from the polyline measured at the staked point.
<Design Ht:>	Output	Allows input of the design height of the target point. The suggested value for the **<Design Ht:>** is as configured in the **<Heights:>** field in **REFLINE Configuration, Heights** page.
<Meas Ht:>	Output	The height measured at the staked point.

Next step
PAGE (F6) changes to the **Coords** page.

REFLINE Results, Coords page

This page displays the design coordinates as well as the differences between design and measured coordinates.

Next step
PAGE (F6) changes to the **Map** page.

REFLINE Results, Map page

The Map page provides an interactive display of the data.
Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step
PAGE (F6) changes to the first page on this screen.

---

38 Reference Plane & Face Scan

38.1 Overview

Description

The Reference Plane & Face Scan application program can be used to measure points relative to a reference plane. A reference plane can also be scanned via Face Scan.

Reference plane tasks

The Reference Plane & Face Scan application program can be used for the following tasks:

- Measuring points to calculate and store the perpendicular distance to the plane.
- Viewing and storing the instrument and/or local coordinates of the measured points.
- Viewing and storing the height difference from the measured points to the plane.
- Scanning a defined area.

☞ Face scan is available for motorised instruments with reflectorless EDM.

☞ Planes can only be computed with grid coordinates.

Activating the application program

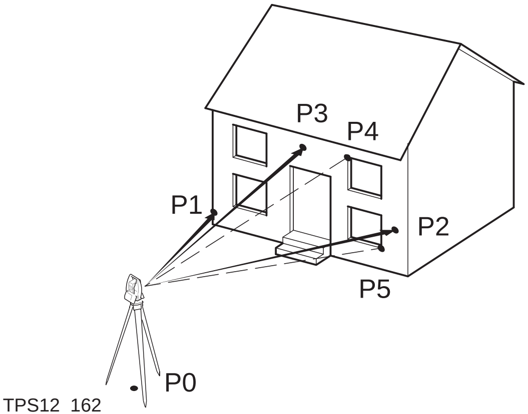
The Reference Plane application program must be activated via a licence key. Refer to "26 Tools...\Licence Keys" for information on how to activate the application program.

Properties of measured points

The properties stored with measured points are:

Type	Reference Plane	Face Scan
Class	**MEAS**	**MEAS**
Sub class	**TPS**	**TPS**
Source	**Ref Plane (Meas)** or **Ref Plane (Face Scan Meas)**	**Face Scan**
Instrument source	**TPS**	**TPS**

Defining a reference plane



P0 Instrument station
P1 Point defining reference plane
P2 Point defining reference plane
P3 Point defining reference plane
P4 Measured point
P5 Measured point

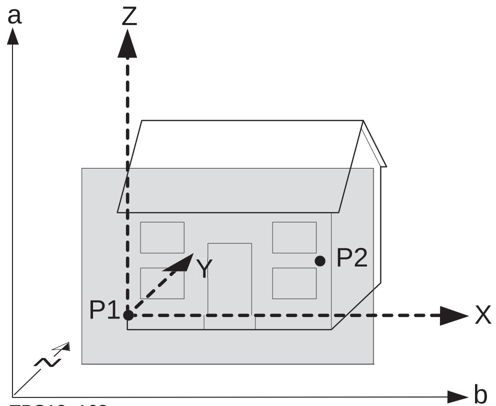
Reference planes are created using a right hand system. For two points defining a plane a vertical plane is used. A reference plane is defined with the X axis and the Z axis of the plane. The Y axis of the plane defines the positive direction of the Y axis. A reference plane can be defined in the following ways.

- vertical
- tilted

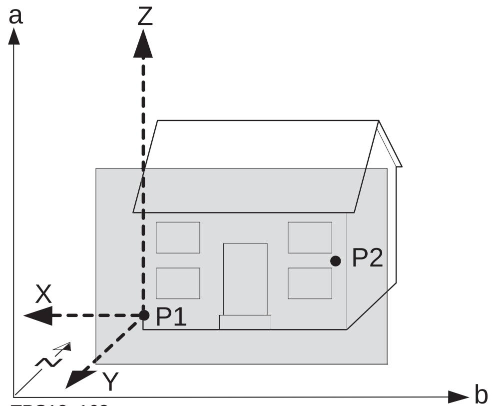
Vertical plane

The axis of the vertical reference plane are:

X axis:	Horizontal and parallel to the plane; X axis starts in point defined as origin point
Z axis:	Parallel to the instrument zenith and parallel to the plane
Y axis:	Perpendicular to the plane; increases in the direction as defined
☞	Offsets are applied in the direction of the Y axis.



TPS12_163



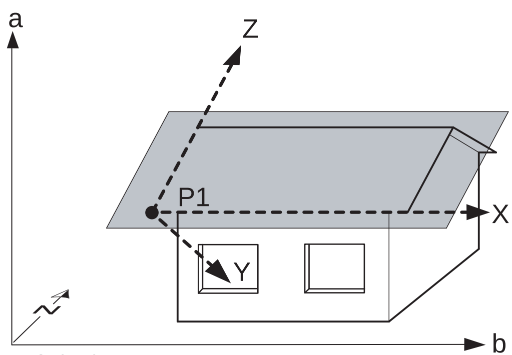
TPS12_163a

a	Height	a	Height
b	Easting	b	Easting
N	Northing	N	Northing
P1	Origin of plane	P1	Origin of plane
P2	Point of plane	P2	Point of plane
X	X axis of plane	X	X axis of plane
Y	Y axis of plane	Y	Y axis of plane
Z	Z axis of plane	Z	Z axis of plane

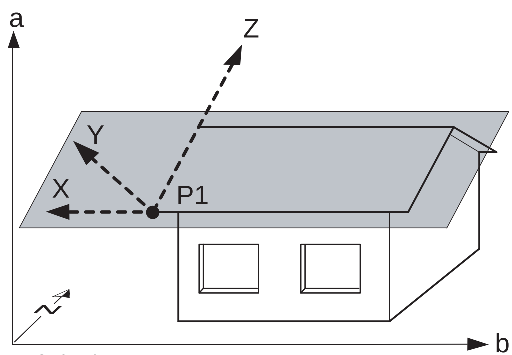
Tilted plane

Any number of points define the plane, perimeter to be scanned is defined by a bottom left-topright window. The axis of the tilted reference plane are:

X axis:	Horizontal and parallel to the plane
Z axis:	Defined by steepest direction of the plane
Y axis:	Perpendicular to the plane; increases in the direction as defined
☞	Offsets are applied in the direction of the Y axis.



TPS12_165



TPS12_165a

a	Height	a	Height
b	Easting	b	Easting
N	Northing	N	Northing
P1	Origin of plane	P1	Origin of plane
X	X axis of plane	X	X axis of plane
Y	Y axis of plane	Y	Y axis of plane
Z	Z axis of plane	Z	Z axis of plane

☞ With four or more points a least squares adjustment is calculated resulting in a best fit plane.

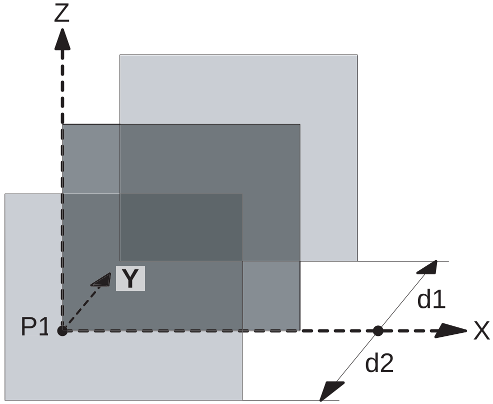
Origin

The origin of the reference plane can be defined to be in the plane coordinates or in the instrument coordinates.

Positive direction of plane

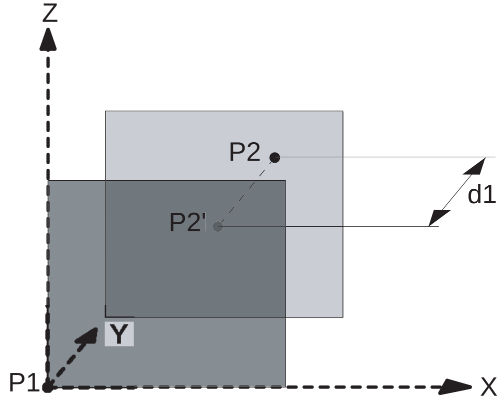
The positive direction of the plane is defined by the direction of the Y axis. The direction can be changed by selecting a point which defines the negative direction of the Y axis.

Offset of the plane



TPS12_164

P1 Origin of plane
X X axis of plane
Y Y axis of plane
Z Z axis of plane
d1 Positive offset
d2 Negative offset



TPS12_164a

P1 Origin of plane
P2 Point defining offset of plane
P2’ P2 projected on original plane
d1 Offset defined by P2
X X axis of plane
Y Y axis of plane
Z Z axis of plane

38.2 Accessing Reference Plane

Access

Select **Main Menu: Programs...\Reference Plane**.

OR

Press **PROG**. Highlight **Reference Plane**. **CONT (F1)**. Refer to "31.2 Accessing the Programs Menu" for information on the **PROG** key.

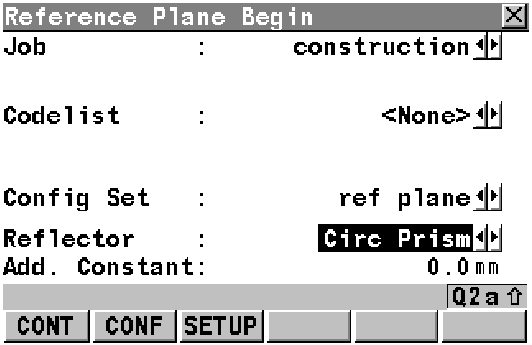
OR

Press a hot key configured to access the screen **REFPLANE Reference Plane Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

REFPLANE Reference Plane Begin



CONT (F1)
To confirm the selections and to continue with the subsequent screen.

CONF (F2)
To configure the Reference Plane application program. Refer to "38.3 Configuring Reference Plane".

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Reference Plane application program	THEN
is to be accessed	**CONT (F1)** accepts the changes and accesses the Reference Plane application program.
is to be configured	**CONF (F2)**. Refer to "38.3 Configuring Reference Plane".

38.3 Configuring Reference Plane

Description

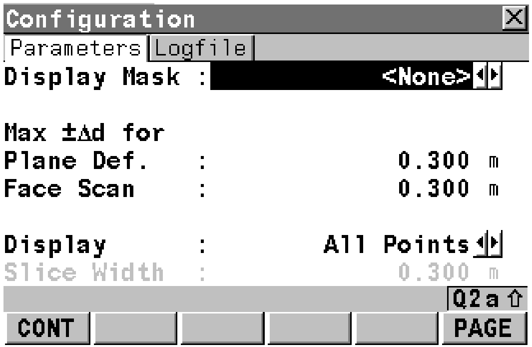
Allows options to be set which are used within the Reference Plane application program. These settings are stored within the configuation set.

Access step-by-step

Step	Description
1.	Refer to "38.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.
2.	**CONF (F2)** to access **REFPLANE Configuration**.

REFPLANE Configuration, Parameters page

This screen consists of the **Parameters** page and the **Logfile** page.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
To edit and display mask currently being displayed. Accesses **CONFIGURE Define Display Mask n**. Available when **<Display Mask:>** is highlighted on **Parameters** page. Refer to "15.2 Display Settings".

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)

To display information about the application program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask is shown in **REFPLANE Measure Points to Plane**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.
<Max ±Δd for Plane Def.:>	User input	The maximum perpendicuar deviation of a point from the calculated plane.
<Face Scan:>	User input	The maximum perpendicular deviation of a measured point in face scan from defined plane. Scanned points outside the defined limit are not stored.
<Display:>		This parameter defines the points displayed in the Plot and Map page views of the Reference Plane application program in the plan view.
	All Points	**<Display: All Points>** displays all points in the plan view.

Field	Option	Description
	Points in Slice	**<Display: Points in Slice>** displays points whithin the defined **<Slice Width:>** in the plan view.
<Slice Width:>	User input	Available for **<Display: Points in Slice>**. This parameter defines the distance from the plane in which points are displayed. This distance is applied to both sides of the plane. If lines and areas are to be displayed in a particular Map page, then parts of lines and areas falling within the defined slice are also displayed.

Next step

PAGE (F6) changes to the **Logfile** page. Refer to paragraph "REFPLANE Configuration, Logfile page"

REFPLANE Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is genereated using the selected **<Format File:>**.

Field	Option	Description
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

CONT (F1) returns to the screen from where this screen was accessed.

38.4 Managing Reference Planes

Description

A reference plane is used to measure points relative to the plane or to scan the plane.

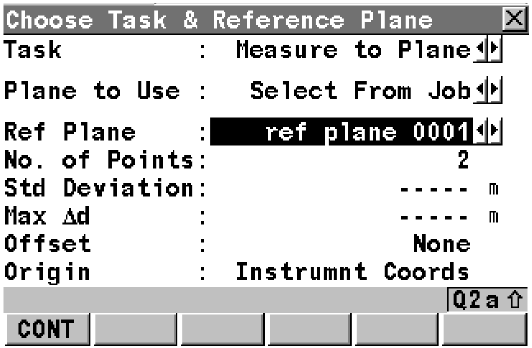
Measure to plane

- Reference planes can be created, edited, stored and deleted in the active job.
- The reference planes can be recalled for later use.
- The plane can be shifted through a point or a defined offset.

Scan a plane

<Task: Scan> in **REFPLANE Choose Task & Reference Plane** to scan the selected plane with the defined grid.

REFPLANE Choose Task & Reference Plane



CONT (F1)
To accept changes and to continue with the subsequent screen.

SHIFT CONF (F2)
To configure the reference plane. Refer to "38.3 Configuring Reference Plane".

Description of fields

Field	Option	Description
<Task:>	**Measure to Plane**	The coordinates of measured points are calculated relative to the reference plane.
	Scan	Measures a sequence of points along a vertical, tilted or horizontal face.
<Plane to Use:>	**Create New Plane**	Defines a new reference plane.
	Select From Job	Reference plane is selected in **<Ref Plane:>**.
<Ref Plane:>	Choicelist	Available for **<Plane to Use: Select From Job>**. The reference plane to be used. Accesses **REFPLANE Manage Reference Planes**.
<No. of Points:>	Output	Available for **<Plane to Use: Select From Job>**. Number of points used for plane definition for the plane shown in the **<Ref Plane:>**.
<Std Deviation:>	Output	Standard deviation of used points for plane definition. ----- is displayed for less than four points.
<Max Δd:>	Output	Maximum distance between a point and the calculated plane. ----- is displayed for less than four points.

Field	Option	Description
<Offset:>	Output	The offset method used as defined in **REFPLANE XX Reference Plane, Offset** page.
<Origin:>	Output	The origin method used as defined in **REFPLANE XX Reference Plane, Origin** page.

Next step

IF	THEN
a new plane is to be created	**CONT (F1)** accesses **REFPLANE New Reference Plane, General** page. Refer to paragraph "Create reference plane step-by-step".
points are to be measured to a plane	**CONT (F1)** accessses **REFPLANE Measure Points to Plane, Reference** page. Refer to "38.5 Measuring Points to a Reference Plane".
a plane is to be scanned	**CONT (F1)** accesses **REFPLANE Define Scanning Parameters**. Refer to "38.6 Scanning a Plane".

Create reference plane step-by-step

Step	Description	Refer to chapter
1.	Refer to "38.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.	
2.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.	
3.	**REFPLANE Choose Task & Reference Plane** Select **<Plane to Use: Create New Plane>**.	
4.	**CONT (F1)** to access **REFPLANE New Reference Plane, General** page. ☞ **NEW (F2)** in **REFPLANE Manage Reference Planes** to access **REFPLANE New Reference Plane, General** page.	
5.	**REFPLANE New Reference Plane, General** page **<Ref Plane:>** The ID of the new reference plane. **<No. of Points:>** Number of points used for plane definition. **<Std Deviation:>** Standard deviation of used points for plane definition. ----- is displayed unless more than four points are used to define the plane. **<Max Δd:>** Maximum distance between measured point and defined plane. ----- is displayed unless more than four points are used to define the plane.	
6.	**PAGE (F6)** to change to the **Points** page.	

Step	Description	Refer to chapter
7.	**REFPLANE New Reference Plane, Points** page. An * is shown to the right of the point for a point which will be used as origin of the plane. An **!** is shown to the left of the point if the point is outside maximum distance between a point and the calculated plane as defined in **REFPLANE Configuration**, **Parameters** page. The column **Δd(m)** displays the perpendicular distance of the point from the definition of the plane.	
☞	**ADD (F2)** to add points from **REFPLANE Data: Job Name** to define the reference plane.	
☞	**USE (F3)** to change between **Yes** and **No** for the highlighted point.	
☞	**DEL (F4)** to remove the highlighted point from the list.	
☞	**SURVY (F5)** to measure a point to be used for the plane. ☞ **DONE (F4)** to return to **REFPLANE New Reference Plane**.	
☞	**SHIFT ORIGN (F4)** to use the highlighted point as the origin of the plane.	
8.	**PAGE (F6)** to change to the **Origin** page.	
9.	**REFPLANE New Reference Plane, Origin** page.	

Step	Description	Refer to chapter
	<Use As Origin: Plane Coords> Point results are additionally stored with X, Y, Z coordinates based on the local plane coordinate system. **<Use As Origin: Instrumnt Coords>** Points on the plane have instrument coordinates. **<X-coord:>** Available for **<Use As Origin: Plane Coords>**. Enter local X coordinate of origin. The origin is defined as the projection of the measured point onto the calculated plane. **<Z-coord:>** Available for **<Use As Origin: Plane Coords>**. Enter local Z coordinate of origin. The origin is defined as the projection of the measured point onto the calculated plane. **<Point:>** Defines the positive direction of the Y axis.	
☞	**DIREC (F5)** Available for **<Point:>** being hightlighted. To access **REFPLANE Survey: XX**. Measure a point to define the positive plane direction.	
10.	**PAGE (F6)** to change to the **Offset** page.	
11.	**REFPLANE New Reference Plane, Offset** page **<Define Offset:>** An offset can be defined by a point or a distance. The defined plane is shifted along the Y axis by the offset.	

Step	Description	Refer to chapter
	<Offset PtID:> Available for **<Define Offset: By Point ID>**. Point ID of offset point. **<Offset:>** Distance by which to offset the plane along the Y axis. For **<Define Offset: By Distance>** the distance can be entered. For **<Define Offset: By Point ID>** the calculated distance to the adjusted plane is displayed. **<Offset:----->** if no values are available.	
	OFSET (F5) Available for **<Offset PtID:>** being high-lighted. To access **REFPLANE Survey: XX, Survey** page. Measure a point to define the offset point.	
12.	**PAGE (F6)** to change to the **Plot** page.	
13.	**REFPLANE New Reference Plane, Plot** page Points displayed depend on the settings in **REFPLANE Configuration, Parameters** page. Points defining the plane are displayed in black, the other points are displayed in grey.	38.3
	SHIFT FACE (F1) to access the face view of the plane. **SHIFT PLAN (F1)** to access the plan view of the plane.	
14.	**STORE (F1)** to compute and store the reference plane.	

Edit a reference plane step-by-step

Step	Description
1.	Refer to "38.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.
2.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.
3.	**REFPLANE Choose Task & Reference Plane** Select **<Plane to Use: Select From Job>**. Highlight **<Ref Plane:>**
4.	**ENTER** to access **REFPLANE Manage Reference Planes**.
5.	**REFPLANE Manage Reference Planes** **EDIT (F3)** to access **REFPLANE Edit Reference Plane, General** page.
6.	**REFPLANE Edit Reference Plane, General** page Continue with Step 5. from paragraph "Create reference plane step-by-step".

Select a reference plane from the job step-by-step

Step	Description
1.	Refer to "38.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.
2.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.
3.	**REFPLANE Choose Task & Reference Plane** Select **<Plane to Use: Select From Job>**.
4.	Highlight **<Ref Plane:>**

Step	Description
5.	**ENTER** to access **REFPLANE Manage Reference Planes**.
6.	**REFPLANE Manage Reference Planes** Select a reference plane.
☞	**MORE (F5)** displays information about date and time of when the reference plane was created and the number of points defining the plane.
7.	**CONT (F1)** to access **REFPLANE Measure Points to Plane, Reference** page.

38.5 Measuring Points to a Reference Plane

Measure points to plane step-by-step

Step	Description
1.	Refer to "38.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.
2.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.
3.	**REFPLANE Choose Task & Reference Plane** Select a reference plane. Refer to paragraph "Select a reference plane from the job step-by-step".
4.	**CONT (F1)** to access **REFPLANE Measure Points to Plane, Reference** page.
5.	**REFPLANE Measure Points to Plane, Reference** page **<Offset ΔPer d:>** The perpendicular distance between measured point and adjusted plane. **<Offset ΔHt:>** The vertical distance between measured point and adjusted plane. For **<Use As Origin: Plane Coords>** **<X Coordinate:>**, **<Y Coordinate:>** and **<Z Coordinate:>** are displayed. For **<Use As Origin: Instrumnt Coords>** **<Easting:>**, **<Northing:>** and **<Height:>** are displayed.
☞	**CMPR (F4)** to calculate offsets to previously measured points.

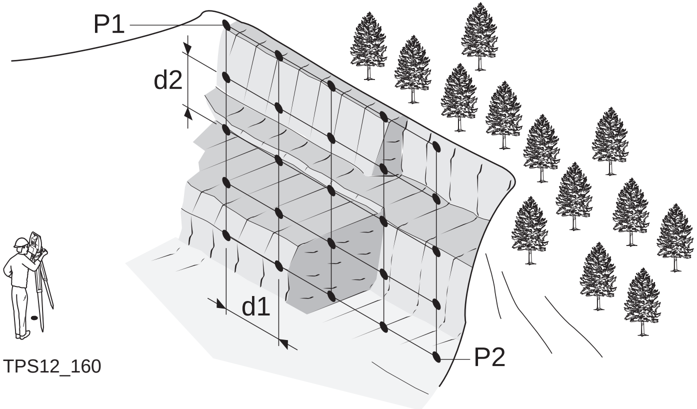
Step	Description
	☞ **STORE (F1)** to store the results for the point currently being displayed. ☞ **DONE (F4)** to return to **REFPLANE Measure Points to Plane, Reference** page.
☞	**PLANE (F5)** to edit the selected reference plane.
☞	**SHIFT INDIV (F5)** for an individual point ID independent of the ID template. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template.
6.	**PAGE (F6)** to change to the **Map** page.
7.	**REFPLANE Measure Points to Plane, Map** page.
☞	**SHIFT FACE (F1)** to access the face view of the plane. ☞ **SHIFT PLAN (F1)** to access the plan view of the plane.
8.	**ALL (F1)** to measure points on the plane.

38.6 Scanning a Plane

Description

Face Scan automates the process of measuring a sequence of points along the defined vertical, tilted or horizontal face. The boundaries of the window of interest and the interval values for vertical and horizontal grid are defined by the user.

Diagram



TPS12_160

Known

P1 First corner of plane
P2 Second corner of plane
d1 **<Horizontal:>** grid spacing
d2 **<Up Slope:>** grid spacing

Unknown

Grid point coordinates

Scan a new plane step-by-step

Step	Description	Refer to chapter
1.	Refer to "38.2 Accessing Reference Plane" to access **REFPLANE Reference Plane Begin**.	
2.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.	
	SHIFT CONF (F2) to access **REFPLANE Configuration, Parameters** page.	38.3
3.	**REFPLANE Choose Task & Reference Plane** **<Task: Scan>** **<Plane to Use: Create New Plane>**	
4.	**CONT (F1)** to access **REFPLANE New Reference Plane**	
5.	**REFPLANE New Reference Plane** Define new reference plane. Refer to paragraph "Create reference plane step-by-step".	
6.	**STORE (F1)** to store the new reference plane.	
7.	Define the first and second corner of the area to be scanned.	
8.	**REFPLANE Define Scanning Parameters** For tilted and vertical planes: **<Horizontal:>** Horizontal grid distance. **<Up Slope:>** Up slope grid distance. **<Pt ID Inc:>** The incrementation used for **<Start Pt ID:>**. No point ID template used.	

Step	Description	Refer to chapter
	• For **<Start Pt ID: RMS>** and **<Pt ID Inc: 10>** the points are **<Point ID: RMS>**, **<Point ID: RMS10>**, **<Point ID: RMS20>**, ..., **<Point ID: RMS100>**, ... • For **<Start Pt ID: 100>** and **<Pt ID Inc: 10>** the points are **<Point ID: 100>**, **<Point ID: 110>**, ..., **<Point ID: 200>**, **<Point ID: 210>**, ... • For **<Start Pt ID: abcdefghijklmn89>** and **<Pt ID Inc: 10>** the points are **<Point ID: abcdefghijklmn99>**, point ID incrementing fails. **<Scan Area:>** Size of the area to be scanned. **<Estimated Pts:>** Estimated number of points to be scanned.	
9.	**START (F1)** to access **REFPLANE Scanning Status, Scanning** page.	
	PAUSE (F3) to pause the scanning of points. **SCAN (F3)** to continue scanning.	
	STOP (F1) to stop the scanning of points.	
10.	**REFPLANE Scanning Status, Scanning** page Status of the scanning is displayed when under process. **<Pts Scanned:>** Number of points being scanned. **<Pts Remaining:>** Number of points remaining to be scanned.	

Step	Description	Refer to chapter
	<Pts Rejected:> Number of skipped points. **<% Completed:>** Percentage of points scanned. **<Time Left:>** Estimated time remaining until scan is finished. **<Point ID:>** Point ID of last stored point.	
11.	**PAGE (F6)** to access **REFPLANE Scanning Status, Plot** page	
12.	**REFPLANE Scanning Status, Plot** page Points currently scanned are displayed in black, previously measured points, lines and areas are dispayed in grey.	
☞	**SHIFT FACE (F1)** to access the face view of the plane. ☞ **SHIFT PLAN (F1)** to access the plan view of the plane.	
13.	**CONT (F1)** to access **REFPLANE Choose Task & Reference Plane**.	

39 Sets of Angles

39.1 Overview

Description

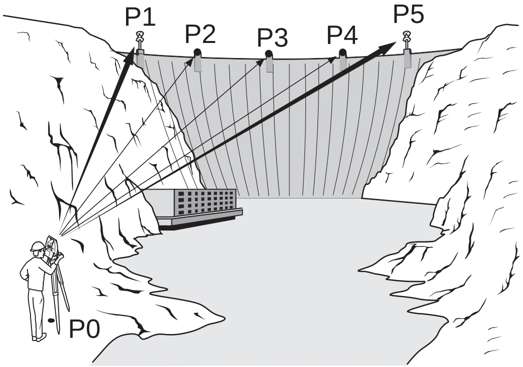
Sets of Angles:

- This program (which can include Monitoring as an option) is used to measure multiple sets of directions and distances (optional) to pre-defined target points in one or two faces.
- The mean direction and mean distance (optional) to each target point, within a set is calculated. The residual for each direction and distance (optional) within a set is also calculated.
- The reduced average direction and average distance (optional) to each target point, for all active sets is calculated.

Monitoring:

- This module can be integrated within the Sets of Angles program.
- With this module, it is possible to use a timer to enable repeated and automated angle and distances measurements to pre-defined target points at defined intervals.

Diagram



Known:

P1 Pre-defined target point - E,N,Height (optional)
P2 Pre-defined target point - E,N,Height (optional)
P3 Pre-defined target point - E,N,Height (optional)
P4 Pre-defined target point - E,N,Height (optional)
P5 Pre-defined target point - E,N,Height (optional)

Unknown:

a) Mean direction and mean distance (optional) to each target point, within a set
b) Mean coordinates (optional) for each target point, for all active sets
c) Residual for each direction and distance (optional), within a set
d) Reduced average direction and average distance (optional) to each target point, for all active sets

Measure at least:

a) Two target points
b) Two sets

Aim360	Aim360 search and Aim360 measurements can be performed to a reflector. After completing the first measurements to each target point, the measurements to the target points in subsequent sets are automated.
Station setup and station orientation	A station set up and station orientation is required before starting the Sets of Angles program, if oriented grid coordinates are to be recorded.
Point properties	The properties stored with Sets of Angles points are: • Class: **MEAS** or **NONE** • Sub class: **TPS** • Source: **Sets of Angles** • Instrument source: **TPS**
Point averaging	An average is never calculated for Sets of Angles points, even if a measured point of class **MEAS** already exists with the same point ID.

39.2 Sets of Angles

39.2.1 Accessing Sets of Angles

Access

Select **Main Menu: Programs...\Sets of Angles**.

OR

Press **PROG**. Highlight **Sets of Angles**. **CONT (F1)**.

Refer to "31.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

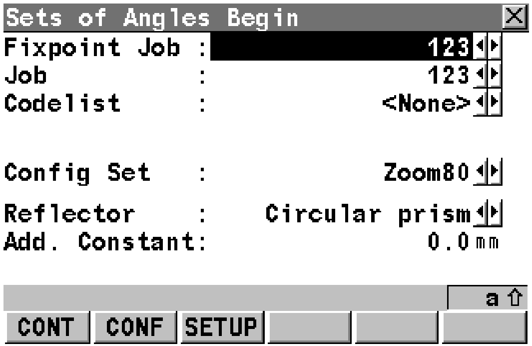
Press a hot key configured to access the screen **SETS Sets of Angles Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

SETS
Sets of Angles Begin



CONT (F1)
To accept changes and access the next screen. The chosen settings become active.

CONF (F2)
To configure the Sets of Angles program. Accesses **SETS Configuration**. Refer to "39.2.2 Configuring Sets of Angles".

SETUP (F3)
To set up the station. Accesses **SETUP Station Setup**.

Description of fields

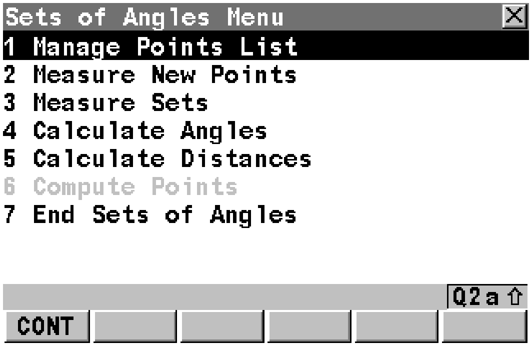
Field	Option	Description
<Fixpoint Job:>	Choicelist	The job where the target points to be observed can be selected and a points list created. All jobs from **Main Menu: Manage...\Jobs** can be selected. The data from this job is shown in **MANAGE Data: Job Name**.
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected. The data from this job is shown in **MANAGE Data: Job Name**.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected job. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.

Field	Option	Description
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts the changes and accesses **SETS Sets of Angles Menu**.

SETS
Sets of Angles Menu



CONT (F1)
To select the highlighted option and to continue with the next screen.

SHIFT CONF (F2)
To configure the Sets of Angles program. Accesses **SETS Configuration**. Refer to "39.2.2 Configuring Sets of Angles".

Description of Sets of Angles Menu options

SETS menu options	Description	Refer to chapter
Manage Points List	To create, edit and manage a points list of the target points for the survey.	39.2.3
Measure New Points	To define the target points and to measure the first set.	39.2.4
Measure Sets	To measure the second set and any further sets.	39.2.5
Calculate Angles	To calculate horizontal/vertical angles and their residuals.	39.2.6
Calculate Distances	To calculate distances and their residuals.	39.2.6
Compute Points	To compute average coordinates using all measurements.	39.2.7
End Sets of Angles	To end the Sets of Angles program.	

Next step

IF the Sets of Angles application program	THEN
is to be accessed	highlight the relevant option and press **CONT (F1)**. Refer to stated chapters above.

IF the Sets of Angles application program	THEN
is to be configured	**CONF (F2)**. Refer to "39.2.2 Configuring Sets of Angles".
is to be ended	highlight **End Sets of Angles** and **CONT (F1)**.

39.2.2 Configuring Sets of Angles

Access

Select **Main Menu: Programs...\Sets of Angles**. **CONT (F1)**. In **SETS Sets of Angles Begin** press **CONF (F2)** to access **SETS Configuration, Parameters** page.

OR

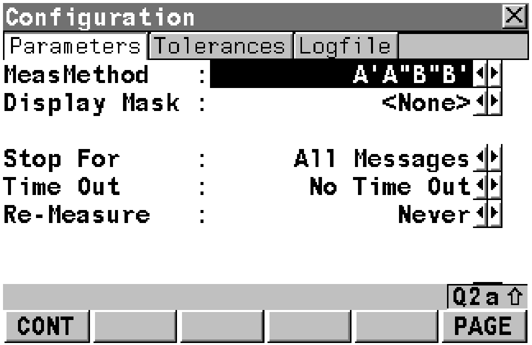
Press **PROG**. Highlight **Sets of Angles**. **CONT (F1)**. In **SETS Sets of Angles Begin** press **CONF (F2)** to access **SETS Configuration, Parameters** page.

OR

Press **SHIFT CONF (F2)** in **SETS Sets of Angles Menu**.

SETS Configuration, Parameters page

This screen consists of the **Parameters** page, the **Tolerances** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DEFLT (F5)
Available for default configuration sets. To recall the default settings.

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<MeasMethod:>		• Determines the order in which the target points are to be measured.
	$A^{I}A^{II}B^{II}B^{I}$	• The target points are measured in face **I** and face **II**. • point A **I** - point A **II** - point B **II** - point B **I** ...
	$A^{I}A^{II}B^{I}B^{II}$	• The target points are measured in face **I** and face **II**. • point A **I** - point A **II** - point B **I** - point B **II** ...
	$A^{I}B^{I}A^{II}B^{II}$	• The target points are measured in face **I** and face **II**. • point A **I** - point B **I**... point A **II** - point B **II** ...
	$A^{I}B^{I}B^{II}A^{II}$	• The target points are measured in face **I** and face **II**. • point A **I** - point B **I** ... point B **II** - point A **II** ...
	$A^{I}B^{I}C^{I}D^{I}$	• The target points are only measured in face **I**. • point A **I** - point B **I** - point C **I** - point D **I** ...

Field	Option	Description
<Display Mask:>	Choicelist	The user defined display mask to be shown in **SETS Select Points - Survey**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.
<Stop For:>	Choicelist	To define what action is taken when a message dialog appears during a measurement set.
	All Messages	All message dialogs are displayed as per normal and are closed as defined by the settings in **<Time Out:>**.
	Tol Exceed Only	Only the message dialog relating to the exceeding of tolerances is displayed and is closed as defined by the settings in **<Time Out:>**.
	Never	• No message dialogs are displayed except for specific warnings. • Specific warnings which affect the instrument and it's ability to continue with the monitoring process will be displayed and will remain on the screen. These include the overheating of the instrument, low battery levels, unavailable space on the CompactFlash card.

Field	Option	Description
<Time Out:>		To define the time delay for the automatic closing of message dialogs during a measurement set. This choicelist is not available when **<Stop For: Never>**.
	No Time Out	There is no automatic closure of message dialogs. When a message dialog appears, it is only closed by pressing **YES (F4)**.
	1 sec to **60 sec**	All message dialogs are automatically closed as defined by these individual time settings.
<Re-Measure:>	Choicelist	To define the action if a target point cannot be measured.
	Never	The target point is skipped and the next target point in the list is measured.
	Automatic	The measurement to the target point is repeated automatically. ☞ The option for **<Aim Settings:>** is also changed for the repeated measurement. If the option is changed, it is applied to all following sets.
	Manual	The measurement to the target point can be repeated manually or the target point can be skipped.
<Timer Monit.:>		This input field is only available when Monitoring is registered through the licence key.

Field	Option	Description
	Yes	Automatic monitoring of target points is activated.
	No	Automatic monitoring of target points is not activated. The Sets of Angles application will apply.

Next step
PAGE (F6) changes to the **Tolerances** page.

SETS Configuration, Tolerances page

Description of fields

Field	Option	Description
<Use Tolerances:>	**Yes** or **No**	The entered horizontal, vertical and distance tolerances are checked during the measurements to verify accurate pointing and measurements.
<Hz Tolerance:>	User input	Tolerance for horizontal directions.
<V Tolerance:>	User input	Tolerance for vertical directions
<Dist Tolerance:>	User input	Tolerance for distances.

Next step
PAGE (F6) changes to the **Logfile** page.

SETS Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file.

Field	Option	Description
		Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

39.2.3 Managing the Points List

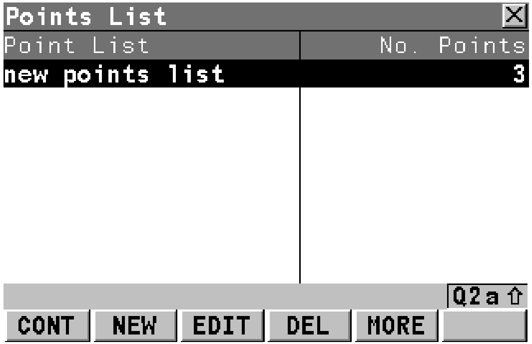
Description

A points list of the target points for the survey can be created, edited and managed. New points are always added from the fixpoint job, as defined in the Sets of Angles Begin screen.

Access

Highlight **Manage Points List** in **SETS Sets of Angles Menu** and **CONT (F1)**.

MANAGE Points List



CONT (F1)
To return to the Sets of Angles Menu.

NEW (F2)
To create a new points list.

EDIT (F3)
To edit an existing points list.

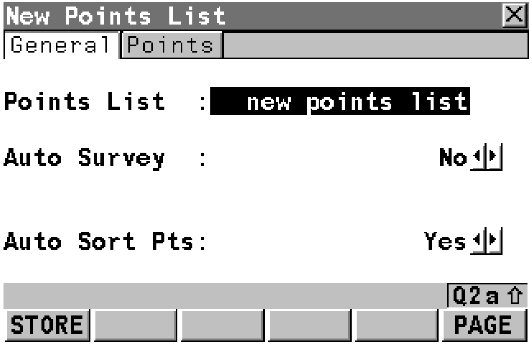
DEL (F4)
To delete an existing points list.

MORE (F5)
To display additional information.

SHIFT HOME (F2)
To move the focus to the top of all the lists.

SHIFT END (F3)
To move the focus to the end of all the lists.

MANAGE
New Points List,
General page

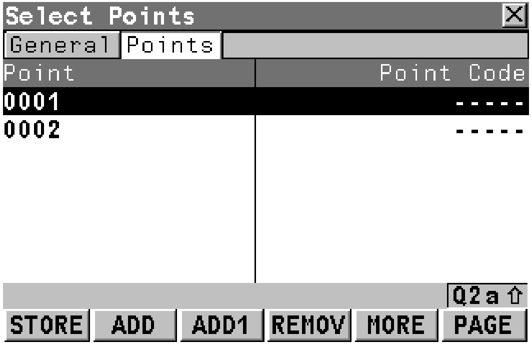


STORE (F1)
To store the new points list.

Description of fields

Field	Option	Description
<Points List:>	User input	The name of the points list.
<Auto Survey:>	**Yes** or **No**	To automatically survey the target points (the instrument will automatically turn and measure the target point).
<Auto Sort Pts:>	**Yes** or **No**	To automatically sort the target points (the instrument will work in a clockwise direction and find the shortest path to move between the target points).

MANAGE Select Points, Points page



STORE (F1)
To store the points to the list.

ADD (F2)
To add points from the fixpoint job to the list.

ADD 1 (F3)
To add one point from the fixpoint job to the list.

REMOV (F4)
To remove the highlighted point from the list. The point itself is not deleted.

MORE (F5)
To display additional information.

39.2.4 Measuring the New Points

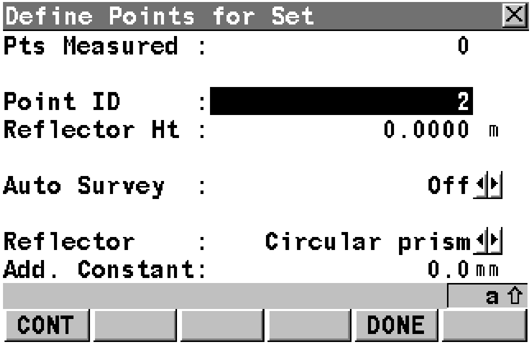
Description

The points to be used for Sets of Angles can be selected and the first set measured. The measurement settings of the first measurement to each point are used for all further sets.

Access

Highlight **Measure New Points** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS Define Points for Set



CONT (F1)
To measure the entered point and to access **SETS Select Points - Survey**.

DONE (F5)
To finish selection of points and access **SETS Sets of Angles Menu** for further steps.

SHIFT GETPT (F4)
To select points stored in the database.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates" for more information on point ID templates.

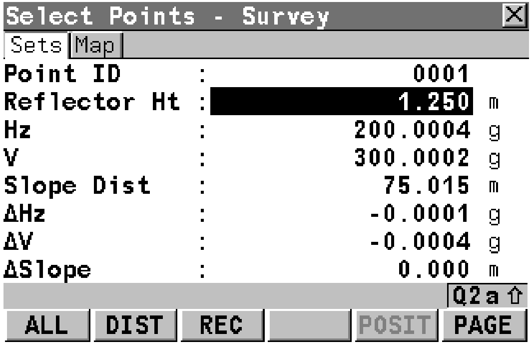
Description of fields

Field	Option	Description
<Auto Survey:>	**On** or **Off**	For instruments with Aim360 and **<Auto Survey: On>** Aim360 search and Aim360 measurements are done to specified targets in additional sets.

Next step

IF points	THEN
are to be meas-ured	**CONT (F1)** to access **SETS Select Points - Survey**.
are to be taken from the database	**SHIFT GETPT (F4)** to access **SETS Data: Job Name**.
are not to be selected	**DONE (F5)** to access **SETS Sets of Angles Menu**.

SETS Select Points - Survey, Sets page



ALL (F1)
To measure and store angles and distance and to return to **SETS Define Points for Set**.

DIST (F2)
To measure a distance.

REC (F3)
To store data and to return to **SETS Define Points for Set**.

POSIT (F5)
To position the instrument to the selected target point.

PAGE (F6)
To change to another page on this screen.

Description of fields
The fields are the same as in **SETS Set XX of XX, Pt XX of XX**.

Next step
ALL (F1) to measure and store and to return to **SETS Define Points for Set**.

Select points step-by-step

The step-by-step description explains how to measure points if **<MeasMethod: $A^{I}B^{I}B^{II}A^{II}$>** and **<Auto Survey: On>** are set.

Step	Description
1.	**SETS Define Points for Set**
2.	Is a point to be selected from the database?

Step	Description
	• If **yes**, continue with step 3. • If **no**, continue with step 5.
3.	**SHIFT GETPT (F4)** to access **SETS Data: Job Name**.
4.	**SETS Data: Job Name** Highlight the desired point and **CONT (F1)** to access **SETS Select Points**. Continue with step 6.
5.	Type in **<Point ID:>** if new or different point ID is required.
6.	**CONT (F1)** to access **SETS Select Points - Survey**.
7.	**SETS Select Points - Survey** **ALL (F1)** to measure and store angles and distance and return to **SETS Define Points For Set**.
8.	Repeat step 2. to step 7. until all points are selected
9.	**DONE (F5)** to end selection of points.

☞ If **<Auto Survey: On>**, instruments with Aim360 automatically measure the selected points in the second face of the first set.

39.2.5 Measuring the Sets

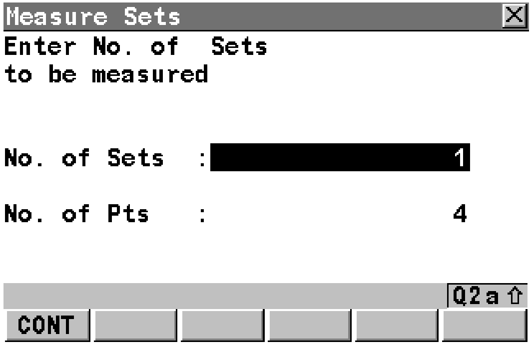
Description

The selected points from **SETS Measure New Points** are used for measuring further sets. The settings of measurements are taken from the first measurement to each target.

Access

Highlight **Measure Sets** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS Measure Sets



CONT (F1)
Opens **SETS Point Measurement - Survey** to measure the points. For **<Auto Survey: On>** measurements are done automatically.

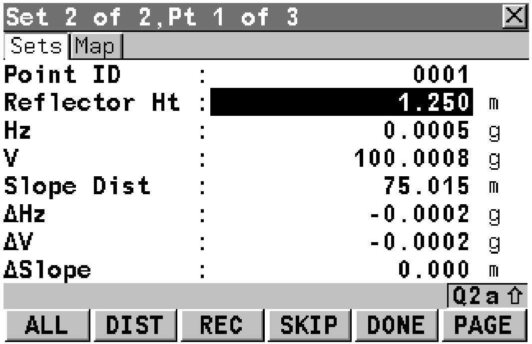
Description of fields

Field	Option	Description
<No. of Sets:>	User input	The number of sets to measure with the target points. There is a maximum of 99 sets allowed.
<No. of Pts:>	Output	The number of target points.

Next step

CONT (F1) to measure further sets of the defined points.

SETS
Set XX of XX,
Pt XX of XX,
Sets page



ALL (F1)
To measure and store angles and distances and to increment to next point.

DIST (F2)
To measure a distance.

REC (F3)
To store data and to increment to next point.

SKIP (F4)
To skip measuring the displayed point and continue with the next point.

DONE (F5)
To end the sets of angles measurements and to return to **SETS Sets of Angles Menu**.

PAGE (F6)
To change to another page on this screen.

SHIFT POSIT (F5)
To position the instrument to the selected target point.

Description of fields

Field	Option	Description
<Δ Hz:>	Output	Difference between the current horizontal angle and the horizontal angle to this target when selected.
<Δ V:>	Output	Difference between the current vertical angle and the horizontal angle to this target when selected.
<Δ Slope:>	Output	Difference between the current slope distance to the target and the slope distance to this target when selected.

Next step

ALL (F1) to measure further sets of the selected points.

☞ Instruments with **<Auto Survey: On>** measure the targets automatically.

Measure sets step-by-step

Step	Description
1.	Refer to " Select points step-by-step" for information on how to select points.
2.	**SETS Measure Sets** **<No. of Sets:>** enter the number of sets to be measured.
3.	**CONT (F1)** to access **SETS Set XX of XX, Pt XX of XX, Sets** page. • motorised instruments measure the targets automatically.

Step	Description
	• non motorised instruments guide to the next point to be measured; follow the instructions given.
4.	**SETS Set XX of XX, Pt XX of XX, Sets** page. **ALL (F1)** to measure and record.
☞	**SKIP (F4)** to skip the measurement of a point. Sets with incomplete measurements are not stored.
5.	Repeat step 4. until all sets are measured.
6.	**DONE (F5)** or automatic after all sets are measured to access **SETS Sets of Angles Menu**. Calculations can be done now.

☞ For the calculation two entire sets must be measured. Horizontal and vertical angles and distances can be calculated individually.

39.2.6 Calculations - Calculating Angles and Distances in Two Faces

Description

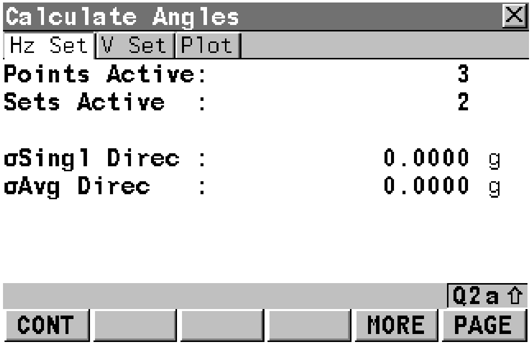
For two and more sets measured with angles and distances in two faces calculations can be done for angles and distances. For sets measured in one face the results can be viewed but no calculations are done. Refer to "39.2.9 Calculations - Viewing Results in One Face" for more information.

Access

Highlight **Calculate Angles** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS Calculate XX, XX Set page

The softkeys are the same for vertical angles, horizontal angles and for distances.



CONT (F1)
To access **SETS Sets of Angles Menu**.

MORE (F5)
To view results of calculation.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Points Active:>	Output	Number of active points which are set to **On** in the **Use** column and used for calculation.

Field	Option	Description
<Sets Active:>	Output	Number of active sets which are set to **On** in the **Use** column and used for calculation.
<σSingl Direc:>	Output	Standard deviation of a single horizontal or vertical direction.
<σSingl Dist:>	Output	Standard deviation of a single distance.
<σAvg Direc:>	Output	Standard deviation of the average horizontal or vertical direction.
<σAvg Dist:>	Output	Standard deviation of the average distance.

Next step

IF	THEN
calculations are to be exited	**CONT (F1)** to access **SETS Sets of Angles Menu**.
results are to be viewed	**MORE (F5)** to access **SETS View XX Results**.

SETS Calculate XX, Plot page

The functionality and softkeys available are described in the MapView chapter. Refer to "30.6 Plot Mode - MapView Screen Area" for information functionality.

39.2.7 Calculations - Calculating Points

Access

Highlight **Compute Points** in **SETS Sets of Angles Menu** and **CONT (F1)**.

SETS
Compute Points,
General page

Description of keys

Key	Description
STORE (F1)	The number of selected points having been measured.
PAGE (F6)	To change to another page on this screen. The functionality and softkeys available are described in the MapView chapter. Refer to "30.6 Plot Mode - MapView Screen Area" for information functionality.
SHIFT QUIT	To exit the application.

Description of fields

Field	Option	Description
<No. of points active:>	Output	The number of selected points having been measured.
<No. of sets active:>	Output	The number of sets having been measured.
<Store points to job:>	Choicelist	The calculated points will be stored in this job. The original points are not copied to this job.

Field	Option	Description
		The working job is selected: If a measurement triplet with the same point ID measured outside the application exists in the job, then the point can be stored with a pre-/suffix or it can be disabled from the calculation. A job other than the working job is selected: The point is stored with calss CTRL. The angles and distances are stored as point results to the point in the database.
<Store Point ID with:>	**Prefix**	Adds the setting for **<Prefix/suffix:>** in front of the original point IDs.
	Suffix	Adds the setting for **<Prefix/suffix:>** at the end of the original point IDs.
<Prefix/suffix: >	User input	The identifier with up to four characters is added in front of or at the end of the ID of the calculated points.

SETS Compute Points, Plot page

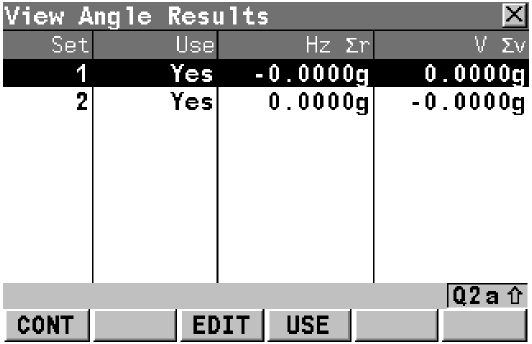
The functionality and softkeys available are described in the MapView chapter. Refer to "30.6 Plot Mode - MapView Screen Area" for information functionality.

39.2.8 Calculations - Viewing Angle and Distance Results in Two Faces

Access

Press **MORE (F5)** in **SETS Calculate Angles or SETS Calculate Distances**

SETS View XX Results



CONT (F1)
To access **SETS Calculate XX**.

EDIT (F3)
To access **SETS View Residuals in Set XX**.

USE (F4)
To set **Yes** or **No** in the **Use** column for the highlighted set.

Description of columns

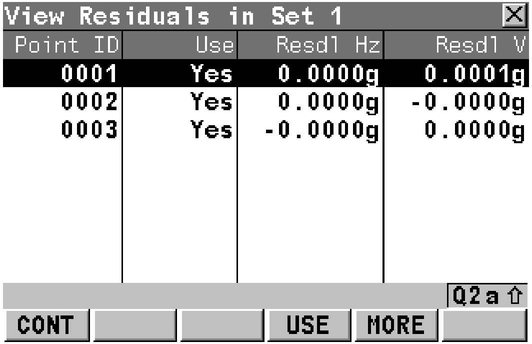
Column	Description
Set	Displays the numbers of all sets measured.
Use	For **Yes**: The selected set is used for calculations. For **No**: The selected set is not used for calculations.
Hz Σr	Shows the calculated Σr in Hz of the selected set. Σr is the sum of the difference between the reduced average direction and each sets directions. For sets not used for calculation ----- is shown.

Column	Description
V Σr	Shows the calculated Σr in V of the selected set. Σr is the sum of the difference between the average V angles and each sets V angles. For sets not used for calculation ----- is shown.

Next step

IF	THEN
results of a single set are to be edited	**EDIT (F3)** to access **SETS View Residuals in Set XX**.
results are to be exited	**CONT (F1)** to access **SETS Calculate XX**.
the setting for use is to be changed	**USE (F4)** to change between **Yes** and **No** for the highlighted set.

SETS
View Residuals in Set XX



CONT (F1)
To access **SETS View XX Results**.

USE (F4)
To set **Yes** or **No** in the **Use** column for the highlighted point.

MORE (F5)
To view additional information.

Description of columns when calculating angles

Column	Description
Point ID	• This column is always visible. • Point ID of the measured points in the order they were defined and measured in **SETS Measure New Points** truncated to six digits from the right.
☞	• The following three columns appear together. By pressing **MORE (F5)** these columns are replaced with other columns.
Use	• For **Yes**: The selected point is used for calculations in all sets. • For **No**: The selected point is not used for calculations in all sets.

Column	Description
Resdl Hz	• Residual in the Hz value of the selected point within the single set.
Resdl V	• Residual in the V value of the selected point within the single set.
☞	• The following two columns appear together. By pressing **MORE (F5)** these columns are replaced with other columns.
Avg Hz	• Reduced Average Hz value of the point in all active sets.
Avg V	• Average V value of the point in all active sets.
☞	• The following two columns appear together. By pressing **MORE (F5)** these columns are replaced with other columns.
Mean Hz	• Mean Hz value of the point within the single set.
Mean V	• Mean V value of the point within the single set.

Description of columns when calculating distances

Column	Description
Point ID	• This column is always visible. • Point ID of the measured points in the order they were defined and measured in **SETS Measure New Points** truncated to six digits from the right.

Column	Description
	• The following three columns appear together. By pressing **MORE (F5)** these columns are replaced with other columns.
Use	• For **Yes**: The selected point is used for calculations in all sets. • For **No**: The selected point is not used for calculations in all sets.
Resdl SD	• Residual in the distance value of the point within the single set.
Avg SD	• Average distance value of the point in all active sets.
	• The following column appears. By pressing **MORE (F5)** this column is replaced with other columns.
Mean SD	• Mean distance value of the point within the single set.

Next step

IF	THEN
additional information is to be viewed	**MORE (F5)** to show additional information.
residuals are to be exited	**CONT (F1)** to access **SETS View XX Results**.

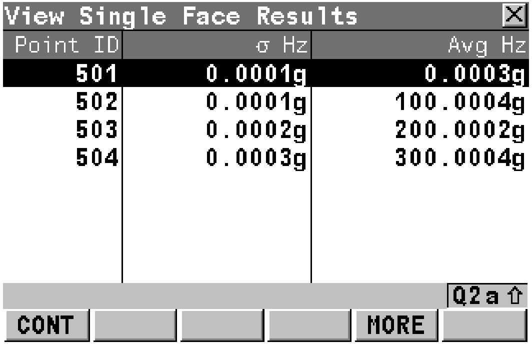
IF	THEN
the setting for use is to be changed	**USE (F4)** to change between **Yes** and **No** for the highlighted point.

39.2.9 Calculations - Viewing Results in One Face

Access

Highlight **Calculate XX** in **SETS Sets of Angles Menu** and press **CONT (F1)**.

SETS
View Single Face Results



CONT (F1)
To access **SETS Sets of Angles Menu**.

MORE (F5)
To view additional columns.

Description of columns

Column	Description
Point ID	Point ID of the measured points in the order they were defined and measured in **SETS Measure New Points** truncated to six digits from the right.
σ Hz	Standard deviation of all Hz readings to the point.
Mean Hz	Mean value of all Hz readings to the current point.
σ V	Standard deviation of all V readings to the current point.
Mean V	Mean value of all V readings to the current point.

Column	Description
σ Dist	Standard deviation of all distance measurements to the current point.
Mean SD	Mean value of all distance measurements to the current point.

Next step

IF	THEN
other columns are to be viewed	**MORE (F5)** to view additional columns.
viewing results is to be exited	**CONT (F1)** to access **SETS Sets of Angles Menu**. Refer to "39.2.1 Accessing Sets of Angles".

39.3 Monitoring

Description

- Monitoring is a module integrated within the Sets of Angles application program.
- Monitoring uses a timer to enable repeated and automated angle and distances measurements to pre-defined target points at defined intervals. The ability to configure the handling of message dialogs during measurement sets is also enabled.

Important aspects

- For monitoring, instruments must be motorised.

Access

- Monitoring is licence protected and is only activated through a licence key. The licence key can be entered manually or loaded from the CompactFlash card.
- Refer to "39.2.1 Accessing Sets of Angles" for details on accessing Monitoring.

Monitoring preparation

- This step-by-step desciption is an example on preparing a set for monitoring.
- Refer to "39.2 Sets of Angles" for a complete description of the Sets of Angles program.

Step	Description
1.	From **Main Menu: Programs...** select **Sets of Angles**.
2.	Press **CONT (F1)** to access the **SETS Sets of Angles Begin** screen.
3.	Set station coordinates and station orientation - **SETUP (F3)**.
4.	Configure Sets of Angles for monitoring - **CONF (F2)**. For the **Parameters** page: • **<MeasMethod: $A^{I}B^{I}B^{II}A^{II}$>** (for example purposes only).

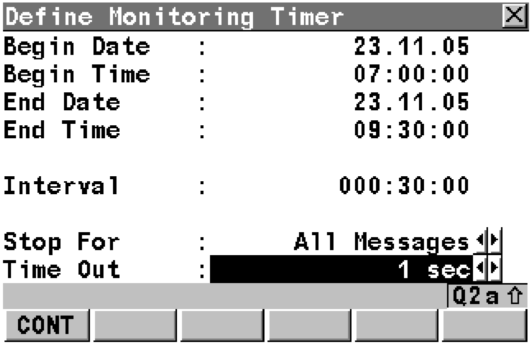
Step	Description
	• **<Display Mask: None>** (for example purposes only). • **<Stop For: All Messages>** (for example purposes only). • **<Time Out: 10 secs>** (for example purposes only). • **<Timer Monit.: Yes>** (this option must be selected for monitoring). This will enable the access to the **SETS Define Monitoring Timer** screen.
5.	Press **CONT (F1)** to access the **SETS Sets of Angles Menu** screen.
6.	Select **Measure New Points**.
7.	Press **CONT (F1)** to access the **SETS Define Points for Set** screen.
8.	Enter details of the target point as required. For each target point, ensure that **<Auto Survey: Yes>** is set. This will enable the automated measurement and recording of the target point in the other face and the automated measurement and recording of all target points during monitoring.
9.	Press **CONT (F1)** to access the **SETS Select Points - Survey** screen.
10.	Measure and record the measurement to the target point as required.
11.	Continue with steps 8. to 10. until all target points for the first measurement set have been measured and recorded.
12.	Press **DONE (F5)** to complete the selection of the target points for the first measurement set in one face and to begin the measurement of the target points in the other face. On completion the **SETS Sets of Angles Menu** screen will be accessed.

Step	Description
13.	Select **Measure Sets**.
14.	Press **CONT (F1)** to access the **SETS Define Monitoring Timer** screen. Refer to "SETS Define Monitoring Timer" for information about the screen.

SETS Define Monitoring Timer

Decription

- This screen enables the entry of dates, times, intervals and the handling of message dialogs during a measurement set. When all required information is entered press **CONT (F1)** to begin the monitoring process.



CONT (F1)
To begin the monitoring process.

Description of fields

- The format of all date and time input fields is defined in **CONFIGURE Units and Formats**.

- The format of the interval input field is hh:mm:ss.

Field	Option	Description
<Begin Date:>	User Input	Start date for monitoring.
<Begin Time:>	User Input	Start time for monitoring.
<End Date:>	User Input	End date for monitoring.
<End Time:>	User Input	End time for monitoring.
<Interval:>	User Input	The time between the start of each scheduled measurement set.
<Stop For:>	Choicelist	• To define what action is taken when a message dialog appears during a measurement set. • The setting for this input field has already been defined in the configuration. Here, it can be changed if required, before starting the monitoring process.
<Time Out:>	Choicelist	• To define the time delay for the automatic closing of message dialogs during a measurement set. This choicelist is not available when **<Stop For: Never>**. • The setting for this input field has already been defined in the configuration. Here, it can be changed if required, before starting the monitoring process.

Monitoring interval

Description

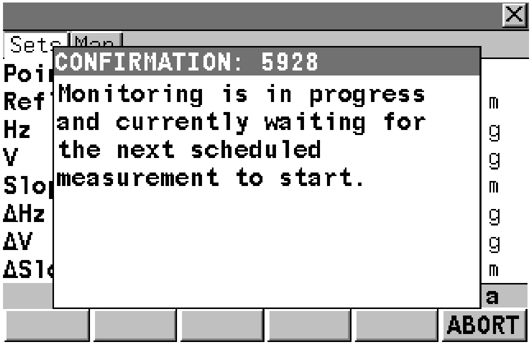
- The times and dates entered define the time frame for the monitoring.
- The time interval defines the starting time for each measurement set which is from **<Begin Time:>** to the next **<Begin Time:>**.

Example

- Data - 3 target points; 4 measure sets; Begin Date: 20.04.2002; Begin Time: 14:00:00; End Date 23.04.2002; End Time 14:00:00; Interval 30 min
- Results - The time taken to measure 4 sets of 3 target points in both faces is 10 minutes. The measurements will start at 14:00:00 on 20.04.2002. At 14:10:00 the first measurement set is complete. The instrument will wait until 14:30:00 for the next scheduled measurement set.

Monitoring in progress

This screen displays a notice that monitoring is in progress.



ABORT (F6)
To stop the monitoring process and return to the **SETS Sets of Angles Menu** screen.

Calculations

Refer to "39.2 Sets of Angles" for information about calculations and the viewing of results.

40 Setup

40.1 Overview

Description

The Setup program is used when setting up a TPS station, to determine the TPS station coordinates and setting the TPS orientation.

Setup methods

- Set Azimuth
- Known Backsight Point
- Orientation & Height Transfer
- Resection
- Resection Helmert
- Local Resection

Each setup method requires different input data and a different number of target points.
All setup methods are described in "40.4 Setup Methods".

Properties of setup points

Type	Station	Target
Class	**REF**	**MEAS** or **NONE**
Sub class	**TPS**	**TPS**
Source	**Setup (setup method)**	**Setup (setup method)**
Instrument source	**TPS**	**TPS**

40.2 Accessing Setup

Access

Select **Main Menu: Programs...\Setup**.

OR

Press **PROG**. Highlight **Setup**. **CONT (F1)**.

Refer to "31.2 Accessing the Programs Menu" for details on the **PROG** key.

OR

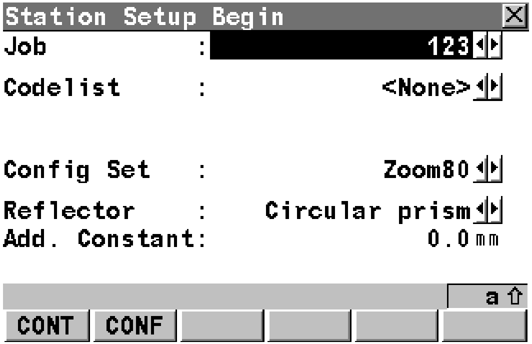
Press **USER** (configuring the User Menu to include the Setup program).

Refer to "2.2 USER Key" for details on the **USER** key.

OR

Press **SETUP (F3)** in the **Begin** screen of another program (other than Setup).

SETUP Station Setup Begin



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure the Setup application program. Accesses **SETUP Configuration**. Refer to "40.3 Configuring Setup".

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected job. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Setup application program	THEN
is to be accessed	**CONT (F1)** to accept the changes and continue.
is to be configured	**CONF (F2)**. Refer to "40.3 Configuring Setup".

40.3 Configuring Setup

Access

Select **Main Menu: Programs...\Setup**.

In SETUP Station Setup Begin press **CONF (F2)** to access **SETUP Configuration**.

OR

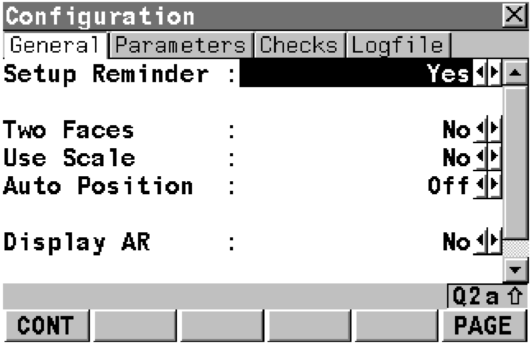
Press **PROG**. Highlight **Setup**. **CONT (F1)**.

In SETUP Station Setup Begin press **CONF (F2)** to access **SETUP Configuration**.

OR

Press **SHIFT CONF (F2)** in **SETUP Station Setup**.

SETUP Configuration, General page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

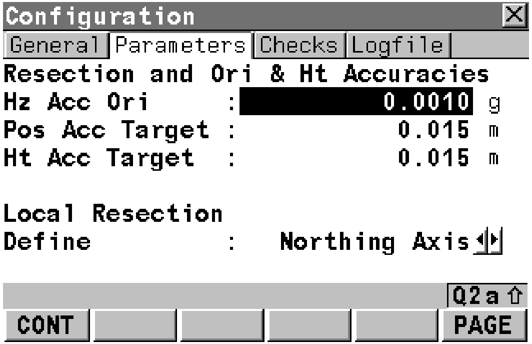
Field	Option	Description
<Setup Reminder:>	Choicelist	Current instrument setup details can be displayed to remind the user to either keep the current instrument setup or to create a new instrument setup. Refer to "40.4.1 Setup Reminder" for details.
	Yes	Whenever **CONT (F1)** is pressed in a **Begin** screen, the current setup information is displayed.
	No	Whenever **CONT (F1)** is pressed in a **Begin** screen, the current setup information is not displayed and the program continues as normal.
<Two Faces:>	Choicelist	Defines if the instrument measures the second face automatically after storing the first.
	Yes	After storing a measurement with **ALL (F1)** or **REC (F3)** motorised instruments change face automatically, non-motorised instruments access **SETUP Telescope Positioning**. The measurements of face I and face II are averaged on the base of face I. The averaged value is stored.
	No	No automatic measurement in two faces.

Field	Option	Description
		☞ For the setup methods **<Method: Set Azimuth>** or **<Method: Known BS Point**> the selected option in the field **<Two Faces:>** is ignored. For these setup methods, measurements are not made in two faces.
<Use Scale:>	Choicelist	The appearance of the **SETUP Results** screen differs with this setting.
	Yes	The calculated scale factor and ppm value from the resection and orientation and height transfer calculation are displayed in the **SETUP Results, Sigma** page. The ppm value may be set in the system as the geometric ppm value. In **SETUP Station Setup** the **<Current Scale:>** is displayed and **PPM (F5)** is available.
	No	The calculated scale factor from the resection calculation is displayed in the **SETUP Results, Sigma** page but cannot be set as the geometric ppm value.
<Auto Position:>	**2D**	Instrument positions horizontally to the point.
	3D	Instrument positions horizontally and vertically to the point.

Field	Option	Description
	Off	Instrument does not position to the point.
<Display AR:>	Choicelist	To set the direction to the backsight point to zero.
	Yes	Sets **<AR: 0.0000>** towards the backsight point. If set in the current display mask, **<AR:>** displays the horizontal angle difference between the backsight point and the measured point. This has no effect on the set orientation.
	No	Does not set a value for **<AR:>**. If the display mask is configured to display **<AR:>** in the Survey application program, the value is identical to the azimuth. ☞ If **<Set Angle Right: Yes>** and more than one backsight point is used, the behaviour is as for **<Set Angle Right: No>**.

Next step
PAGE (F6) changes to the **Parameters** page.

SETUP Configuration, Parameters page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

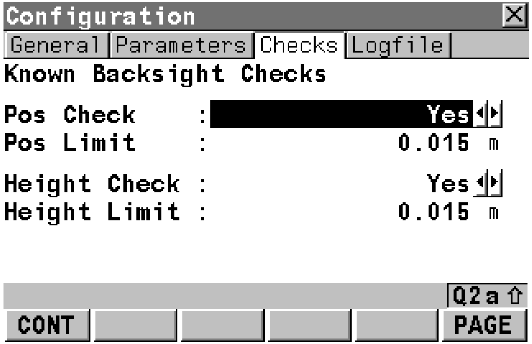
Description of fields

Field	Option	Description
When **<Method: Resections>** or **<Method: Ori & Ht Transfer>**, the following fields apply:		
<Hz Acc Ori:>	User input	For Resection or Orientation and Height Transfer. Limit for the standard deviation of the orientation for resection and orientation and height transfer.
<Pos Acc Target:>	User input	For Resection or Orientation and Height Transfer. Position accuracy of the target point for resection and orientation and height transfer.

Field	Option	Description
<Ht Acc Target:>	User input	For Resection or Orientation and Height Transfer. Height accuracy of the target point for resection and orientation and height transfer.
When **<Method: Local Resection>**, the following fields apply:		
<Define:>	Choicelist	For Local Resection. To define the positive North or positive East axis.
	Northing Axis	The second point measured defines the direction of the positive North axis.
	Easting Axis	The second point measured defines the direction of the positive East axis.
When **<Method: Resection Helmert>**, the following fields apply:		
<Weighting:>	**1/Distance** or **1/Distance** 2	To change the distance weighting that is used in the calculation of the station height in the resection.

Next step
PAGE (F6) changes to the **Checks** page.

SETUP Configuration, Checks page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

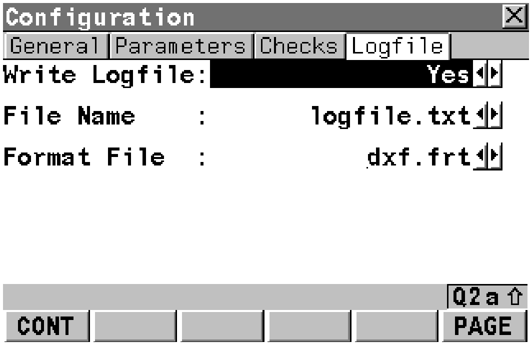
Field	Option	Description
When **<Method: Known BS Point>**, the following fields apply:		
<Pos Check:>	**Yes** or **No**	Allows a check to be made on the horizontal coordinate difference between the existing and the measured known backsight point. If the defined **<Pos Limit:>** is exceeded, the setup can be repeated, skipped or stored.
<Pos Limit:>	User input	Available for **<Pos Check: Yes>**. Sets the maximum horizontal coordinate difference accepted in the position check.

Field	Option	Description
<Height Check:>	**Yes** or **No**	Allows a check to be made on the vertical difference between the existing and the measured known backsight point. If the **<Height Limit:>** is exceeded, the stakeout can be repeated, skipped or stored.
<Height Limit:>	User input	Available for **<Height Check: Yes>**. Sets the maximum vertical difference accepted in the height check.

Next step

PAGE (F6) changes to the **Logfile** page.

SETUP Configuration, Logfile page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **Format Files** where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

40.4 Setup Methods

40.4.1 Setup Reminder

Description

- When activated, the setup reminder function displays a screen which enables the user to check the current station setup details before proceeding with the survey. When this screen appears, three options are available to the user:
  - 1. To keep the current station setup and proceed with the survey.
  - 2. To create a new station setup.
  - 3. To check the backsight point.
- The setup reminder function is available to every application program, except:
  - Alignment Tool Kit
  - Setup

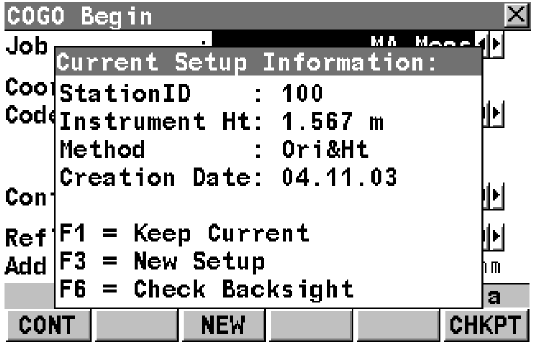
Access

When the setup reminder function is activated (refer to "40.3 Configuring Setup"), the current station setup details are displayed whenever **CONT (F1)** is pressed in a **Begin** screen in an application program.

Setup Reminder screen

Reminder for setup method
- Set Azimuth
- Known BS Point

Reminder for setup method
- Ori & Ht Transfer
- Resection
- Resection Helmert
- Local Resection



Description of softkeys

Softkey	Description
CONT (F1)	To continue with the existing program.
NEW (F3)	To start the Setup program and create a new station setup.
CHKPT (F6)	To open the Check Recorded Pt/Backsight Pt screen.

40.4.2 Set Azimuth

Requirements

- The position coordinates of the station point are required. The instrument is set up and oriented to either a known or unknown target point, to which a true or assumed azimuth is set.

Updating Hz measurements

- A station setup using this setup method is always automatically flagged with an 'update later' attribute. Therefore, all angle measurements taken from that station are always automatically updated.

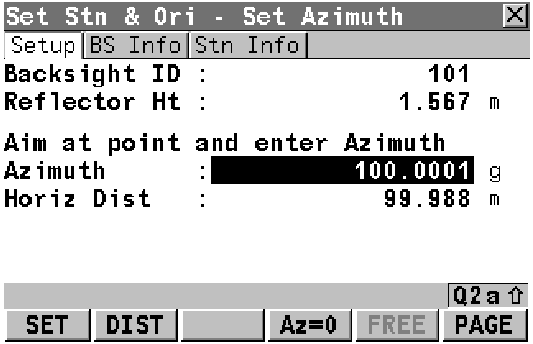
Access step-by-step

- This screen can be accessed from the **SETUP Station Setup** screen or by pressing **SETAZ (F5)** in the **SURVEY Survey** screen. The step-by-step description is for access from the **SETUP Station Setup** screen.
- Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Press **PROG** to access the **Programs** menu.	
2.	Select and activate **Setup** to move to the first screen.	
3.	Press **CONT (F1)** to access **SETUP Station Setup**.	
4.	**<Method:>** Ensure that **Set Azimuth** is selected. **<Station Coord:>** Select the source for the instrument station coordinates. **<Station ID:>** Enter/Select the instrument station. **<Instrument Ht:>** Enter the height of the instrument station.	

Step	Description	Refer to chapter
	<Fixpoint Job:> Select the fixpoint job of the control/target points.	
5.	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in **CONFIGURE TPS Corrections, GeoPPM** page: • if **<Calc Scale: Automatically>**, **<Computd Scale:>** is displayed. • if **<Calc Scale: Manually>**, **<Current Scale:>** is displayed.	16.4
6.	Press **CONT (F1)** to access **SETUP Set Stn & Ori - Set Azimuth**.	

SETUP
Set Stn & Ori -
Set Azimuth,
Setup page



SET (F1)
To set the station and orientation and exit the Setup application program.

DIST (F2)
To measure a distance to the point being used to set the azimuth.
A distance measurement is **NOT** required when setting the Station and the Orientation **SET (F1)**. Checking is **NOT** performed on the distance measurement when setting the Station and the Orientation **SET (F1)**.

Az=0 (F4)
Available on the **Setup** page. To set **<Azimuth: 0>** and running. This value is not set to the system until **SET (F1)** is pressed.

HOLD (F5) or **FREE (F5)**
Available on the **Setup** page and if **<Aim360: Off>**. **HOLD (F5)** freezes the current **<Azimuth:>** value, making it possible to set the **<Azimuth:>** value first, turn the instrument to the desired direction and release the **<Azimuth:>** value using **FREE (F5)**.

PAGE (F6)
To change to another page on this screen.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
Available on the **Setup** page. To change between entering an individual backsight point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates" for more information on point ID templates.

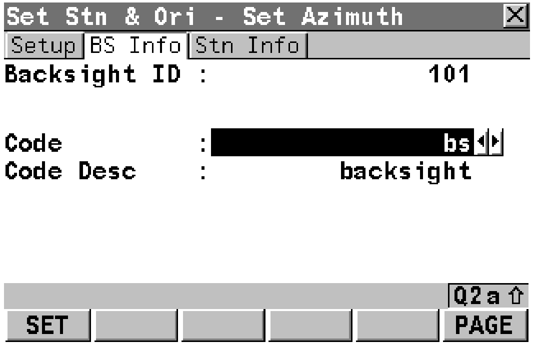
Description of fields

Field	Option	Description
<Backsight ID:>	User input	Point ID of the backsight point according to the point ID template.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Azimuth:>	User input	The current system azimuth value. If a different azimuth is typed in and **ENTER** is pressed or if **Az=0 (F4)** is pressed, this azimuth value is displayed in the field and updated with the telescope movement. The value is not set to the system until **SET (F1)** is pressed.
<Horiz Dist:>	Output	Press **(F2)** to measure a distance to the target point being used to set the azimuth.

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **BS Info** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

SETUP
Set Stn & Ori - Set Azimuth, BS Info page



SET (F1)
To set the station and orientation and exit the Setup application program.

PAGE (F6)
To change to another page on this screen.

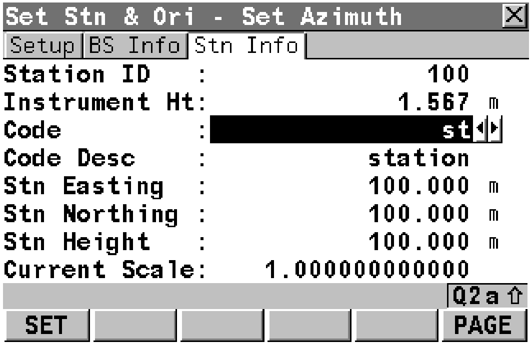
Description of fields

Field	Option	Description
<Backsight ID:>	Output	Backsight ID as entered in **SETUP Station Setup**.
<Code:>	Choicelist	The code for the backsight point.
<Code Desc:>	Output	A short description of the code.

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **Stn Info** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

SETUP
Set Stn & Ori - Set Azimuth, Stn Info page



SET (F1)
To set the station and orientation and exit the Setup application program.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Station ID:>	Output	Station ID as selected in **SETUP Station Setup**.
<Instrument Ht:>	User input	The instrument height.

Field	Option	Description
<Code:>	Choicelist	The code for the station point.
<Code Desc:>	Output	A short description of the code.
<Stn Easting:>	Output	The easting coordinate for the setup station.
<Stn Northing:>	Output	The northing coordinate for the setup station.
<Stn Height:>	Output	The height of the setup station.
<Current Scale:>	Output	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in **CONFIGURE TPS Corrections, GeoPPM** page. Refer to "16.4 TPS Corrections" for details.

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **Setup** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

Set azimuth step-by-step

Application: Set up the instrument over a known point with orientation to a point with known azimuth.

Settings: Set **<Automation: Aim360>** in **CONFIGURE EDM & Aim360 Settings**.

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Access **SETUP Set Stn & Ori - Set Azimuth**.	40.4.2
2.	**SETUP Set Stn & Ori - Set Azimuth, Setup** page **<Azimuth:>** The azimuth to the backsight point. **<Backsight ID:>** The point ID of the backsight point. **<Reflector Ht:>** The current reflector height. Aim at the reflector on the backsight point.	
3.	**SET (F1)** to set the station and orientation and return to **Main Menu**.	

40.4.3 Known Backsight Point

Requirements

- The position coordinates of the station point are required. The instrument is set up and oriented to a known backsight target.

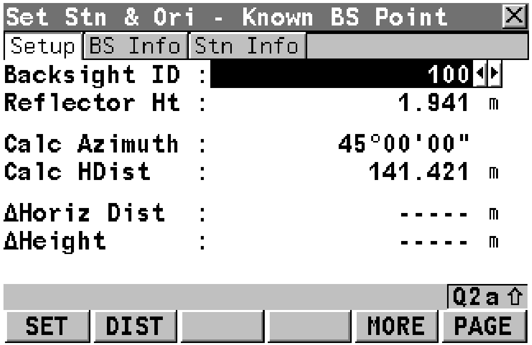
Access step-by-step

Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Press **PROG** to access the **Programs** menu.	
2.	Select and activate **Setup** to move to the first screen.	
3.	Press **CONT (F1)** to access **SETUP Station Setup**.	
4.	**<Method:>** Ensure that **Known BS Point** is selected. **<Station Coord:>** Select the source for the instrument station coordinates. **<Station ID:>** Enter/Select the instrument station. **<Instrument Ht:>** Enter the height of the instrument station. **<Fixpoint Job:>** Select the fixpoint job of the control/target points.	
5.	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in **CONFIGURE TPS Corrections, GeoPPM** page: • if **<Calc Scale: Automatically>**, **<Computd Scale:>** is displayed.	16.4

Step	Description	Refer to chapter
	• if **<Calc Scale: Manually>**, **<Current Scale:>** is displayed.	
6.	Press **CONT (F1)** to access **SETUP Set Stn & Ori - Known BS Point**.	

SETUP
Set Stn & Ori - Known BS Point, Setup page



SET (F1)
To set the station and orientation and exit the Setup application program.

DIST (F2)
To measure the distance to the backsight point.

MORE (F5)
Available on the **Setup** page. Toggles between the displayed values. As default the Δ values for azimuth, horizontal distance and height are shown. If **MORE (F5)** is pressed, the display changes to the measured values of azimuth, horizontal distance and height.

PAGE (F6)
To change to another page on this screen.

Description of fields

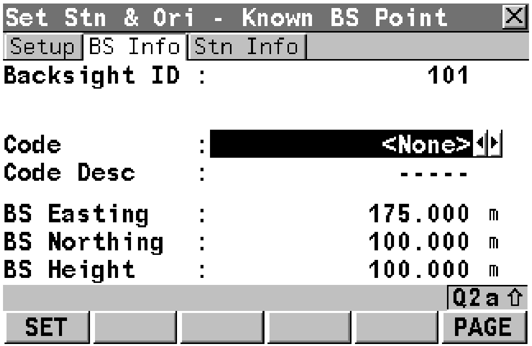
Field	Option	Description
<Backsight ID:>	Choicelist	Backsight point ID. All 3D and 2D points from **<Fixpoint Job:>** can be selected.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Calc Azimuth:>	Output	Displays the calculated azimuth from the selected station to the backsight point.
<Calc HDist:>	Output	Displays the calculated horizontal distance between the selected station and backsight point.
<ΔHoriz Dist:>	Output	The difference between the calculated horizontal distance from station to backsight point and the measured distance.
<ΔHeight:>	Output	The difference between the coordinate height of the backsight point and the measured height of the backsight point. If the backsight point is a 2D point, this field shows -----.
<Horiz Dist:>	Output	Displayed after a distance was measured with **DIST (F2)** and after **MORE (F5)** was pressed. The measured horizontal distance to the backsight point. Shows ----- before **DIST (F2)**.

Field	Option	Description
<Height:>	Output	Displayed after a distance was measured with **DIST (F2)** and after **MORE (F5)** was pressed. The measured height of the backsight point. Shows ----- before **DIST (F2)**

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **BS Info** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

SETUP
Set Stn & Ori - Known BS Point, BS Info page



SET (F1)
To set the station and orientation and exit the Setup application program.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Backsight ID:>	Output	Backsight ID as entered in **SETUP Station Setup**.
<Code:>	Choicelist	The code for the backsight point.
<Code Desc:>	Output	A short description of the code.
<BS Easting:>	Output	The easting coordinate for the backsight point.
<BS Northing:>	Output	The northing coordinate for the backsight point.
<BS Height:>	Output	The height of the backsight point.

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **Stn Info** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

SETUP Set Stn & Ori - Known BS Point, Stn Info page

This screen has the same functionality as **SETUP Set Stn & Ori - Set Azimuth, Stn Info page**. Refer to "40.4.2 Set Azimuth" for further information. Refer to "8.5.3 Editing a Code" for further information on coding.

Next step

IF	THEN
the next page is to be accessed	**PAGE (F6)** changes to the **Setup** page.
the station and orientation is to be set	**SET (F1)** to set the station and orientation.

40.4.4 Orientation and Height Transfer

Requirements

- The position coordinates of the station point are required. The instrument is set up and oriented to one or more known backsight targets.

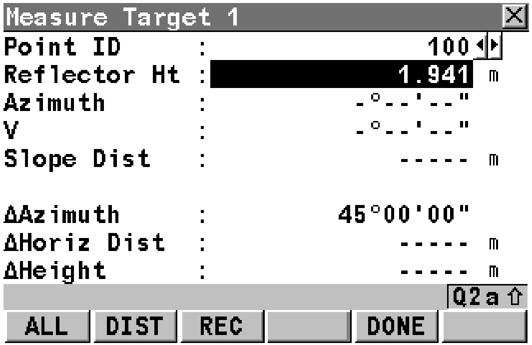
Access step-by-step

Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Press **PROG** to access the **Programs** menu.	
2.	Select and activate **Setup** to move to the first screen.	
3.	Press **CONT (F1)** to access **SETUP Station Setup**.	
4.	**<Method:>** Ensure that **Ori & Ht Transfr** is selected. **<Station Coord:>** Select the source for the instrument station coordinates. **<Station ID:>** Enter/Select the instrument station. **<Instrument Ht:>** Enter the height of the instrument station. **<Fixpoint Job:>** Select the fixpoint job of the control/target points.	
5.	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in **CONFIGURE TPS Corrections, GeoPPM** page: • if **<Calc Scale: Automatically>**, **<Computd Scale:>** is displayed.	16.4

Step	Description	Refer to chapter
	• if **<Calc Scale: Manually>**, **<Current Scale:>** is displayed.	
6.	Press **CONT (F1)** to access **SETUP Measure Target**.	

SETUP Measure Target



ALL (F1)
To measure and store the distances and angles made to the control points. After storing the measurement data to the **<Job:>**, the next **<Point ID:>** in the job is displayed. The instrument positions to the point if enough data is available.

DIST (F2)
To measure and display distances.

REC (F3)
Records displayed values to the current job. A distance measurement is not necessary before pressing **REC (F3)**. After storing the measurement data to the **<Job:>**, the next **<Point ID:>** in the job is displayed. The instrument positions to the point if enough data is available.

CALC (F5)
Available when sufficient data (when two or more points have been measured) is available for calculation. Runs the setup calculation and accesses **SETUP Results**.

SHIFT FIND (F2)
Available once sufficient data is available for calculation. Accesses **SETUP Find Target** to guide the reflector to the selected target point. Refer to "40.6 Finding a Target Point" for information on this screen.

SHIFT POSIT (F4)
Available once sufficient data is available for calculation. To position the instrument to the selected target point.

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	The point ID of the target point to be measured. All points from **<Fixpoint Job:>** can be selected, except class **NONE**.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Azimuth:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.

Field	Option	Description
<Slope Dist:>	Output	The measured slope distance after **DIST (F2)** was pressed.
<ΔAzimuth:>	Output	Displays the difference between the calculated azimuth and the current horizontal angle. If **<Method: Resection>,** displays ----- until sufficient data for calculation is available.
<ΔHoriz Dist:>	Output	The difference between the calculated and the measured horizontal distance.
<ΔHeight:>	Output	The difference between the given and the measured height of the target point.

Next steps

IF	THEN
more target points are to be measured	**ALL (F1)** to measure and store distances and angles, or **REC (F3)** to store the current measurement.
sufficient target points were measured	**CALC (F5)** to access **SETUP Results**. Refer to "40.5 Setup Results" for more information.

☞ A maximum of ten target points can be measured and used for the calculation. When the maximum number of points was measured, the **SETUP Results** screen is accessed automatically after **ALL (F1)**. In the **SETUP Additional Informa-**

tion screen measured target points can be deleted and the **SETUP Measure Target** screen can be reaccessed to measure new target points.

40.4.5 Resection/Resection Helmert

Requirements

The coordinates of the station point are unknown. The coordinates and orientation are determined by sighting to one or more known target points (maximum of ten target points). Only angles or both angles and distances may be measured. For a resection, least squares or robust calculations are used. For a resection Helmert, Helmert calculations are used.

Access step-by-step

Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Press **PROG** to access the **Programs** menu.	
2.	Select and activate **Setup** to move to the first screen.	
3.	Press **CONT (F1)** to access **SETUP Station Setup**.	
4.	**<Method:>** Select either **Resection** or **Resection Helmert**. **<Station ID:>** Enter the instrument station. **<Instrument Ht:>** Enter the height of the instrument station. **<Fixpoint Job:>** Select the fixpoint job of the control/target points.	
5.	Press **CONT (F1)** to access **SETUP Measure Target**.	
6.	**SETUP Measure Target**	40.4.4
7.	**ALL (F1)** or **REC (F3)**.	

Step	Description	Refer to chapter
8.	Refer to "40.4.4 Orientation and Height Transfer" for details on fields/keys.	

40.4.6 Local Resection

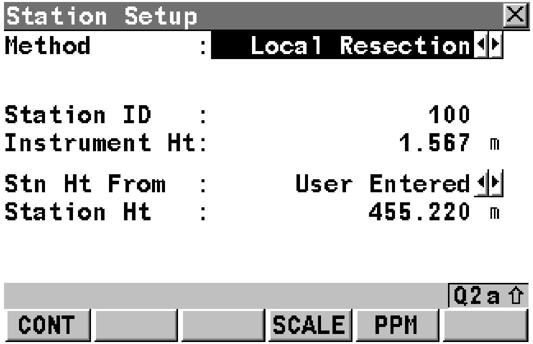
Description

- This method can be used to calculate the two or three-dimensional local coordinates for the instrument station and the orientation of the horizontal circle from distance and angular measurements to two target points.
- For Resection and/or Resection Helmert, refer to "40.4.5 Resection/Resection Helmert".

Access step-by-step

Step	Description
1.	Press **PROG** to access the **Programs** menu.
2.	Select and activate **Setup** to move to the first screen.
3.	Press **CONT (F1)** to access **SETUP Station Setup**.
4.	**<Method:>** Ensure that **Local Resection** is selected. **<Station ID:>** Enter the instrument station. **<Instrument Ht:>** Enter the height of the instrument station. **<Stn Ht From:>** Select the source for the instrument station height. **<Station Ht:>** Enter the elevation of the instrument station.
5.	Press **CONT (F1)** to access **SETUP Measure Target**.

SETUP
Station Setup



CONT (F1)
To accept all settings and continue. The chosen settings are activated and the next screen **SETUP Measure Target** is displayed.

SCALE (F4)
To display the geometric corrections used with the measurements. Refer to "16.4 TPS Corrections".

PPM (F5)
To display the atmospheric corrections used with the measurements. Refer to "16.4 TPS Corrections".

SHIFT CONF (F2)
To configure the application program SETUP. The screen **SETUP Configuration** is displayed. Refer to "40.3 Configuring Setup".

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between successive numbering **<Station ID>** and individual numbering **<Indiv Pt ID>**. entering an individual backsight point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates" for more information on point ID templates.

Description of fields

Field	Option	Description
<Method:>	Choicelist	**<Method: Local Resection>**
<Station ID:>	User input	The station ID of the instrument station.
<Instrument Ht:>	User input	Instrument height.
<Stn Ht From:>	**User Entered** or **Target 1 Ht Diff**	Only available when **<Method: Local Resection>**. For **<Stn Ht From: User Entered>** the height value of the station will be entered by the user and used to calculate the height of the measured points. For **<Stn Ht From: Target 1 Ht Diff>** the first measured point will be given Height=0 and the height of the station will be calculated relative to this point.
<Station Ht:>	Output	Only available when **<Stn Ht From: User Entered>**. The elevation of the instrument station.

Local resection step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	**CONT (F1)** to access **SETUP Measure Target 1**.	
2.	**SETUP Measure Target 1** Choose a target point and type in a reflector height. Aim correctly at the reflector.	40.4.4
3.	**ALL (F1)** to record the measurement.	
4.	**SETUP Measure Target 2** Choose a target point and type in a reflector height. Aim correctly at the reflector.	40.4.4
5.	**ALL (F1)** to record the measurement and to access **SETUP Results**.	
6.	**SETUP Results, Stn Coords** page	40.5
7.	**SET (F1)** to store the selected setup data and exit the application program.	

40.5 Setup Results

40.5.1 Least Square and Robust Calculation

Description

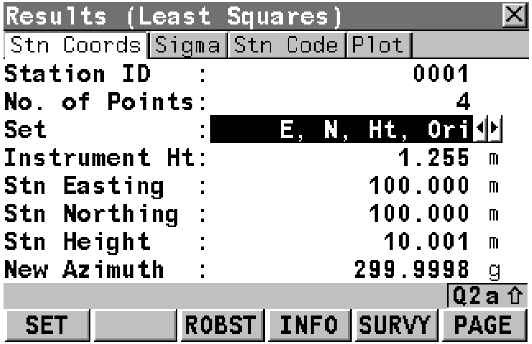
- This screen is displayed after a resection or orientation and height transfer calculation.
- For the calculations the least square or the robust method can be used. After the station is set, all following measurements will be related to this new station and orientation.

Access

Press **CALC (F5)** in the **SETUP Measure Target** screen.

SETUP Results, Stn Coords page

The screen described consists of the **Stn Coords**, **Sigma**, **Stn Code** and **Plot** page. The explanations for the softkeys given below are valid for the **Stn Coords** and **Sigma** page. Refer to "7.3.2 Creating a New Point" for information on the keys on the **Stn Code** page refer to "30.6 Plot Mode - MapView Screen Area" for information on the keys on the **Plot** page.



SET (F1)
To set data selected in **<Set:>** and to store all setup data and exit the application program.

ROBST (F3) or **LSQRS (F3)**
To display the results for the robust or the least squares calculation method.

INFO (F4)
To display additional information about the accuracy of the measured target points and to delete inconsistent measurements in the **SETUP Additional Information** screen.

DONE (F5) (Applicable to **Add Points Later**)
To temporarily exit the Setup program. The station setup will be incomplete but can be continued and completed at a later time.

SURVY (F5) (Applicable to **Meas All Now**)
To access **SETUP Measure Target** and to measure more target points.

PAGE (F6)
To change to another page on this screen.

SHIFT 3 PAR (F2) or **SHIFT 4 PAR (F2)**
Switches between a 3 parameter and 4 parameter helmert calculation. The results are immediately updated.

SHIFT OTHER (F5)
Available if two solutions were calculated. Changes between these solutions.

Description of fields

Field	Option	Description
<Station ID:>	User input	Station ID of the current station set up.
<No. of Points:>	Output	Number of points used in calculation.
<Set:>	Choicelist	The selected options are set and stored in the system. All other values are taken from the current system setup.
	E, N, Ht, Ori, **E, N, Ht** or **E, N, Ori**	Available for **<Method: Resection>** and **<Method: Resection Helmert>**.
	Ht,Ori, **Ht** or **Ori**	Available for **<Method: Ori & Ht Transfr>**.
<Instrument Ht:>	Output	The current instrument height.

Field	Option	Description
<Stn Easting:>	Output	For **<Method: Ori & Ht Transfr>** Easting is displayed either from fixpoint job or system, as selected. For **<Method: Resection>** and **<Method: Resection Helmert>** the calculated Easting is displayed.
<Stn Northing:>	Output	For **<Method: Ori & Ht Transfr>** Northing is displayed either from fixpoint job or system, as selected. For **<Method: Resection>** and **<Method: Resection Helmert>** the calculated Northing is displayed.
<Stn Height:>	Output	The calculated Height is displayed.
<New Azimuth>	Output	New oriented azimuth with running angle as telescope moves.

Next step

PAGE (F6) changes to the **Sigma** page.

SETUP Results, Sigma page

Description of fields

Field	Option	Description
<σEasting:>	Output	Available for **<Method: Resection>** and **<Method: Resection Helmert>**. Standard deviation of the calculated station Easting.

Field	Option	Description
<σNorthing:>	Output	Available for **<Method: Resection>** and **<Method: Resection Helmert>**. Standard deviation of the calculated station Northing.
<σ Height:>	Output	Standard deviation of the calculated station Height.
<Δ Height:>	Output	Delta height, the difference between original and calculated height.
<σ Hz Orient:>	Output	Standard deviation of the calculated orientation.
<Calc Scale:>	Output	Calculated scale factor from resection or orientation and height transfer.
<Calc ppm:>	Output	Available for **<Use Scale: Yes>**. ppm from calculated scale. ppm=(scale*1000000)-1.
<Current Scale:>	Output	The geometric scale correction is displayed. The correction displayed depends upon the options chosen in **CONFIGURE TPS Corrections, GeoPPM** page. Refer to "16.4 TPS Corrections" for details.

Next step
PAGE (F6) changes to the **Stn Code** page.

SETUP Results, Stn Code page

The functionality of the **Stn Code** page is similar to **MANAGE New Point, Code** page. Refer to "7.3.2 Creating a New Point" for more information on keys.

Description of fields

Field	Option	Description
<Point Code:>		The thematical code for the point.
	Choicelist	Available for **<Thematc Codes: With Codelist>**. All point codes from the job codelist can be selected. The attributes are shown as output, input or choicelist fields depending on their definition.
	User input	Available for **<Thematc Codes: Without Codelist>**. Codes can be typed in but not selected from a codelist. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown.
<Code Desc:>	Output	Available for **<Thematc Codes: With Codelist>**. The description of the code.
<Attribute n:>	User input	Available for **<Thematc Codes: Without Codelist>**. Up to eight attribute values are available.

Next step

PAGE (F6) changes to the **Plot** page.

40.5.2 Additional Information

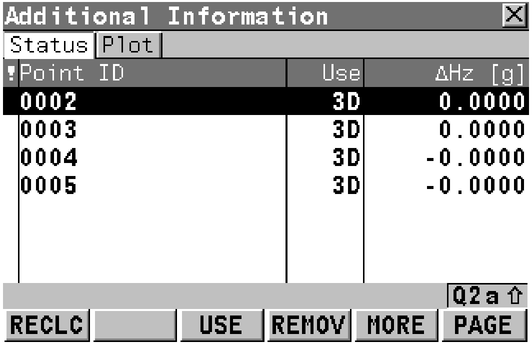
Description

- The **SETUP Additional Information** screen displays information about the accuracy of the measured target points and allows exclusion of measurements that are not to be used in the calculation.
- Additional measurements can be made and measurements can be deleted.

Access

Press **INFO (F4)** in the **SETUP Results** screen.

SETUP Additional Information, Status page



RECLC (F1)
To recalculate the station data and update all values after target points have been deleted or excluded from the calculation. Returns to the **SETUP Results** screen.

USE (F3)
To decide whether or not to use a target point in the calculation. Changes the value in the **Use** column.

REMOV (F4)
To delete a point from the list of measured target points and exclude it from the Setup calculation.

MORE (F5)
To change between displaying **ΔHz**, **ΔDist**t, **ΔHeight**, **ΔEast** and **ΔNorth** in the fourth column.

SHIFT SURVY (F5)
Accesses the **SETUP Measure Target** screen to measure more target points.

PAGE (F6)

To change to an other page on the screen. Refer to "30 MapView Interactive Display Feature" for more information.

Description of columns

Column	Description
!	The **!** indicates that the delta value of either measured horizontal angle, distance or height exceeds the calculation limit.
Point ID	The point ID of the measured target points.
Use	Indicates if and how a target point is used in the station calculation. Choices are **3D**, **2D, 1D** and **NO**.
ΔHz	Can be displayed by pressing **MORE (F5)**. Difference between calculated and measured horizontal angle for the target points. If a target point does not have coordinates, ----- are displayed. Differences exceeding the defined limit are indicated by a *.
ΔDist	Can be displayed by pressing **MORE (F5)**. Difference between calculated and measured distance from the station to the target points. If a target point does not have coordinates, ----- are displayed. Differences exceeding the defined limit are indicated by a *.

Column	Description
ΔHeight	Can be displayed by pressing **MORE (F5)**. Difference between calculated and measured height of the target points. If a target point does not have a height coordinate, ----- are displayed. Differences exceeding the defined limit are indicated by a *.
ΔEast	Can be displayed by pressing **MORE (F5)**. Difference between fixpoint and measured point, calculated from new station coordinates.
ΔNorth	Can be displayed by pressing **MORE (F5)**. Difference between fixpoint and measured point, calculated from new station coordinates.

Next step

PAGE (F6) changes to the **Plot** page.

SETUP Results, Plot page

Refer to "30.6 Plot Mode - MapView Screen Area" for details on the keys on the **Plot** page.

Next step

PAGE (F6) changes to the first page on this screen.

Next steps

IF	THEN
more target points are to be measured	**SHIFT SURVY (F5)** to access the **SETUP Measure Target** screen.
point measurements are to be accepted	**RECLC (F1)** to recalculate the station data and return to the **SETUP Results** screen.

40.5.3 Local Resection Calculation

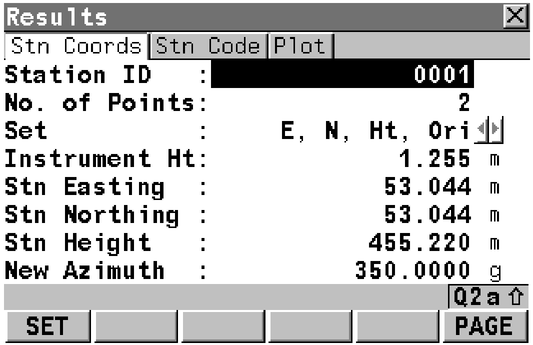
Description

- This screen is displayed after the local resection calculation.
- After the station is set, all following measurements will be related to this new station and orientation.

Access

Press **ALL (F1)** in the **SETUP Measure Target 2** screen.

SETUP Results, Stn Coords page



SET (F1)
To set data selected in **<Set:>** and to store all setup data and exit the application program.

PAGE (F6)
To change to an other page on the screen.

Description of fields

Field	Option	Description
<Station ID:>	User input	Station ID of the current station set up.
<No. of Points:>	Output	Number of points used in calculation.

Field	Option	Description
<Set:>	Output	The displayed options are set and stored in the system. All other values are taken from the current system setup.
<Instrument Ht:>	Output	The current instrument height.
<Stn Easting:>	Output	The calculated Easting.
<Stn Northing:>	Output	The calculated Northing.
<Stn Height:>	Output	The calculated Height.
<New Azimuth>	Output	New oriented azimuth with running angle as telescope moves.

Next step
PAGE (F6) changes to the **Stn Code** page.

SETUP Results, Stn Code page

The functionality of the **Stn Code** page is similar to **MANAGE New Point, Code** page. Refer to "7.3.2 Creating a New Point" for more information on keys.

Description of fields

Field	Option	Description
<Point Code:>		The thematical code for the offset point.

Field	Option	Description
	Choicelist	Available for **<Thematc Codes: With Codelist>**. All point codes from the job codelist can be selected. The attributes are shown as output, input or choicelist fields depending on their definition.
	User input	Available for **<Thematc Codes: Without Codelist>**. Codes can be typed in but not selected from a codelist. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown.
<Code Desc:>	Output	Available for **<Thematc Codes: With Codelist>**. The description of the code.
<Attribute n:>	User input	Available for **<Thematc Codes: Without Codelist>**. Up to eight attribute values are available.

Next step
PAGE (F6) changes to the **Stn Plot** page.

SETUP Results, Stn Plot page

Refer to "30.6 Plot Mode - MapView Screen Area" for information on the keys on the **Plot** page.

Next step
PAGE (F6) changes to the first page on this screen.

40.6 Finding a Target Point

Description

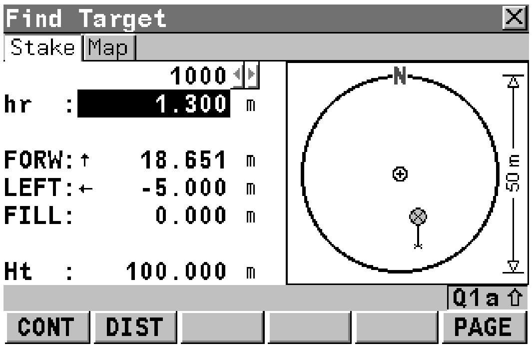
- The **SETUP Find Target** screen can be accessed, to guide the reflector to the selected target point.
- The screen is only available if the Stakeout application is available on the instrument.
- The functionality of this screen is similar to a stakeout routine and is intended to help find hidden survey bench marks or reference points.

Access

Press **SHIFT FIND (F2)** in **SETUP Measure Target** once enough data is available to roughly calculate the new orientation.

SETUP Find Target

This screen is shown with **<Stake Mode: Ortho from Stn>.** For graphics/symbols being displayed the settings are **<Symbols: From Station>** and **<Graphics: From Station>**. Refer to "41.4.1 Elements of the Graphical Display in the Stakeout" for information on elements of the graphic.



CONT (F1)
Exits **SETUP Find Target** and returns to **SETUP Measure Target**.

DIST (F2)
To measure and display distances. Updates all output fields in the screen.

Description of fields

Field	Option	Description
<Point ID:>	Output	The point ID of the target point to be measured.
<Reflector Ht:>/ <hr:>	Output	The default reflector height as defined in the active configuration set is suggested.
<Go FORWARD:>/ <FORW:> or **<Go BACWARD:>/ <BACK:>**	Output	The horizontal distance from the current reflector position to the target point along the line from the station to the current reflector position. Field is **<Go FORWARD:>** when the reflector has to be moved towards the instrument and **<Go BACKWARD:>** when the reflector has to be moved away from the instrument. Shows ----- before the first distance measurement with **DIST (F2)**.
<Go RIGHT:>/ <RGHT:> or **<Go LEFT:>/ <LEFT:>**	Output	Horizontal distance from the current reflector position to the target point orthogonal to the line from the station to the current reflector position. Field is **<Go RIGHT:>** when the target point is to the right of that line and **<Go LEFT:>** when the reflector is to the left of that line. Shows ----- before the first distance measurement with **DIST (F2)**.

Field	Option	Description
<FILL:> or **<CUT:>**	Output	The height difference between the target point and the measured point. Field is **<CUT:>** when the measured point is higher than the target point and **<FILL:>** if the measured point is lower than the target point. Shows ----- before the first distance measurement with **DIST (F2)** or if the target point is a 2D point.
<Height> or <Ht:>	Output	The measured height of the current position. Shows ----- before the first distance measure-ment with **DIST (F2)** or if the target point is a 2D point.

Next step

CONT (F1) to return to the **SETUP Measure Target** screen.

41 Stakeout

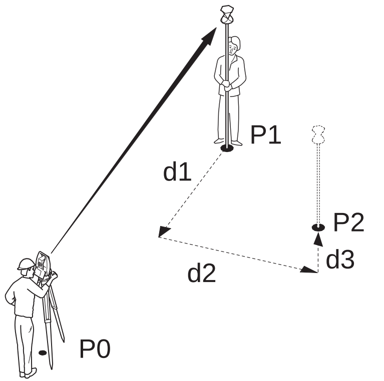
41.1 Overview

Description

The Stakeout application program is used to place marks in the field at predetermined points. These predetermined points are the points to be staked. The points to be staked may

- have been uploaded to a job on the instrument using GGO.
- already exist in a job on the instrument.
- have been uploaded from an ASCII file to a job on the instrument using **Main Menu: Convert...\Import ASCII/GSI Data to Job**.
- be typed in.

Diagram



P0	Station
P1	Current position
P2	Point to be staked
d1	Stake out element
d2	Stake out element
d3	Stake out element

Stakeout modes

Points can be staked using different modes:

- Polar mode.
- Orthogonal mode.

☞ The points to be staked must exist in a job on the active memory device or can be typed in.

Point types

It is possible to stake:

- Position only points.
- Height only points.
- Points with full sets of coordinates.

Height type

Height type of the point to be staked: Orthometric

Height source

Heights can be taken into account from

- the vertical component of a coordinate triplet.
- a **D**igital **T**errain **M**odel.

DTM Stakeout must be activated via a licence key. Refer to "26 Tools...\Licence Keys" for information on how to type in or upload the licence key.
If activated, the height of the points to be staked can be edited in the field.

Coding of staked points

Codes can be attached to staked points. Refer to "9 Coding" for information on coding. The behaviour of the coding functionality depends on the

- selected **<Stakeout Job:>** as the job with the points to be staked.
- selected **<Job:>** as the active job.
- definition of a display mask with input fields for coding and attributes.

IF <Stakeout Job:> and <Job:>	AND a display mask for point codes and attrib-utes	THEN
are identical	is used	the point code and attributes attached to the point to be staked are suggested for the staked point. They can be changed.
are identical	is not used	the staked point is stored with the point code and attributes attached to the point to be staked.
are not identical	is used	**<Point Code: <None>>** is suggested. It can be changed and attributes can be entered. After a point has been stored with a code different to **<Point Code: <None>>** then the last used point code is suggested the next time.
are not identical	is not used	the staked point is stored with **<Point Code: <None>>**.

It may happen that the codes and/or attributes of the staked point and the point to be staked do not match. In this case, a screen opens where they can be corrected. Refer to "9.6 Code and Attribute Mismatch" for information on solving a code and/or attribute mismatch.

Properties of staked points

The properties stored with staked points are:

- Class: **MEAS**
- Sub class: **Stakeout**
- Source: **Stakeout**
- Instrument source: **TPS**

Averaging of staked points

The principles for averaging are identical to those of the Survey application program. Refer to "7.3.4 Mean Page" for information on averaging.

41.2 Accessing Stakeout

Access

Select **Main Menu: Programs...\Stakeout**.

OR

Press **PROG**. Highlight **Stakeout**. **CONT (F1)**. Refer to "31.2 Accessing the Programs Menu" for information on the **PROG** key.

OR

Press a hot key configured to access the screen **STAKEOUT Stakeout Begin**. Refer to "2.1 Hot Keys" for information on hot keys.

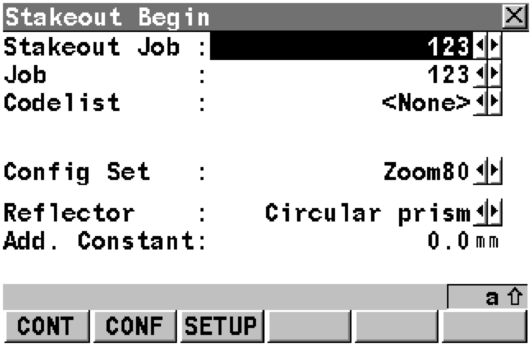
OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **STAKE (F5)** from another application program, for example COGO.

STAKEOUT Stakeout Begin



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure Stakeout application program. Accesses **STAKEOUT Configuration**. Refer to "41.3 Configuring Stakeout".

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

Description of fields

Field	Option	Description
<Stakeout Job:>	Choicelist	The job containing the points to be staked. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected. Points which are staked out are stored in this job. The original points to be staked are not copied to this job. The data from this job is shown in **MANAGE Data: Job Name**.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.

Field	Option	Description
<DTM Job:>	Choicelist	Available for **<Use DTM: DTM only>** and **<Use DTM: DTM & Stake Job>** in **STAKEOUT Configuration**, **Heights** page. To select a DTM to be staked and to select the active DTM layer to be used. Heights are then staked out relative to the selected DTM. Refer to "41.4.5 Staking Out a DTM".
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Stakeout application program	THEN
is to be accessed	**CONT (F1)** accepts the changes and accesses Stakeout application program. Refer to "41.4 Staking Out".

IF the Stakeout application program	THEN
is to be configured	**CONF (F2)**. Refer to "41.3 Configuring Stakeout".

41.3 Configuring Stakeout

Access

Select **Main Menu: Programs...\Stakeout**. In **STAKEOUT Stakeout Begin** press **CONF (F2)** to access **STAKEOUT Configuration**.

OR

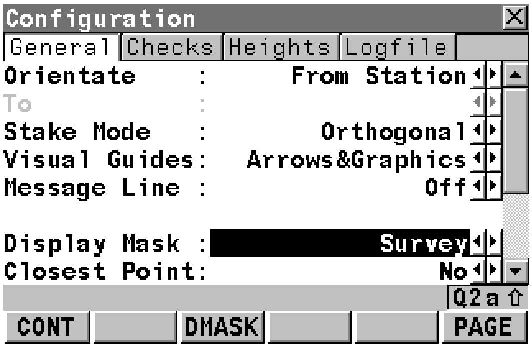
Press **PROG**. Highlight **Stakeout**. **CONT (F1)**. In **STAKEOUT Stakeout Begin** press **CONF (F2)** to access **STAKEOUT Configuration**.

OR

Press **SHIFT CONF (F2)** in **STAKEOUT XX Stakeout**.

STAKEOUT Configuration, General page

This screen consists of the **General** page, the **Checks** page, the **Heights** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted on **General** page. Refer to "15.2 Display Settings".

PAGE (F6)
To change to another page on this screen.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Orientate:>		The reference direction to be used to stakeout points. The stakeout elements and the graphical display shown in the Stakeout application program are based on this selection.
	From Station	The direction of the orientation is from the instrument to the point to be staked.
	To Station	The direction of the orientation is from the point to be staked to the instrument.
	From North	The direction of the orientation is from the North direction to the point to be staked.
	To North	The direction of the orientation is from the point to be staked to the North direction.
	To Arrow	The direction of the orientation is from the current position to the point to be staked. The graphical display shows an arrow pointing in the direction of the point to be staked.

Field	Option	Description
	To Last Point	Timewise the last recorded point. If no points are yet staked, **<Orientate: To North>** is used for the first point to be staked.
	To Point(Stake)	A point from **<Stakeout Job:>** selected in **STAKEOUT Stakeout Begin**.
	To Point(Store)	A point from **<Job:>** selected in **STAKEOUT Stakeout Begin**.
	To Line(Stake)	The direction of the orientation is parallel to a reference line from **<Stakeout Job:>** selected in **STAKEOUT Stakeout Begin**. Open the listbox to create, edit or delete a reference line.
	To Line(Store)	The direction of the orientation is parallel to a reference line from **<Job:>** selected in **STAKEOUT Stakeout Begin**. Open the listbox to create, edit or delete a reference line.

Field	Option	Description
<To:>	Choicelist	Available for **<Orientate: To Point(Stake)>**, **<Orientate: To Point(Store)>**, **<Orientate: To Line(Stake)>** and **<Orientate: To Line(Store)>**. To select the point or line to be used for orientation. Refer to "7.2 Accessing Data Management" for information on creating, editing and deleting a known point. Refer to "37.4 Starting Reference Line" for information on creating, editing and deleting a line.
<Stake Mode:>		The method of staking out.
	Polar	The direction from the orientation reference, the horizontal distance and the cut/fill is displayed.
	Orthogonal	The distance forwards to/backwards from the point, the distance right/left to the point and the cut/fill is displayed.
<Visual Guides:>		Arrows and/or a graphical display in **STAKEOUT XX Stakeout**. help finding the point to be staked.
	Off	Neither arrows nor a graphical display are shown.
	Arrows	Upon pressing **DIST (F2)** arrows are shown.

Field	Option	Description
	Graphics	A graphical display is shown. Refer to "41.4.1 Elements of the Graphical Display in the Stakeout"..
	Arrows&Graphics	Upon pressing **DIST (F2)** arrows are shown. A graphical display is always shown.
<Message Line:>		For each point which is selected for staking, angle and distance information is momentarily displayed in the message line.
	Off	No information is displayed in the message line.
	Dist From Stn	The delta Hz angle that the instrument should turn to the point and the distance from the instrument to the point is momentarily displayed in the message line.
	Dist Frm Last Pt	The delta Hz angle that the instrument should turn to the point and the distance from the last staked point is momentarily displayed in the message line.
<Display Mask:>	Choicelist	The user defined display mask to be shown in **STAKEOUT XX Stakeout**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.

Field	Option	Description
<Closest Point:>		The order of the points suggested for staking out.
	Yes	After staking and storing a point, the next point suggested for staking out is the point closest to the point which was staked. If there are many points in **<Stakeout Job:>**, the search may take a few seconds.
	No	After staking and storing one point, the next point suggested for staking out is the subsequent one in **<Stakeout Job:>**.
<Auto Position:>	**2D**	Instrument positions horizontally to the point to be staked.
	3D	Instrument positions horizontally and vertically to the point to be staked.
	Off	Instrument does not position to the point to be staked.
<Update Angle:>	**Yes**	Angles are updated with telescope movement after a distance was measured.
	No	Angles and stakeout values are updated after a distance measurement. Then all values are frozen until the next distance is taken. When **<Automation: Track360:>** and locked to a target the values do not change.

Field	Option	Description
<Store Pt ID:>	**Same as Stake Pt**	The manually occupied staked points are stored with the same point ID's as the points to be staked.
	Prefix	Adds the setting for **<Prefix/Suffix:>** in front of the original point ID's.
	Suffix	Adds the setting for **<Prefix/Suffix:>** at the end of the original point ID's.
<Prefix/Suffix: >	User input	Available for **<Store Pt ID: Prefix>** and **<Store Pt ID: Suffix>**. The identifier with up to four characters is added in front of or at the end of the ID of the manually occupied staked point.

Next step

PAGE (F6) changes to the **Checks** page. Refer to paragraph "STAKEOUT Configuration, Checks page".

STAKEOUT Configuration, Checks page

Description of fields

Field	Option	Description
<Pos Check:>	**Yes** or **No**	Allows a check to be made on the horizontal coordinate difference between the staked point and the point to be staked. If the defined **<Pos Limit:>** is exceeded, the stakeout can be repeated, skipped or stored.

Field	Option	Description
<Pos Limit:>	User input	Available for **<Pos Check: Yes>**. Sets the maximum horizontal coordinate difference accepted in the position check.
<Height Check:>	**Yes** or **No**	Allows a check to be made on the vertical difference between the staked point and the point to be staked. If the defined **<Height Limit:>** is exceeded, the stakeout can be repeated, skipped or stored.
<Height Limit:>	User input	Available for **<Height Check: Yes>**. Sets the maximum vertical difference accepted in the height check.
<Beep near Pt:>	**Yes** or **No**	The instrument beeps when the horizontal radial distance from the current position to the point to be staked is equal to or less than defined in **<Dist from Pt:>**.
<Dist from Pt:>	User input	Available for **<Beep near Pt: Yes>**. The horizontal radial distance from the current position to the point to be staked when a beep should be heard.

Next step

PAGE (F6) changes to the **Heights** page. Refer to paragraph "STAKEOUT Configuration, Heights page".

STAKEOUT Configuration, Heights page

Description of fields

Field	Option	Description
<Height Offset:>	User input	Allows a constant height offset to be applied to the height of the points or DTM being staked.
<Edit Height:>	**Yes**	The field **<D Ht:>** for the design height is displayed in **STAKEOUT Orthogonal Stakeout**, **Stake** page and **STAKEOUT Polar Stakeout**, **Stake** page. The design height is the height of the point to be staked. The value for **<D Ht:>** can be changed.
	No	The field **<Ht:>** for the height of the current position is displayed in **STAKEOUT Orthogonal Stakeout**, **Stake** page and **STAKEOUT Polar Stakeout**, **Stake** page. The value for **<Ht:>** cannot be changed.
<Use DTM:>		Available if DTM Stakeout has been activated via a licence key. Refer to "26 Tools...\Licence Keys" for information on how to type in or upload the licence key. Available unless **STAKEOUT Configuration, Heights** page was accessed while being within the Stakeout application program.
	No	No DTM file is used. The positions and heights of points in the selected **<Stakeout Job:>** are staked out.

Field	Option	Description
	DTM only	Activates the stakeout of heights without positions. Heights relative to the selected **<DTM Job:>** are staked out.
	DTM & Stake Job	The positions of points in the selected **<Stakeout Job:>** are staked out. Heights to be staked out are taken from **<DTM Job:>**.

Next step

PAGE (F6) changes to the **Logfile** page. Refer to paragraph "STAKEOUT Configuration, Logfile page".

STAKEOUT Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

41.4 Staking Out

41.4.1 Elements of the Graphical Display in the Stakeout

Description

A graphical display provides a guide to find the point to be staked out. The elements of the graphical display used within the Stakeout application program screens are explained in this chapter. Some of the elements depend on the selection for **<Visual Guides:>** in **STAKEOUT Configuration**, **General** page. Other elements are commonly displayed.

The **Map** page provides an interactive display of the data. Refer to "30.5 Map Mode" for information on the functionality and softkeys available.

Elements of graphical display

Theodolite	
Reflector	
Point to be staked	
North	
North arrow	

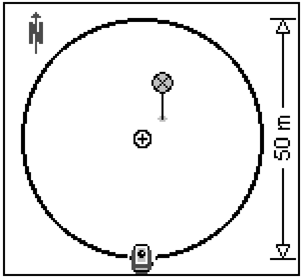
Current scale

For **<Visual Guides: Off>** no graphical display is shown on the screen.

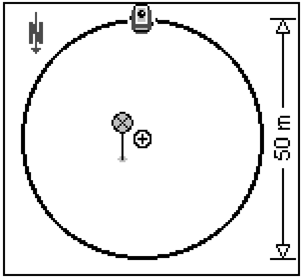
Graphical display

For scale >1000 m the circle is displayed in grey.

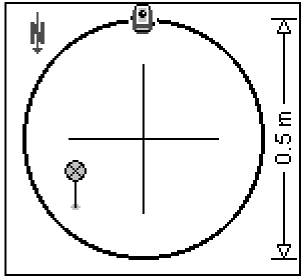
From Station or North



To Station or North



For scale 0.5 m



41.4.2 Manual Entry of Points to be Staked

Description

Manual entry of points to be staked can be used to input angle and distance values.

☞ It is possible to type in angles and distances independent of the used **<Stake Mode:>**.

Manual entry of points step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Set up and orient the instrument.	40
2.	Start the Stakeout application program.	
3.	**STAKEOUT Stakeout Begin** Check the settings.	
4.	**CONT (F1)** to access **STAKEOUT XX Stakeout**.	41.4
5.	**STAKEOUT XX Stakeout** **SHIFT MSTAK (F3)** to access **STAKEOUT Manual Entry**.	
6.	**STAKEOUT Manual Entry** Enter the values of the point to be staked.	
7.	**STAKE (F1)** to access **STAKEOUT XX Stakeout**.	
☞	The point is created and the coordinates of the point are remembered allowing the point to be staked out.	

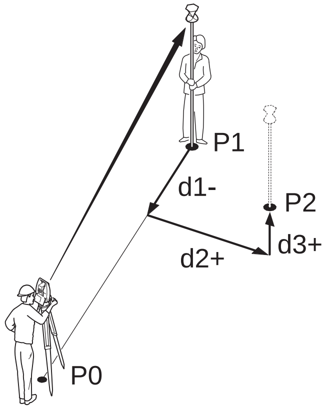
Step	Description	Refer to chapter
8.	**STAKEOUT XX Stakeout** Check the reflector height.	
9.	Continue with step 9. from paragraph "Stake out in orthog-onal from station mode step-by-step".	

41.4.3 Staking Out in Orthogonal Mode

Description

Points can be staked out using orthogonal values to guide to the point to be staked. Values are relative to the line defined by station and current position. The stakeout elements are a horizontal distance forwards/backwards, a horizontal distance right/left and a cut/fill. The values are calculated between the current position and the point to be staked. The values are calculated either from the station to the point or from the point to the station depending on the setting of **<Stake Mode:>**.

Orthogonal from and to station



P0	Station
P1	Current position
P2	Point to be staked
d1	**<Go FORWARD:>** ↓ ↑ or **<Go BACK:>** ↑ ↓
d2	**<Go RIGHT:>** → or **<Go LEFT:>** ←
d3	**<CUT:>** or **<FILL:>**

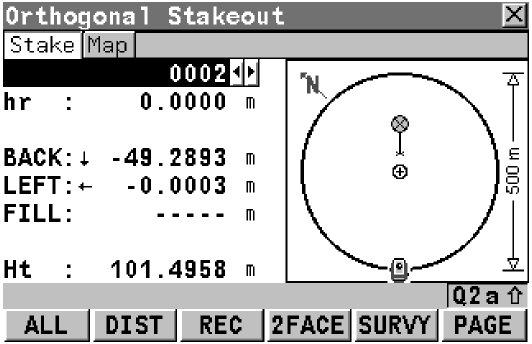
☞ **<Stake Mode: Ortho from Stn>** is configured in **STAKEOUT Configuration**, **General** page. Refer to "41.3 Configuring Stakeout".

Access

Refer to "41.2 Accessing Stakeout" to access **STAKEOUT Orthogonal Stakeout**.

STAKEOUT Orthogonal Stakeout, Stake page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.



ALL (F1)
To measure a distance and store distance and angles.

DIST (F2)
To measure a distance.

REC (F3)
To store angles and distance. Distance must be measured before.

2FACE (F4)
To take a measurement in Face I and Face II. The point stored is an average of the two measurements.
When using instruments fitted with Aim360, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.
This hotkey is only available for <**EDM Mode**: **Standard**> and <**EDM Mode**: **Fast**> and in the Survey, Reference Line and Stakeout programs.

SURVY (F5)
To access Survey application program to measure points independent from the Stakeout application program. To return to Stakeout application program, press **SHIFT QUIT (F6)** or **ESC**.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To configure stakeout. Refer to "41.3 Configuring Stakeout".

SHIFT POS2D (F3)
To position the telescope (X,Y) onto the point to be staked.

SHIFT POS3D (F4)
To position the telescope (X,Y,Z) onto the point to be staked.

SHIFT MSTAK (F5)
To enter angle and distance values to stake out a point. Refer to "41.4.2 Manual Entry of Points to be Staked".

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	The point ID of the point to be staked. Accesses **STAKEOUT Data: Job Name** where points are shown according to sort and filter settings and staked points are indicated by ⚑.
<Reflector Ht:> or **<hr:>**	User input	The default reflector height as defined in the active configuration set is suggested.
<Go FORWARD:> or **<FORW:>**	Output	The horizontal distance along the line defined by station and reflector from the current position to the point to be staked. ↓ or ↑ to move towards the station depending on **<Symbols:>**.
<Go BACK:> or **<BACK:>**	Output	The horizontal distance in reverse direction from the line defined by station and reflector from the current position to the point to be staked. ↑ or ↓ to move away from the station depending on **<Symbols:>**.
<Go RIGHT:> or **<RGHT:>**	Output	The direction depends on **<Stake Mode:>**. The horizontal distance orthogonal to the right of the line defined by station and reflector from the current position to the point to be staked. → to move to the right of the line defined in **<Symbols:>**, ← to move to the left of the line defined in **<Symbols:>**.

Field	Option	Description
<Go LEFT:> or **<LEFT:>**	Output	The direction depends on **<Stake Mode:>**. The horizontal distance from the current position to the point to be staked orthogonal to the left of the line defined by station and reflector. ← to move to the left of the line defined in **<Symbols:>**, → to move to the right of the line defined in **<Symbols:>**.
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account. Move down.
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account. Move up.
<Height:> or **<Ht:>**	Output	Available for **<Edit Height: No>** in **STAKEOUT Configuration**, **Heights** page. The height of the current position is displayed as orthometric height. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account.

Field	Option	Description
<Design Ht:> or **<D Ht:>**	User input	Available for **<Edit Height: Yes>** in **STAKEOUT Configuration**, **Heights** page. The design height, which is the height of the point to be staked, is displayed as orthometric height. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is not taken into account. Changing the value for **<D Ht:>** changes the values displayed for **<CUT:>** and **<FILL:>**.

Next step

PAGE (F6) changes to the **Map** page. Refer to paragraph "STAKEOUT Orthogonal Stakeout, Map page".

STAKEOUT Orthogonal Stakeout, Map page

The **Map** page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

Stake out in orthogonal from station mode step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Set up and orient the instrument.	40
	<Automation: Track360> and **<EDM Mode: Tracking>** are configured in **CONFIGURE EDM & Aim360 Settings**.	16.1
2.	Start the Stakeout application program.	41.2
3.	**STAKEOUT Stakeout Begin** Check the settings.	41.2
4.	**CONF (F2)** to access **STAKEOUT Configuration, General** page.	
5.	**STAKEOUT Configuration**, **General** page **<Orientate: From Station>** **<Stake Mode: Orthogonal>**	41.3
	This step-by-step instruction uses typical settings in all other fields on all pages in **STAKEOUT Configuration**.	41.3
6.	**CONT (F1)** to access **STAKEOUT Stakeout Begin**.	
7.	**CONT (F1)** to access **STAKEOUT Orthogonal Stakeout**.	
8.	**STAKEOUT Orthogonal Stakeout**, **Stake** page Check the suggested point ID and the reflector height.	
9.	**DIST (F2)**.	
10.	Move to the point to be staked either by following the range information in the fields **<FORW:>**, **<BACK:>**, **<RGHT:>** and **<LEFT:>** or the graphical display.	

Step	Description	Refer to chapter
☞	When the value is at or nearly zero, the current position is the point to be staked.	
11.	Hold the reflector steady over the marker.	
12.	**REC (F1)** stores distance and angles.	
☞	For **<Pos Check: Yes>** and/or **<Height Check: Yes>** in **STAKEOUT Configuration**, **Checks** page, a check is made on the horizontal and/or vertical coordinate distance from the staked point to the point to be staked. If either of the configured difference limits are exceeded, **STAKEOUT Difference Limit Exceeded** is accessed.	41.4.6
13.	Are more points to be staked? • If **yes**, continue with step 14. • If **no**, continue with step 16.	
14.	**STAKEOUT Orthogonal Stakeout**, **Stake** page According to sort and filter settings, the subsequent point in **<Stakeout Job:>** is suggested for staking out.	
15.	Repeat steps 8. to 13.	
16.	**SHIFT QUIT (F6)** to return to the screen from where **STAKEOUT Stakeout Begin** was accessed.	

Stake out in orthogonal to station mode step-by-step

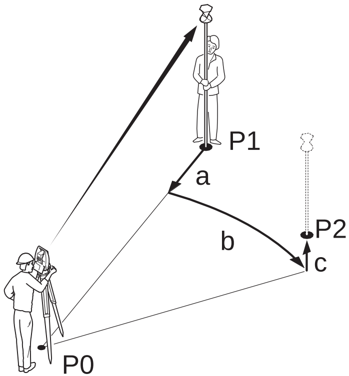
The steps are identical to those of staking out in orthogonal from station mode. Follow the instructions in paragraph "Stake out in orthogonal from station mode step-by-step" using **<Orientate: To Station>** and **<Stake Mode: Orthogonal>**. The values are calculated from the point to the station.

41.4.4 Staking Out in Polar Mode

Description

The stakeout elements are a direction from the station, a horizontal distance and a cut/fill. The range information is calculated from the current position to the point to be staked in reference to the station.

Diagram



P0 Station
P1 Current position
P2 Point to be staked
a **<Δ DISTANCE:>**
b **<Δ HZ:>**
c **<CUT:>** or **<FILL:>**

☞ **<Stake Mode: Polar>** is configured in **STAKEOUT Configuration**, **General** page. Refer to "41.3 Configuring Stakeout".

Access

Refer to "41.2 Accessing Stakeout" to access **STAKEOUT Polar Stakeout**.

STAKEOUT Polar Stakeout, Stake page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.

The keys are identical with those in **STAKEOUT Orthogonal Stakeout**, **Stake** page. Refer to "41.4.3 Staking Out in Orthogonal Mode" for information on the keys.

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	The point ID of the point to be staked. Accesses **STAKEOUT Data: Job Name** where points are shown according to sort and filter settings and staked points are indicated by ⚑.
<Reflector Ht:> or **<hr:>**	User input	The default reflector height as defined in the active configuration set is suggested.
<Δ HZ:>	Output	The difference of the horizontal angle from the point to be staked to the current position. ☞ For **<Orientate: From Station>** and **<Orientate: To Station>** the value is calculated and displayed permanently. For other orientation methods, the distance must be measured before the value can be displayed.
<Δ DISTANCE:> or **<Δ D:>**	Output	The difference of the horizontal distance from the point to be staked to the current position along the line defined by current position and station.

Field	Option	Description
<CUT:>	Output	The negative height difference from the height of the current position to the height of the point to be staked. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account. Move down.
<FILL:>	Output	The positive height difference from the height of the current position to the height of the point to be staked. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account. Move up.
<Height:> or **<Ht:>**	Output	Available for **<Edit Height: No>** in **STAKEOUT Configuration**, **Heights** page. The height of the current position is displayed as orthometric height. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is taken into account.
<Design Ht:> or **<D Ht:>**	User input	Available for **<Edit Height: Yes>** in **STAKEOUT Configuration**, **Heights** page. The design height, which is the height of the point to be staked, is displayed as orthometric height. The value for **<Height Offset:>** configured in **STAKEOUT Configuration**, **Heights** page is not taken into account.

Field	Option	Description
		Changing the value for **<D Ht:>** changes the values displayed for **<CUT:>** and **<FILL:>**.

Next step

PAGE (F6) changes to the **Map** page. Refer to paragraph "STAKEOUT Orthogonal Stakeout, Map page".

STAKEOUT Polar Stakeout, Map page

The **Map** page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

PAGE (F6) changes to the first page on this screen.

Stake out in polar mode step-by-step

The steps are identical to those of staking out in orthogonal mode. Refer to "41.4.3 Staking Out in Orthogonal Mode". Follow the instructions in paragraph "Stake out in orthogonal from station mode step-by-step" using **<Stake Mode: Polar>**. The values are displayed as **<Δ HZ:>** and **<Δ DISTANCE:>**.

41.4.5 Staking Out a DTM

Description

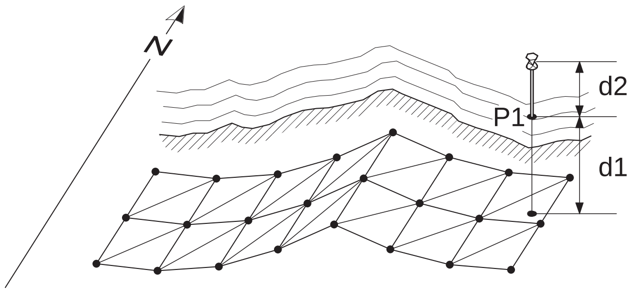
With the Stakeout application program a **D**igital **T**errain **M**odel can be staked. The heights of the current positions are compared against those of a selected DTM job. The height differences are calculated and displayed.

Staking a DTM may be used for

- staking out where the DTM represents the surface to be staked.
- quality control purposes where the DTM represents the final project surface.

DTM jobs are created in GGO. DTM jobs are stored in the \DBX directory on the active memory device.

Diagram



P1 Point to be staked
d1 **<CUT:>** or **<FILL:>**
d2 Reflector height

Access

Refer to "41.2 Accessing Stakeout" to access **STAKEOUT XX Stakeout**.

Stake out a DTM step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
☞	DTM Stakeout must be activated via a licence key.	26
☞	The DTM job to be used must be stored in the \DBX directory on the active memory device.	
1.	Start the Stakeout application program.	41.2
2.	**STAKEOUT Stakeout Begin** **CONF (F2)** to access **STAKEOUT Configuration**.	
3.	**PAGE (F6)** until the **Heights** page is active.	
4.	**STAKEOUT Configuration**, **Heights** page **<Use DTM: DTM only>**	41.3
☞	**<Use DTM: DTM & Stake Job>** is not covered in this step-by-step instruction. The stake out procedure is identical as described for the selected **<Stake Mode:>**. The heights to be staked are taken from the selected **<DTM Job:>** defined in **STAKEOUT Stakeout Begin**.	41.3
☞	This step-by-step instruction uses typical settings in all other fields on all pages in **STAKEOUT Configuration**. The selection for **<Stake Mode:>** is irrelevant since no positions are staked.	41.3
5.	**CONT (F1)** to access **STAKEOUT Stakeout Begin**.	
6.	**STAKEOUT Stakeout Begin**	41.2

Step	Description	Refer to chapter
	<DTM Job:> Select a DTM job. Check the other settings.	
7.	**CONT (F1)** to access **STAKEOUT DTM Stakeout**.	
8.	**STAKEOUT DTM Stakeout**, **Stake** page Check the suggested reflector height.	
9.	**DIST (F2)**.	
10.	**STAKEOUT DTM Stakeout**, **Stake** page **<CUT:>** or **<FILL:>** The negative or positive height difference from the current position to the equivalent point in the selected DTM job is calculated and displayed. Height offsets apply for whole DTM.	
11.	Mark the current position.	
12.	**REC (F1)** to store distance and angles.	
☞	For **<Height Check: Yes>** in **STAKEOUT Configuration**, **Checks** page, a check is made on the vertical coordinate distance from the staked point to the point to be staked. If the configured difference limit is exceeded, **STAKEOUT Difference Limit Exceeded** is accessed.	41.4.6
13.	Are more heights to be staked? • If **yes**, move to the next position and repeat steps 8. to 13. • If **no**, continue with step 14.	

Step	Description	Refer to chapter
14.	**SHIFT QUIT (F6)** to return to the screen from where **STAKEOUT Stakeout Begin** was accessed.	

41.4.6 Stakeout Difference Limit Exceeded

Description

If configured a check is made on the horizontal and/or vertical coordinate distance from the staked point to the point to be staked when storing a staked point. Refer to "41.3 Configuring Stakeout" for information on configuring the check and the limits.

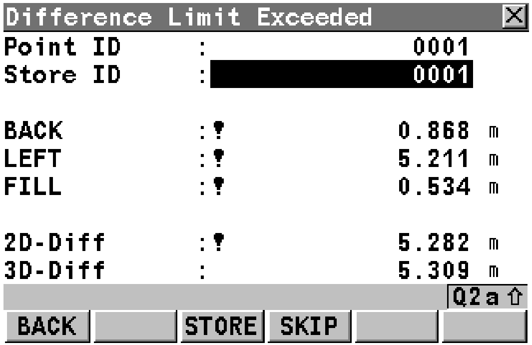
Access

The screen shown below is accessed automatically when the staked point is stored if either of the configured difference limits are exceeded.

STAKEOUT Difference Limit Exceeded

The availability of the fields depends on the configured **<Stake Mode:>**.

The limits that have been exceeded are shown in bold and indicated by a !.



BACK (F1)
To return to **STAKEOUT XX Stakeout** without storing the point. Staking out of the same point continues.

STORE (F3)
To accept the coordinate differences, store the point information and return to **STAKEOUT XX Stakeout**.

SKIP (F4)
To return to **STAKEOUT XX Stakeout** without storing the point. According to filter and sort settings the subsequent point in **<Stakeout Job:>** is suggested for staking out.

Description of fields

Field	Option	Description
<Point ID:>	Output	The point ID of the point to be staked.
<Store ID:>	User input	The unique number which is used to store the staked point. Allows a different point ID to be typed in if needed.
<Δ EASTING:>	Output	The difference of the Easting coordinate between the the point to be staked and the current position.
<Δ NORTHING:>	Output	The difference of the Northing coordinate between the point to be staked and the current position.
<Δ HZ:>	Output	The difference of the horizontal angle to the point to be staked and the current position.
<Δ DISTANCE:>	Output	The difference of the horizontal distance to the point to be staked and the current position.
<FORWARD:>	Output	The horizontal distance from the current position to the point to be staked along the line defined by station and reflector.
<BACK:>	Output	The horizontal distance from the current position to the point to be staked in the reverse direction of the line defined by station and reflector.

Field	Option	Description
<RIGHT:>	Output	Horizontal distance from the current position to the point to be staked orthogonal to the right of the line defined by station and reflector.
<LEFT:>	Output	Horizontal distance from the current position to the point to be staked orthogonal to the left of the line defined by station and reflector.
<CUT:>	Output	The negative height difference from the height of the staked point to the height of the point to be staked.
<FILL:>	Output	The positive height difference from the height of the staked point to the height of the point to be staked.
<2D-Diff:>	Output	Displays the horizontal difference from the staked point to the point to be staked.
<3D-Diff:>	Output	Displays the spatial difference from the staked point to the point to be staked.

Next step

IF the exceeded difference limit	THEN
is not to be accepted	**BACK (F1)** to stake the same point again.

IF the exceeded difference limit	THEN
is to be accepted	**STORE (F3)** to store the point and to stake out the next point.
is not to be accepted but cannot be improved	**SKIP (F4)** to skip staking this point and to stake out the next point.

42 Survey - General

42.1 Accessing Survey

Access

Select **Main Menu: Survey**.

OR

Select **Main Menu: Programs...\Survey**

OR

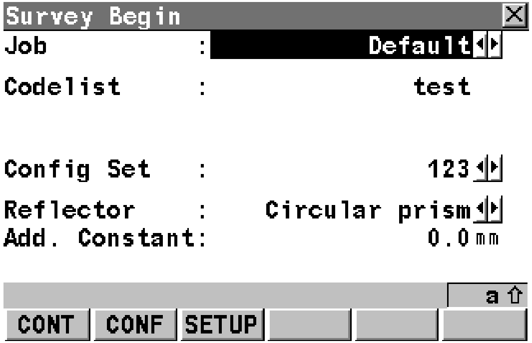
Press a hot key configured to access the screen **SURVEY Survey Begin**.
Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

OR

Press **PROG**. Highlight **Survey**. **CONT (F1)**.
Refer to "31.2 Accessing the Programs Menu" for details on the **PROG** key.



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure SmartCodes, auto points and remote point measurements. Accesses **SURVEY Configuration**. Refer to "43 Survey - Auto Points" and to "44 Survey - Remote Point" for information on the fields and keys.

SETUP (F3)
To set up station. Accesses **SETUP Station Setup**.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.

Field	Option	Description
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) to access **SURVEY Survey: Job Name**, where measurements can be performed with **ALL (F1)** or **DIST (F2)** and/or **REC (F3)**.

42.2 Surveying Points

Description

The Survey application program is used for point measurement. Coordinates for points can be measured and stored using **ALL (F1)**, **DIST (F2)** and **REC (F3)**.

Access step-by-step

The table describes the main access to **SURVEY Survey: Job Name**.

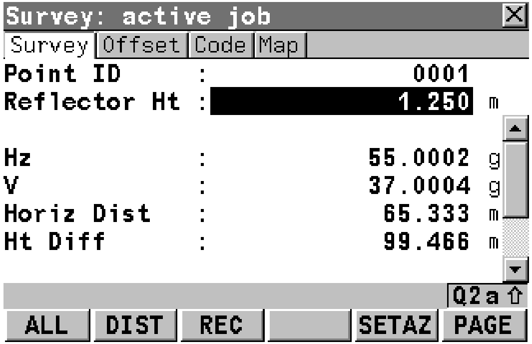
Access is possible from other screens where individual point measurements are needed, for example from **COGO Inverse** with **SURVY (F5)**.

Step	Description
1.	Refer to "42.1 Accessing Survey" to access **SURVEY Survey Begin**.
2.	**SURVEY Survey Begin** **CONT (F1)** to access **SURVEY Survey: Job Name**.

SURVEY Survey: Job Name, Survey page

The fields shown are those from a typical configuration set.The screen described consists of the **Survey** page and the **Map** page. The explanations for the softkeys given below are valid for the **Survey** page. Refer to "30 MapView Interactive Display Feature" for information on the keys on the **Map** page.

The fields and functionality of this screen vary slightly when accessed from other application programs where individual point measurements are needed.



ALL (F1)
To measure and store distances and angles.

STOP (F1)
Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data.
If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

REMOT (F4)
Available if **<Use Remote Pt: Yes>** is set in the **SURVEY Configuration, Remote Pt** page. To access **SURVEY Survey Remote Point**.

SETAZ (F5)
To access the **SETUP Set Stn & Ori - Set Azimuth** screen to set the horizontal angle.
Refer to "40.4.2 Set Azimuth" for information on the **SURVEY Set Stn & Ori - Set Azimuth** screen.

TEST (F5)

To access the **SURVEY EDM Test Signal/Frequency** screen. Available for **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

SHIFT CONF (F2)

To configure auto points and remote point measurements. Accesses **SURVEY Configuration**. When **SHIFT AVGE (F2)** or **SHIFT ABS (F2)** are active, this key is not available. Refer to "43 Survey - Auto Points" and to "44 Survey - Remote Point" for information on the fields and keys.

SHIFT AVGE (F2)

To check the residuals for the averaged point. Available for **<Averaging Mode: Average>** and for more than one measured coordinate triplet recorded for the same point. Refer to "7.3.4 Mean Page".

SHIFT ABS (F2)

To check the absolute difference between the measurements. Available for **<Averaging Mode: Absolute Diffs>** and for more than one measured coordinate triplet recorded for the same point. Refer to "7.3.4 Mean Page".

SHIFT 2FRec (F3)

To aim manually at the target and only record the angle measurement (Hz/V) in Face I and Face II. The point stored is an average of the two measurements.

This hotkey is only available in the Survey program for **<EDM Type: Reflector (RL)>** or **<EDM Type: Reflctrless (IR)>** if **<Automation: None>**.

SHIFT 2FAll (F4)

To take a measurement in Face I and Face II. The point stored is an average of the two measurements.

When using instruments fitted with Aim360, the point is automatically measured in both faces, the resulting point is stored and the instrument is returned to the first face.

This hotkey is only available in the Survey program for **<EDM Type: Reflector (RL)>** or **<EDM Type: Reflctrless (IR)>**.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for measured points. The configured point ID template is used. The ID can be changed: • To start a new sequence of point ID's overtype the point ID. • For AN individual number independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "15.1 ID Templates".
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing the Survey application program. An individual reflector height can by typed in.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Horiz Dist:>	Output	The horizontal distance after **DIST (F2)** was pressed. No distance is displayed when accessing the screen and after **REC (F3)** or **ALL (F1)**.

Field	Option	Description
<Ht Diff:>	Output	The height difference between station and measured point after **DIST (F2)**. Displays ----- when accessing the screen and after **REC (F3)** or **ALL (F1)**.
<Easting:>	Output	Easting coordinate of the measured point.
<Northing:>	Output	Northing coordinate of the measured point.
<Height:>	Output	Elevation of the measured point.

Next step

PAGE (F6) changes to another page on this screen.

43 Survey - Auto Points

43.1 Overview

Description

- Auto points is used to automatically measure and store points at a specific rate. Additionally, individual auto points can be stored outside the defined rate. Auto points logged between starting and stopping logging of auto points form one chain. A new chain is formed each time logging of auto points is started.
- Auto points can be collected in the Survey application program. An **Auto** page is visible when logging of auto points is active.
- Up to two offset points related to one auto point can be logged. The offset points can be both to the left or right and they can be coded independently of each other and of the auto points. Refer to "43.4 Offset Points of Auto Points".

Coding of auto points

Coding of auto points is similar to coding of measured points. Refer to "9 Coding" for information on coding.
The differences are:

- Thematical coding: Always available.
- Free coding: Always available.
- Quick coding: Not available.
- Codes of auto points overwrite the codes of points existing in the active job with the same point ID but with a different code as the auto point.
- Codes of auto points can be changed when no auto points are being logged.
- Up to three attributes can be stored with a code

Properties of auto points

The properties stored with auto points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **Survey (Auto)** or **Survey (Auto Of)**
- Instrument source: **TPS**

Averaging of auto points

An average is never calculated for auto points even if a measured point of class **MEAS** already exists with the same point ID.

43.2 Configuring Auto Points

Access

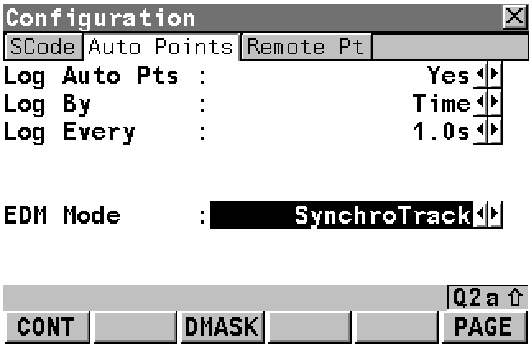
Select **Main Menu: Survey**. In **SURVEY Survey Begin** press **CONF (F2)** to access **SURVEY Configuration**.

OR

In **SURVEY Survey: Job Name** press **SHIFT CONF (F2)** to access **SURVEY Configuration**.

SURVEY Configuration, Auto Points page

The settings on this page activate the logging of auto points and define the method of logging.



CONT (F1)

To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)

Available for **<Log Auto Pts: Yes>**. To configure what is viewed in the **Auto** page in the Survey application program. Refer to paragraph "SURVEY Configure Auto Pts Display Mask".

PAGE (F6)

To change to another page on this screen.

Description of fields

Field	Option	Description
<Log Auto Pts:>	Yes	Activates logging of auto points. ☞ All other fields on the screen are active and can be edited with this setting.
	No	Deactivates logging of auto points and all fields on this screen.
<Log By:>	Time	Auto points are stored according to a time interval.
	Distance	The difference in distance from the last stored auto point, which must be reached before the next auto point is measured. The auto point is stored with the next available measured position.
	Height Diff	The height difference from the last stored auto point, which must be reached before the next auto point is measured. The auto point is stored with the next available measured position.
	Dist or Ht	Before the next auto point is measured, either the difference in distance or the difference in height must be reached. The auto point is stored with the next available measured position.

Field	Option	Description
	Stop & Go	An auto point is stored when the position of the reflector does not move more than the distance configured in **<Stop Position:>** within the **<Stop Time:>**. Once a point has been stored, the position from the point just stored must change more than the distance configured in **<Stop Position:>** before he routine starts again.
	User Decides	An auto point is stored upon pressing **REC (F3)** in **SURVEY Survey: Job Name, Auto** page. In the beginning, the chain to which the auto points should be assigned must be started with **START (F1)**. In the end, the chain must be closed with **STOP (F1)**.
<Log Every:>		Available when: • **<Log By: Time>** • **<Log By: Distance>** • **<Log By: Height Diff>**.
	For **<Log By: Time>** from **0.1s** to **60.0s**	For **<Log By: Time>**. The time interval before the next auto point is logged.
<Min Distance:>	User input	Available for **<Log By: Dist or Ht>**. The value for the difference in distance before the next auto point is logged.

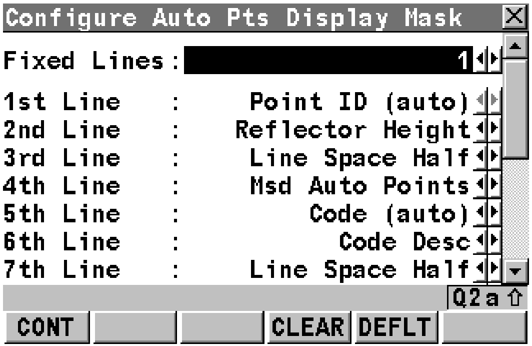
Field	Option	Description
<Min Height:>	User input	Available for **<Log By: Dist or Ht>**. The value for the height difference before the next auto point is logged.
<Stop Position:>	User input	Available for **<Log By: Stop & Go>**. The maximum distance within which the position is considered stationary.
<Stop Time:>	User input	Available for **<Log By: Stop & Go>**. The time while the position must be stationary until an auto point is stored.
<EDM Mode:>	**Tracking**	Continuous distance measurement with 0.3 s measuring time and 5 mm + 2 ppm accuracy. When the logging of auto points has started, **TRK** is displayed as an icon.
	Synchro-Track	Available only for **<EDM Type: Reflector (IR)>**. This is the measurement mode for the interpolation of angle measurements in IR tracking mode. In difference to normal IR tracking mode, where angle measurements are only assigned to certain distance measurements, SynchroTrack will perform a linear interpolation between the previous and following angle measurement, based upon the timestamp of the EDM measurement.

Field	Option	Description
		When the logging of auto points has started, **SYNC** is displayed as an icon.

Next step

IF the display mask	THEN
is not to be configured	**CONT (F1)** closes the screen and returns to the screen from where **SURVEY Configuration, Auto Points** page was accessed.
is to be configured	**DMASK (F3)**. Refer to paragraph "SURVEY Configure Auto Pts Display Mask".

SURVEY
Configure Auto Pts Display Mask



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

CLEAR (F4)
To set all fields to **<XX. Line: Line Space Full>**.

DEFLT (F5)
Available if the active configuration set is a default configuration set. To recall the default settings.

Description of fields

Field	Option	Description
<Fixed Lines:>	From **0** to **5**	Defines how many lines do not scroll in **SURVEY Survey: Job Name, Auto** page when that display mask is used.
<1st Line:>	Output	Fixed to **<1st Line: Point ID (auto)>**.
<2nd Line:> to **<16th Line:>**	**Add. Constant**	Output field for the additive constant of the currently selected reflector.
	Angle Right	Output field for the angle right.
	Annotation 1-4	Input field for comments to be stored with the point.
	Attrib (free) 01-20	Output field for attributes for free codes.
	Attrib (pt) 01-03	Input field for attributes for point codes.
	Azimuth	Output field for the azimuth.
	Code (auto)	Choicelist or input field for auto point codes.
	Code (free)	Output field for free codes.
	Code Desc	Output field for the description of codes.
	Code Desc (free)	Output field for the description of free codes.
	Code Type	Output field for the description of point codes.

Field	Option	Description
	EDM Mode	Output field displaying the current EDM mode.
	EDM Type	Output field displaying the current EDM type.
	Easting	Output field for the Easting coordinate of the measured point.
	Height	Output field for the height coordinate of the measured point
	Height Diff	Output field for the height difference between station and reflector.
	Horiz Dist	Output field for the horizontal distance calculated from the measured slope distance and the vertical angle.
	Hz-Angle	Output field for the horizontal angle.
	Line Space Full	Insert full line space.
	Line Space Half	Insert half line space.
	Longitudinal Tilt	Output field for the longitudinal tilt of the vertical axis.
	Msd Auto Points	Output field for the number of auto points logged after pressing **START (F1)** in **SURVEY Survey: Job Name, Auto** page. Counting starts from 0 every time **START (F1)** is pressed.

Field	Option	Description
	Northing	Output field for the North coordinate of the measured point.
	Offset Cross	Input field for the horizontal distance offset for the measured point, perpendicular to the line of sight.
	Offset Height	Input field for the height offset of the measured point.
	Offset Length	Input field for the horizontal distance offset, in the direction of line of sight.
	Reflector	Output field for the chosen reflector.
	Reflector Height	Input field for the reflector height.
	SD-Last Rec	Output field for the last recorded distance.
	Slope Dist	Output field for the measured slope distance.
	Transversal Tilt	Output field for the transversal tilt of the vertical axis.
	V-Angle	Output field for the vertical angle.

Next steps

Step	Description
1.	**CONT (F1)** closes the screen and returns to **SURVEY Configuration, Auto Points** page.

Step	Description
2.	**CONT (F1)** returns to the screen from where **SURVEY Configuration, Auto Points** page was accessed.

43.3 Auto Points

Requirements

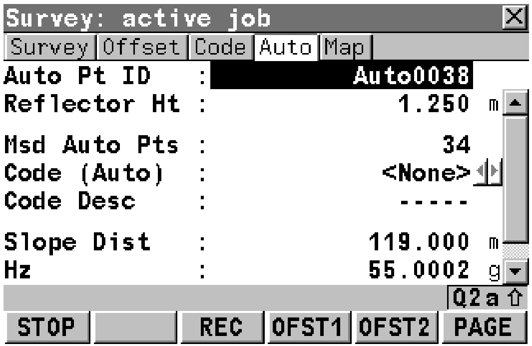
<Log Auto Pts: Yes> in **SURVEY Configuration, Auto Points** page.

Access step-by-step

Step	Description
1.	Refer to "42.1 Accessing Survey" to access **SURVEY Survey Begin**.
2.	**SURVEY Survey Begin** Check the settings.
3.	**CONT (F1)** to access **SURVEY Survey: Job Name**.
4.	**PAGE (F6)** until the **Auto** page is visible.

SURVEY Survey: Job Name, Auto page

The **Auto** page of a typical configuration set is explained. Before logging of auto points has started, the page appears as shown below:



START (F1)
To start logging of auto points and offset points if configured or, for **<Log By: User Decides>** to start the chain to which the auto points should be assigned. The first auto point is stored. **<EDM Mode: Tracking>** becomes active. For **<EDM Type: Reflector (IR)>** instrument locks onto reflector. For **<EDM Type: Long Range (LO)>** **<EDM Type: Reflector (IR)>** is set and instrument locks onto the reflector.

STOP (F1)

To end recording of auto points and offset points if configured or, for **<Log By: User Decides>**, to end the chain to which the auto points are assigned..

REC (F3)

Available for **STOP (F1)**. To store an auto point at any time.

OFST1 (F4)

To configure recording of the first type of offset points. Refer to "43.4 Offset Points of Auto Points".

OFST2 (F5)

To configure recording of a second type of offset points. Refer to "43.4 Offset Points of Auto Points".

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure auto points. Refer to "43.2 Configuring Auto Points".

SHIFT QUIT (F6)

To exit the Survey application program. Point information logged until pressing **SHIFT QUIT (F6)** is saved in the database.

Description of fields

Field	Option	Description
<Auto Pt ID:>	User input	Available unless **<Auto Pts: Time & Date>** in **CONFIGURE ID Templates**. The identifier for auto points. The configured ID template for auto points is used. The ID can be changed. To start a new sequence of point ID's overtype the point ID.
	Time and Date	Available for **<Auto Pts: Time & Date>** in **CONFIGURE ID Templates**. The current local time and date is used as identifier for auto points.
<Reflector Ht:>	User input	The default reflector height as defined in the active configuration set is suggested.
<Msd Auto Pts:>	Output	Available after pressing **START (F1)** and before pressing **STOP (F1)**. The number of auto points measured since **START (F1)** has been pressed.
<Code (Auto):>		The thematical code for the auto point. • If a point code is selected then any open line/area is closed. The occupied point is stored with the selected code idependently of any line/area.

Field	Option	Description
		• If a line code is selected then any open line is closed and a new line with the selected code is created. The line ID is defined by the configured line ID template. The occupied point is assigned to that line. The line stays open until it is closed manually or another line code is selected. • If an area code is selected then the behaviour is as for lines.
	Choicelist	Available for **<Thematc Codes: With Codelist>**. The setting for **<Show Codes:>** in **CONFIGURE Coding & Linework** determines if either all codes or only point codes are available. The attributes are shown as output, input or choicelist fields depending on their definition.
	User input	Available for **<Thematc Codes: Without Codelist>**. Codes can be typed in but not selected from a codelist. A check is performed to see if a code of this name already exists in the job. If so, the according attributes are shown. Configure a display mask with a choicelist for code types to define if a point, line or area code is typed in.

Field	Option	Description
<Code Desc:>	Output	The description of the code.
<Slope Dist:>	Output	The measured slope distance. When **START (F1)** is pressed, **<EDM Mode: Tracking>** is set and the slope distance is constantly updated.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.

Next step

IF	THEN
auto points are to be logged	**START (F1)**. Then, for <Log By: User Decides>, **REC (F3)** whenever an auto point is to be stored.
offset points are to be configured	**OFST1 (F4)** or **OFST2 (F5)**. Refer to "43.4 Offset Points of Auto Points".

43.4 Offset Points of Auto Points

43.4.1 Overview

Description

Offset points

- can be created with auto points when auto points are stored to the database.
- can be to the left or to the right of auto points.
- are automatically computed with the logging of auto points, if configured.
- form a chain relative to the chain of auto points to which they are related. Subsequently computed chains are independent from each other.
- can be coded independently of auto points.
- have the same time of when they were stored as the auto points to which they are related.
- have the same coding functionality, properties and averaging functionality as auto points. Refer to "43.1 Overview".

Up to two offset points can be related to one auto point.
The screens for the configuration of offset points are identical except for the title **Auto Points - Offset 1** and **Auto Points - Offset 2**. For simplicity, the title **Auto Points - Offset** is used in the following description.

Computation of offset points

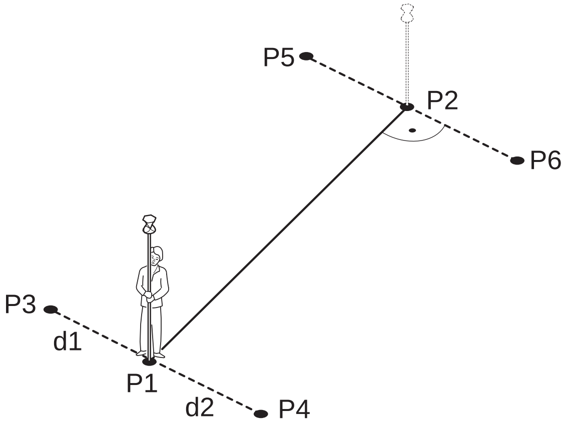
The computation of offset points depends on the number of auto points in one chain.

One auto point

No offset points are computed or stored.

Two auto points

The configured offsets are applied perpendicular to the line between two auto points.



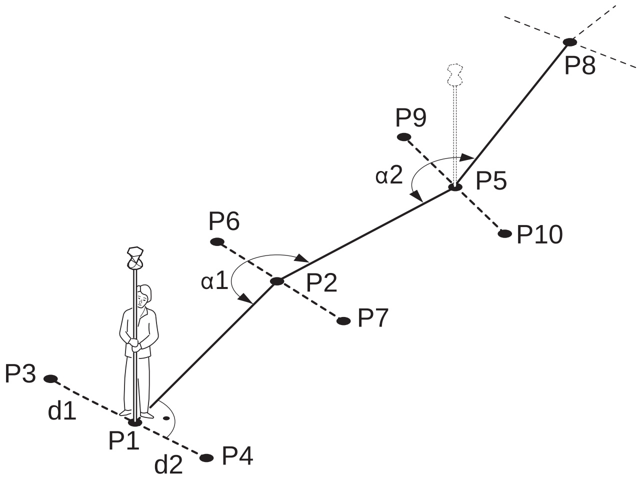
P1	First auto point
P2	Second auto point
P3	First offset point for P1
P4	Second offset point for P1
P5	First offset point for P2
P6	Second offset point for P2
d1	Horizontal offset to the left
d2	Horizontal offset to the right

Three or more auto points

The first offset points are computed perpendicular to the line between the first and the second auto point.

The last offset point is computed perpendicular to the line between the last auto point and the one before.

All other offset points are computed on a bearing. The bearing is half of the angle between the last and the next measured auto point.



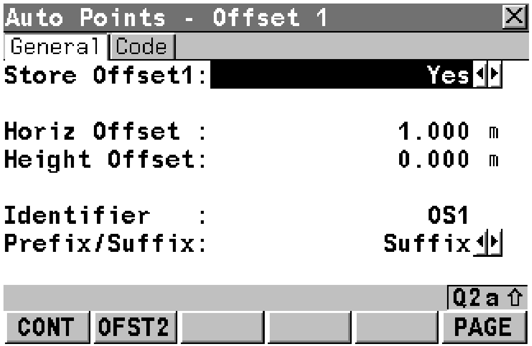
P1 First auto point
P2 Second auto point
P3 First offset point for P1
P4 Second offset point for P1
P5 Third auto point
P6 First offset point for P2
P7 Second offset point for P2
P8 Fourth auto point
P9 First offset point for P5
P10 Second offset point for P5
d1 Horizontal offset to the left
d2 Horizontal offset to the right
α1 Angle between P1 and P5
α2 Angle between P2 and P8

43.4.2 Configuring Offset Points

Access step-by-step

Step	Description
1.	Refer to "42.2 Surveying Points" to access **SURVEY Survey: Job Name**.
2.	**PAGE (F6)** until the **Auto** page is active.
3.	**OFST1 (F4)** or **OFST2 (F5)** to access **SURVEY Auto Points - Offset**.

SURVEY Auto Points - Offset, General page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

OFST2 (F2) and **OFST1 (F2)**
To switch between configuring offset point type one and two.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Store Offset1:> and **<Store Offset2:>**	**Yes**	Activates logging of offset points. ☞ All other fields in the screen are active and can be edited with this setting.
	No	Deactivates logging of offset points and all fields in this screen.
<Horiz Offset:>	User input	The horizontal offset between -1000 m and 1000 m at which the offset point is collected.
<Height Offset:>	User input	The height offset between -100 m and 100 m from the related auto point.
<Identifier:>	User input	The identifier with up to four characters is added in front of or at the end of the ID of the auto point. This ID is then used as the point ID for the related offset point. This could support an automatic workflow into CAD packages including setting symbols and stringing lines.
<Prefix/Suffix:>	**Prefix**	Adds the setting for **<Identifier:>** in front of the auto point ID.
	Suffix	Adds the setting for **<Identifier:>** at the end of the auto point ID.

Next step
PAGE (F6) changes to the **Code** page.

SURVEY
Auto Points - Offset, Code page

The setting for **<Thematc Codes:>** in **CONFIGURE Coding & Linework** determines the availability of the fields and softkeys.

CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

NEW-A (F2)
Available for **<Thematc Codes: With Codelist>**. To create additional attributes for the selected **<Point Code:>**.

NAME (F3) or **VALUE (F3)**
Available for **<Thematc Codes: With Codelist>**. Available for attributes for which an attribute name can be typed in. To highlight **<Attribute n:>** or the field for the attribute value. The name of **<Attribute n:>** can be edited and an attribute value can be typed in.

LAST (F4)
Available for **<Thematc Codes: With Codelist>**. To recall the last used attribute values for the selected code.

DEFLT (F5)
Available for **<Thematc Codes: With Codelist>**. To recall the default attribute values for the selected code.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Point Code:>	Choicelist	The thematical code for the offset point. Available for **<Thematc Codes: With Codelist>**. The setting for **<Show Codes:>** in **CONFIGURE Coding & Linework** determines if either all codes or only point codes are available. The attributes are shown as output, input or choicelist fields depending on their definition.
<Code:>	User input	The thematical code for the offset point. Available for **<Thematc Codes: Without Codelist>**. Codes can be typed in but not selected from a codelist. A check is performed to see if a point code of this name already exists in the job. If so, the according attributes are shown.
<Code Desc:>	Output	Available for **<Thematc Codes: With Codelist>**. The description of the code.
<Attribute n:>	User input	Available for **<Thematc Codes: Without Codelist>**. Up to three attribute values can be stored.

Next step

IF	THEN
offset point configuration is finished	**CONT (F1)** to return to **SURVEY Survey: Job Name**.
a second offset point is to be configured	**PAGE (F6)** and then **OFST2 (F2)** or **OFST1 (F2)** to change to **SURVEY Auto Points - Offset** for the second point.

Example for offset point ID's

The offset point ID is a combination of the auto point ID and an identifier as prefix or suffix.

The right most part of the auto point ID is incremented within the point ID. The auto point ID is truncated from the left if the length of the auto point ID plus identifier prefix or suffix is greater than 16 characters.

Auto point ID	Identifier	Prefix/Suffix	Offset point ID
Auto1234 Auto1235	OS1	Prefix	OS1Auto1234 OS1Auto1235 ...
Auto1234 Auto1235	OS1	Suffix	Auto1234OS1 Auto1235OS1 ...

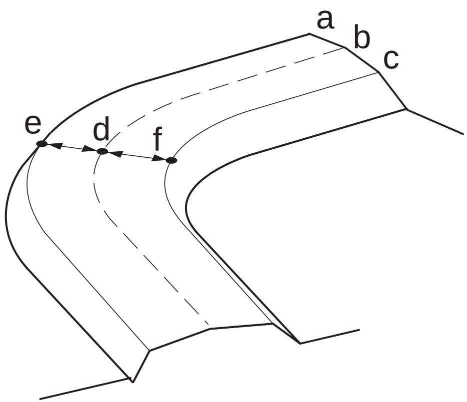
☞ Refer to "15.1 ID Templates" for more information on point ID's.

43.4.3 Working Example

Description

Application:	Pick up points along the centreline, to the right and to the left of a road.
Goal:	Points are to be picked up automatically every 5 m while walking along the centreline. The points to the right and to the left of the road are to be picked up automatically with those of the centreline. The auto point ID's are CL0001, CL0002,.... The offset point ID's are OSCL0001, OSCL0002,... for the right side of the road and CL0001OS, CL0002OS,... for the left side. The offset to the right and to the left is 3 m. The height difference is -0.3 m to the right and 0.3 m to the left.

Diagram



a) Left side of the road
b) Centreline
c) Right side of the road
d) CL0001
e) OSCL0001
f) CL0001OS

☞

- The default display mask for **SURVEY Survey: Job Name**, **Auto** page is used.
- **<Distance Unit: Metres (m)>** in **CONFIGURE Units & Formats**, **Units** page.
- An ID template for the auto points is configured. Refer to "15.1.6 Working Example" for information on how to configure ID templates.

Field procedure step-by-step

Step	Description
1.	**Main Menu: Survey**.
2.	**SURVEY Survey Begin** Select a job, a reflector and a configuration set with the settings mentioned above.

Step	Description
3.	**CONF (F2)** to access **SURVEY Configuration**.
4.	**SURVEY Configuration**, **Auto Points** page **<Log Auto Pts: Yes>** **<Log By: Distance>** **<Log Every: 5.0000>**
5.	**CONT (F1)** to return to **SURVEY Survey Begin**.
6.	**CONT (F1)** to access **SURVEY Survey: Job Name**.
7.	**PAGE (F6)** until the **Auto** page is active.
8.	**OFST1 (F4)** to configure the offset points for the right side of the road.
9.	**SURVEY Auto Points - Offset 1, General** page **<Store Offset1: Yes>** **<Horiz Offset: 3.0000>** **<Height Offset: -0.3000>** **<Identifier: OS>** **<Prefix/Suffix: Prefix>**
10.	**OFST2 (F2)** to configure the offset points for the left side of the road.
11.	**SURVEY Auto Points - Offset 2, General** page **<Store Offset2: Yes>** **<Horiz Offset: -3.0000>** **<Height Offset: 0.3000>**

Step	Description
	<Identifier: OS> **<Prefix/Suffix: Suffix>**
12.	**CONT (F1)** closes the screen and returns to **SURVEY Survey: Job Name**, **Auto** page.
13.	**SURVEY Survey: Job Name**, **Auto** page **START (F1)** starts logging of auto points and offset points.
14.	Walk along the centreline of the road as far as points need to be picked up.
☞	**OFST1 (F4)** to change the offset or the height difference between the auto points on the centreline and the right side of the road.
☞	**OFST2 (F5)** to change the offset or the height difference between the auto points on the centreline and the left side of the road.
15.	**STOP (F1)** ends recording of auto points and offset points.
☞	The stopping measuring auto points is indicated in the EDM icon.
16.	After finishing the survey, import the data into a CAD package. If the offset point ID's or codes fulfill the requirements of the CAD package, the offset points to the right and to the left of the road are automatically strung together.

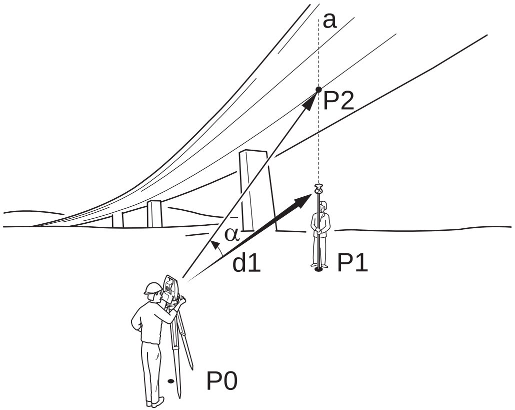
44 Survey - Remote Point

44.1 Overview

Description

Remote point is used to determine the 3D coordinates of inaccessible points, for example on bridges. The horizontal distance to a base point directly underneath or above the remote point is measured. Then the instrument is aimed at the remote point. The coordinates of the remote point are calculated with the distance measured to the base point and the angles measured to the remote point.

Diagram



P0	Instrument station
P1	Base point
P2	Remote point
d1	Horizontal distance to the base point
α	Vertical angle between base point and remote point
a	Vertical axis from P1 to P2

☞ To ensure correct results, the remote point and the reflector must be lined up vertically. If it is not possible to maintain an exactly vertical line, the acceptable

<Hz Dist Tol:> must be chosen. The horizontal distance to the remote point and to the base point should coincide.

Properties of remote points

The properties stored with auto points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **Survey (Rem Pt)**
- Instrument source: **TPS**

Averaging of remote points

An average can be calculated for remote points if a measured point of class MEAS already exists with the same point ID. The average flag for the point is **AUTO**.

44.2 Accessing Remote Point

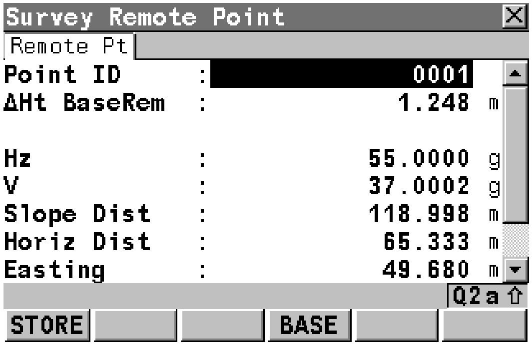
Remote point measurements are possible from the Survey application program when **<Use Remote Pt: Yes>** is set in the **SURVEY Configuration, Remote Pt** page and a valid distance measurement is available. Refer to "44.3 Configuring Remote Point".

Unless **<Display Mask: None>** in **SURVEY Configuration, Remote Pt** page, this screen contains an additional, user defined display mask.

Access

REMOT (F4) in **SURVEY Survey: Job Name** after one point is measured.

SURVEY Survey Remote Point, Remote Pt page



STORE (F1)
Stores the remote point. Stays in the **SURVEY Survey Remote Point** screen.

BASE (F4)
Returns to **SURVEY Survey: Job Name**. The distance measurement is cleared.

Description of fields

Field	Option	Description
<Point ID:>	User input	Displays the point ID for the remote point. The point ID in **SURVEY Survey Remote Point** is always identical to the point ID in **SURVEY Survey: Job Name**.
<ΔHt BasRem:>	Output	The elevation difference between the base point and the remote point.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Slope Dist:>	Output	The current slope distance to the remote point calculated from the horizontal distance to the base point and the current vertical angle.
<Horiz Dist:>	Output	The horizontal distance measured to the base point.
<Easting:>	Output	Calculated Easting coordinate for the remote point.
<Northing:>	Output	Calculated Northing coordinate for the remote point.
<Height:>	Output	Calculated height for the remote point.

Next step

IF	THEN
if a remote point is to be stored	**STORE (F1)**.
a new base point is to be measured	**BASE (F4)** to return to **SURVEY Survey: Job Name**.

44.3 Configuring Remote Point

Access

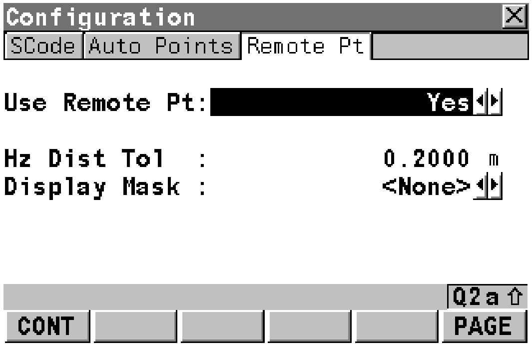
Select **Main Menu: Survey**. In **SURVEY Survey Begin** press **CONF (F2)** to access **SURVEY Configuration**. **PAGE (F6)** until the **Remote Pt** page is active.

OR

In **SURVEY Survey: Job Name** press **SHIFT CONF (F2)** to access **SURVEY Configuration**. **PAGE (F6)** until the **Remote Pt** page is active.

SURVEY Configuration, Remote Pt page

The settings on this screen activate the remote point function.



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted. Refer to "15.2 Display Settings".

Description of fields

Field	Option	Description
<Use Remote Pt:>	**Yes**	Activates the remote point function. **REMOT (F4)** is added to the function keys in **SURVEY Survey: Job Name**.
	No	Deactivates the remote point function, **REMOT (F4)** is not available in **SURVEY Survey: Job Name**.
<Hz Dist Tol:>	User input	The horizontal distance to the remote point is equal to the horizontal distance of the base point. The value for **<Hz Dist Tol:>** is the maximum tolerated length of the chord between the base point and the remote point.
<Display Mask:>	Choicelist	Displays **<None>** until a display mask is chosen. All display masks from **Main Menu: Config...\Survey Settings...\Display Settings** can be selected.

Next step

CONT (F1) to return to the screen **SURVEY Configuration** was accessed from.

44.4 Working Example

Description

Application:	Pick up points along a bridge. The points to be measured are not directly accessible with a reflector.
Working technique:	Remote point surveying.
Settings:	**<Use Remote Pt: Yes>** in the **SURVEY Configuration, Remote Pt** page.

Measuring remote points step-by-step

Step	Description
☞	The reflector height at the base point is always applied in the calculation of the base point elevation. For the calculation of the remote point elevation the reflector height is automatically set to zero.
1.	Aim at the reflector that is placed at the base point, which is directly underneath the remote point to be measured.
2.	**SURVEY Survey: Job Name** **DIST (F2)** to measure the horizontal distance to the base point.
3.	**REMOT (F4)**.
4.	Aim at the remote point to be measured.
5.	**SURVEY Survey Remote Point, Remote Pt** page **STORE (F1)** to measure and store the angle measurements and calculated coordinates for the remote point.

Step	Description
6.	**BASE (F4)** to return to **SURVEY Survey: Job Name** and measure a new base point.

45 Survey Cross Section

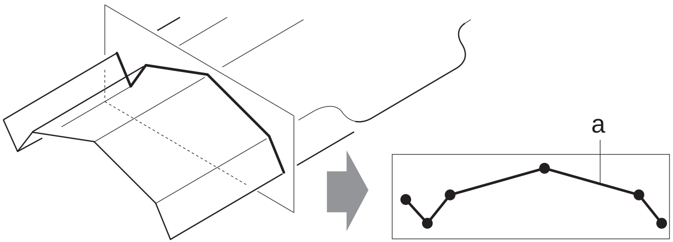
45.1 Overview

Description

The Survey Cross Section application program allows for the automatic changing of codes during a survey. This is particularly useful when surveying multiple cross sections. Examples could include surveys of railway lines, roads, small waterways, driveways and paths.

The codes for the elements in the cross section to be surveyed are all stored and pre-defined in a template. The codes are then automatically changed after each point observation.

Diagram



a) Cross section element

Template

Templates are used to pre-define the order of the codes for the survey.
A template pre-defines

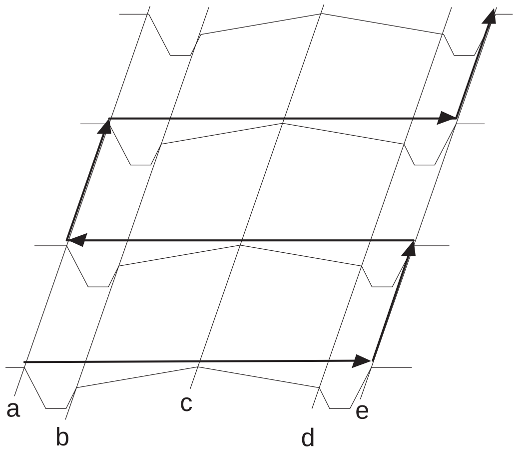
- the coding sequence of a cross section.
- the type of coding.

Cross section methods and directions

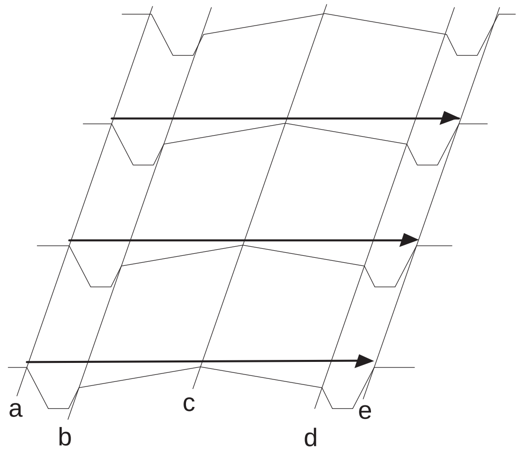
Templates can be applied

- to the ZigZag method or the Same Direction method.
- in either a forward direction or in a backward direction.

ZigZag



Same Direction



Coding of cross section elements

Codes can be attached to cross section elements. Refer to "9 Coding" for information on coding.

- Thematical coding: Available
- Free coding: Available
- Quick coding: Not available

Refer to "9.6 Code and Attribute Mismatch" for information on solving a code and/or attribute mismatch.

Properties of cross section points

The properties stored with cross section points are:

- Class: **MEAS**.
- Sub class: **TPS**.
- Source: **Cross Section**.
- Instrument source: **TPS**.

Averaging of cross section elements

The principles for averaging are identical to those of the Survey application program. Refer to "7.3.4 Mean Page" for information on averaging.

Exporting data

The points and lines are recorded as for all other application programs. The data can be exported as normal.

45.2 Accessing Survey Cross Section

Access

Select **Main Menu: Programs...\Survey Cross Section**.

OR

Press **PROG**. Highlight **Survey Cross Section**. **CONT (F1)**.

Refer to "31.2 Accessing the Programs Menu" for details on the **PROG** key.

OR

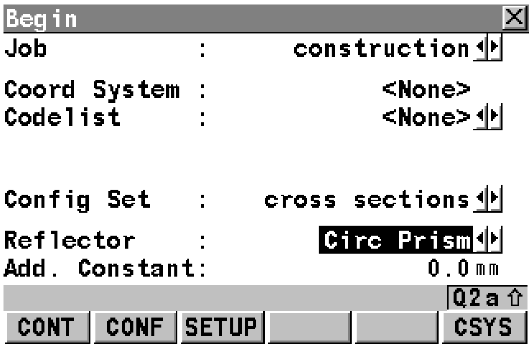
Press a hot key configured to access the screen **X-SECTION Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

X-SECTION Begin



CONT (F1)
To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure Survey Cross Section application program. Accesses **X-SECTION Configuration**. Refer to "45.3 Configuring Survey Cross Section".

SETUP (F3)
To set up the station. Accesses **SETUP Station Setup**.

Description of fields

Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

IF the Survey Cross Section application program	THEN
is to be accessed	**CONT (F1)** accepts the changes and accesses Survey Cross Section application program. Refer to "45.4 Surveying Cross Sections".
is to be configured	**CONF (F2)**. Refer to "45.3 Configuring Survey Cross Section".

45.3 Configuring Survey Cross Section

Access

Select **Main Menu: Programs...\Survey Cross Section**. In **X-SECTION Begin** press **CONF (F2)** to access **X-SECTION Configuration**.

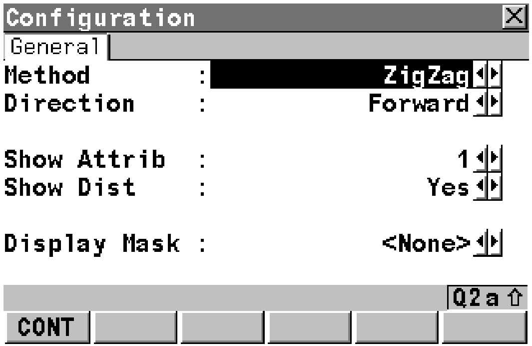
OR

Press **PROG**. Highlight **Survey Cross Section**. **CONT (F1)**. In **X-SECTION Begin** press **CONF (F2)** to access **X-SECTION Configuration**.

OR

Press **SHIFT CONF (F2)** in **X-SECTION Survey: Job Name**.

X-SECTION Configuration, General page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

DMASK (F3)
To edit the display mask currently being displayed in this field. Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted on **General** page. Refer to "15.2 Display Settings".

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Method:>		Method by which subsequent cross sections will be surveyed. Refer to "45.1 Overview" for a diagram.
	ZigZag	Each new cross section is started at the same end as where the previous cross section finished.
	Same Direction	Each new cross section is started at the same end as where the previous cross section started.
<Direction:>		The way of surveying the cross section. This influences in which order the elements of a template will be applied. Refer to "45.1 Overview" for a diagram.
	Forward	The cross sections will be surveyed in the same way as the elements are defined in the selected **<Template:>** in **X-SECTION Survey: Job Name**.
	Backward	The cross sections will be surveyed in the reverse way as the elements are defined in the selected **<Template:>** in **X-SECTION Survey: Job Name**.

Field	Option	Description
<Show Attrib:>		Defines which attribute field is displayed in **X-SECTION Survey: Job Name**. Useful if the surveyor is stringing - can then see that the correct string attribute value is being used.
	Do Not Show	No attribute field is displayed in **X-SECTION Survey: Job Name**.
	From **1** to **20**	The attribute field which is displayed in **X-SECTION Survey: Job Name**.
<Show Dist:>	**Yes** or **No**	Activates an output field in **X-SECTION Survey: Job Name**. The horizontal grid distance from the current position to the point last surveyed for the same cross section will be displayed.
<Display Mask:>	Choicelist	The user defined display mask is shown in **X-SECTION Survey: Job Name**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.

Next step

CONT (F1) returns to the screen from where this screen was accessed.

45.4 Surveying Cross Sections

Description

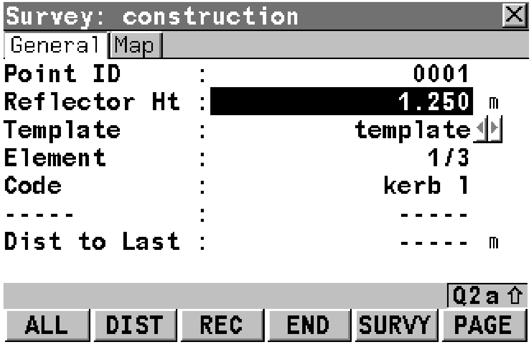
The fields on this screen indicate which cross section element is to be surveyed next.

Access step-by-step

Step	Description
1.	Refer to "45.2 Accessing Survey Cross Section" to access **X-SECTION Begin**.
2.	In **X-SECTION Begin** select a job.
3.	Select an appropriate configuration set.
4.	Select a reflector.
5.	**CONT (F1)** to access **X-SECTION Survey: Job Name**, **General** page.

X-SECTION Survey: Job Name, General page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.



ALL (F1)
To measure and store distances and angles.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data.
If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

START (F4) and **END (F4)**
To open and close the selected cross section template. While the template is open, the elements of the cross section can be surveyed.

SURVY (F5)
To manually occupy a point that is not part of the cross section. The point is not treated as an element of the cross section. The open template remains open.
Available if a template has been opened with **START (F4)**.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure the Cross Section Survey application program. Refer to "45.3 Configuring Survey Cross Section".

SHIFT PREV (F3)

To select the previous element of the cross section template. The currently measured element will not be stored. Available for **STOP (F4)** being displayed.

SHIFT NEXT (F4)

To select the next element of the cross section template. The currently measured element will not be stored. Available for **STOP (F4)** being displayed.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**

To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates".

SHIFT QUIT (F6)

To exit Cross Section Survey application program. An open template will be closed.

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways: • To start a new sequence of point ID's type over the point ID. • For an individual point ID independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "15.1 ID Templates".
<Reflector Ht:>	User input	The reflector height.
<Template:>		The active template for the cross section.
	Choicelist	The cross section template is closed. Opening the choicelist accesses **X-SECTION Templates** where a new template can be created and an existing template can be selected or deleted. Refer to "45.5 Cross Section Templates". ----- is displayed if no template is defined.
	Output	The cross section template is open.
<Element:>	Output	Displayed as x/y.

Field	Option	Description
		x Number of next element on active template. The number increases/decreases as moving across the cross section depending on the selection for **<Method:>** in **X-SECTION Configuration**. y Total number of elements on active template.
<Code:>	Output	The name of the code. Point codes will be stored with the measured point. Free codes will be stored, depending on the configuration, before or after the measured point.
<Stringline ID:>	Output	Available for **<String Attrib:>** being activated in **CONFIGURE Coding & Linework**, **Coding** page. Points that have the same code attached and belong to different cross sections are strung to one line.
<Dist to Last:>	Output	The horizontal grid distance from the current position to the last surveyed point. ----- is displayed for unavailable information.

Next step

IF	THEN
a cross section template is to be opened	select the desired **<Template:>**. **START (F4)**.
an element of a cross section is to be surveyed	**ALL (F1)**
a cross section template is to be closed	select the desired **<Template:>**. **END (F4)**.
data is to be viewed graphically	**PAGE (F6)**. Refer to paragraph "X-SECTION Survey: Job Name, Map page".
the screen is to be quit	**ESC**.

X-SECTION Survey: Job Name, Map page

The **Map** page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

An element of a cross section template can also be surveyed from the **Map** page.

Next step

PAGE (F6) changes to the first page on this screen.

45.5 Cross Section Templates

45.5.1 Accessing Cross Section Template Management

Description

Cross section templates
- pre-define the sequence of codes for a cross section.
- consist of elements.

Elements can be defined such that the surveyed points of a cross section are
- stored with a point code.
- stored with a free code.

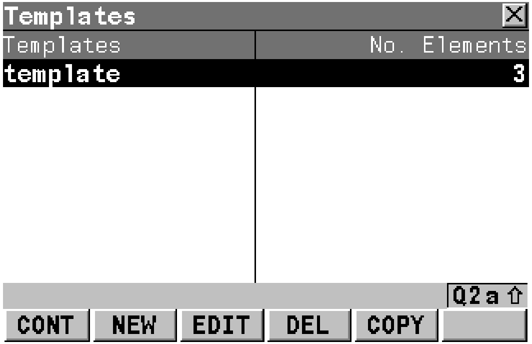
During the process of surveying a cross section, the code for the next element to be occupied is then selected and suggested automatically.

Access step-by-step

Step	Description
1.	Refer to "45.4 Surveying Cross Sections" to access **X-SECTION Survey: Job Name**.
2.	**X-SECTION Survey: Job Name**, **General** page Open the choicelist for **<Template:>**.

X-SECTION Templates

All cross section templates stored in the active job are listed in alphabetical order, including the number of elements in each cross section template.



CONT (F1)
To select the highlighted cross section template and to return to the screen from where this screen was accessed.

NEW (F2)
To create a cross section template. Refer to "45.5.2 Creating a New Cross Section Template".

EDIT (F3)
To edit the highlighted cross section template. Refer to "45.5.3 Editing a Cross Section Template".

DEL (F4)
To delete the highlighted cross section template.

COPY (F5)
To create a cross section template based on the one currently highlighted.

Next step

IF a cross section template	THEN
is to be selected	highlight the desired cross section template. **CONT (F1)** closes the screen and returns to the screen from where **X-SECTION Templates** was accessed.

IF a cross section template	THEN
is to be created	**NEW (F2)**. Refer to "45.5.2 Creating a New Cross Section Template".
is to be edited	highlight the cross section template and **EDIT (F3)**. Refer to "45.5.3 Editing a Cross Section Template".
is to be created based on an existing template	**COPY (F5)**. Refer to "45.5.2 Creating a New Cross Section Template".

45.5.2 Creating a New Cross Section Template

Access

Step	Description
1.	Open the choicelist for **<Template:>** in **X-SECTION Survey: Job Name**, **General** page.
2.	**X-SECTION Templates** Is a cross section template to be created from scratch? • If **yes**, **NEW (F2)** to access **X-SECTION New Template**. • If **no**, **COPY (F5)** to access **X-SECTION New Template**.

X-SECTION New Template, General page

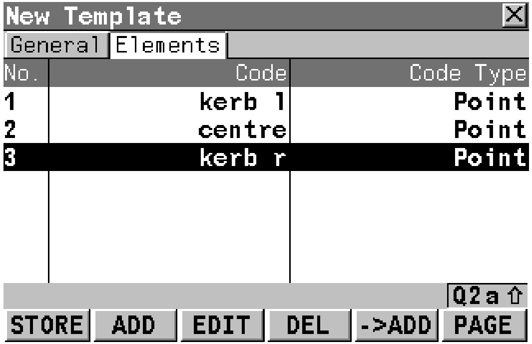
Type in a name for the new cross section template.

Next step

PAGE (F6) changes to the **Elements** page. Refer to paragraph "X-SECTION New Template, Elements page".

X-SECTION New Template, Elements page

IF this screen was accessed with	THEN
NEW (F2)	all columns are empty.
COPY (F5)	the same elements are listed as were being used for the template highlighted when **COPY (F5)** was pressed.



STORE (F1)
To store the cross section template and to return to the screen from where this screen was accessed.

ADD (F2)
To add one or several element(s) to the cross section template. Refer to paragraph "X-SECTION Add Element".

EDIT (F3)
To edit the highlighted element. Refer to paragraph "X-SECTION Add Element".

DEL (F4)
To delete the highlighted element from the cross section template.

->ADD (F5)
To insert one element before the currently highlighted element of the cross section template. Refer to paragraph "X-SECTION Add Element".

PAGE (F6)
To change to another page on this screen.

Description of columns

Field	Description
No.	The number of the element.
Code	The code assigned to the element. ----- is displayed if no code is assigned to the element.

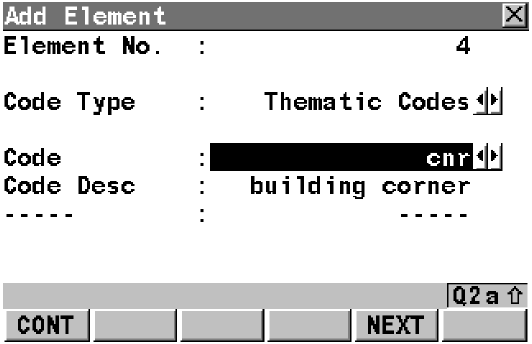
Field	Description
Code Type	The type of the code assigned to the element.

Next step

IF	THEN
the creation of a template is finished	**STORE (F1)**.
an element is to be added	**ADD (F2)** or **->ADD (F5)**. Refer to paragraph "X-SECTION Add Element".
an element is to be edited	**EDIT (F3)**. Refer to paragraph "X-SECTION Add Element".

X-SECTION Add Element

The functionality of the screens **X-SECTION Insert Element** and **X-SECTION Edit Element in Template** is very similar. Differences to **X-SECTION Add Element** are outlined below.



CONT (F1)
To add the element at the end of the cross section template or to store the changes.
To return to the screen from where this screen was accessed.

NEXT (F5)
Available in **X-SECTION Add Element**.
To add the element at the end of the cross section template. To stay in this screen and create the next element.

PREV (F5)
Available in **X-SECTION Edit Element in Template**.
To store the changes. To stay in this screen and edit the previous element.

NEXT (F6)
Available in **X-SECTION Edit Element in Template**.
To store the changes. To stay in this screen and add the next element.

Description of columns

Field	Option	Description
<Element No.:>	Output	For **X-SECTION Add Element** and **X-SECTION Insert Element**: The number of the element to be added. For **X-SECTION Edit Element in Template**: Displayed as x/y. x Number of the element to be edited. y Total number of elements on the active template.
<Code Type:>		The type of code to be used with the element.
	Free Code	To store a code independent of the element as time related information.
	Thematic Codes	To store a code together with the element.
<Rec Free Code:>	**After Point** or **Before Point**	Available for **<Code Type: Free Code>**. Determines if a free code is stored before or after the point.
<Code (free):>	Choicelist	The code which will be stored before or after the point/line. Available for **<Code Type: Free Code>**.

Field	Option	Description
<Code:>	Choicelist	The code which will be stored with the next point/line. Available for **<Code Type: Thematic Codes>**.
Attribute name	Output	The attribute and the attribute value which will be stored with the point/line. Available unless **<Show Attrib: Do Not Show>** in **X-SECTION Configuration**.

Next step

CONT (F1) adds the element or stores the changes and returns to **X-SECTION New Template**, **Elements** page.

45.5.3 Editing a Cross Section Template

Access

Refer to "45.2 Accessing Survey Cross Section" to access **X-SECTION Templates**.

Edit cross section template step-by-step

Step	Description
1.	In **X-SECTION Templates** highlight the cross section template to be edited.
2.	**EDIT (F3)** to access **X-SECTION Edit Template**, **General** page.
3.	**X-SECTION Edit Template** All the following steps are identical with the creation of a new cross section template. Refer to "45.5.2 Creating a New Cross Section Template".

45.6 Working Example

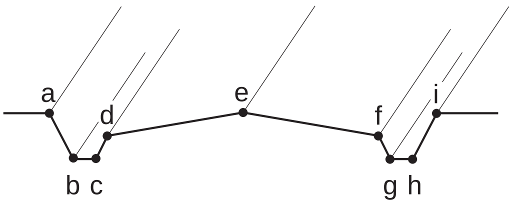
Description

Application: Surveying a road, taking the same cross sections at particular intervals.

Goal: The points of each cross section are to be picked up. Codes are assigned automatically. The codes are shown in the diagram.

Each new cross section is started at the same end as where the previous cross section finished.

Diagram



a) Top of bank 1, TB1
b) Bottom of bank 1, BB1
c) Bottom of bank 2, BB2
d) Edge of bitumen 1, EB1
e) Center line, CL
f) Edge of bitumen 2, EB2
g) Bottom of bank 3, BB3
h) Bottom of bank 4, BB4
i) Top of bank 2, TB2

Requirements

- A codelist containing the codes TB1, BB1, BB2, EB1, CL, EB2, BB3, BB4 and TB2 has been created in GGO and loaded onto the receiver.

Field procedure step-by-step

The following table explains the most common settings. Refer to the stated chapter for more information on screens.

Step	Description	Refer to chapter
1.	Start the Survey Cross Section application program.	45.2
2.	**X-SECTION Begin** **<Codelist:>** The codelist containing the point codes TB1, BB1, BB2, EB1, CL, EB2, BB3, BB4 and TB2 must be displayed. Check the settings.	45.2 8.3
3.	**CONF (F2)**	
4.	**X-SECTION Configuration** **<Method: ZigZag>** **<Direction: Forward>** **<Show Dist: Yes>**	45.3
5.	**CONT (F1)**	
6.	Have cross section templates been defined yet? • If **yes**, continue with step 18. • If **no**, continue with step 7.	
7.	**OK (F4)** to confirm the information message and to access **X-SECTION New Template**.	
8.	**X-SECTION New Template**, **General** page	45.5.2

Step	Description	Refer to chapter
	<Template Name:> Type in a name for the new cross section template.	
9.	**PAGE (F6)** to access **X-SECTION New Template**, **Elements** page	
10.	**ADD (F2)** to access **X-SECTION Add Element**.	
11.	**X-SECTION Add Element** **<Code Type: Thematic Codes>** **<Code: TB1>**	45.5.2
12.	**NEXT (F5)** adds the element to the cross section template and stays in this screen to create the next element.	
13.	Repeat steps 11. and 12. for the next seven elements.	
14.	Repeat step 11. for the last element.	
15.	**CONT (F1)** to add the element to the cross section template and to return to **X-SECTION New Template**.	
16.	**STORE (F1)** to store the new cross section template and to return to **X-SECTION Templates**.	
17.	**X-SECTION Templates** The newly created template is highlighted.	
18.	**CONT (F1)** to access **X-SECTION Survey: Job Name**.	
19.	**X-SECTION Survey: Job Name**	45.4

Step	Description	Refer to chapter
	<Element: 1/5> **<Code: TB1>**	
☞	Open the choicelist for **<Templates:>** to create a new cross section template or to select or delete an existing template.	
20.	**START (F4)** to open the template.	
21.	Go to the beginning of the first cross section.	
22.	**ALL (F1)** to measure and store the element.	
23.	Repeat steps 22. for the remaining four elements.	
24.	Go to the position for the next cross section. **<Dist To Last:>** displays the interval.	
☞	Since working in ZigZag mode, the next cross section starts "at the end", this means with TB2.	
25.	Continue until all cross sections are surveyed.	
26.	**END (F4)** to close the template.	
27.	**SHIFT QUIT (F6)** to quit the screen.	

46 Traverse

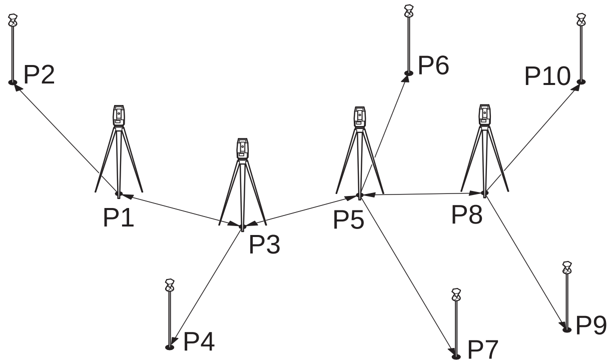
46.1 Overview

Description

The Traverse application is to fulfil one of the most common operations done by surveyors to establish a control point base system to be used as a skeleton for other survey operations for example topographic survey, point stakeout, line stakeout or road stakeout.

Types of traverse

- External reference & closed loop
- Internal reference & position check
- Open end & position check
- Closed end traverse



TPS12_140

P1 Traverse point
P2 Backsight point
P3 Traverse point
P4 Sideshot point
P5 Traverse point
P6 Sideshot point
P7 Sideshot point
P8 Closing point
P9 Sideshot point
P10 Closing angle point

Properties of Traverse points

The properties stored with the Traverse points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **Traverse**
- Instrument: **TPS**

Averaging of Traverse points

An average point of class **MEAS** is calculated by the Traverse application program.

46.2 Accessing Traverse

Access

Select **Main Menu: Programs...\Traverse**.

OR

Press **PROG**. Highlight Traverse. **CONT (F1)**.

Refer to "31.2 Accessing the Programs Menu" for details on the **PROG** key.

OR

Press a hot key configured to access the screen **TRAVERSE Traverse Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

TRAVERSE Traverse Begin

CONT (F1)
To accept changes and to access the subsequent screen. The chosen settings become active.

CONF (F2)
To configure the Traverse application program. Refer to "46.3 Configuring Traverse".

Description of fields

Field	Option	Description
<Fixpoint Job:>	Choicelist	The job containing points for the control points, to begin, to check and to end the traverse. Points are searched in **<Fixpoint Job:>**, if not found in **<Fixpoint Job:>**, the active job will be searched.
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Codelist:>	Choicelist	No codes are stored in the selected job. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The active reflector. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.

Field	Option	Description
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts changes and accesses Traverse application program.

46.3 Configuring Traverse

Access

Select **Main Menu: Programs...\Traverse**. In **TRAVERSE Traverse Begin** press **CONF (F2)** to access **TRAVERSE Configuration**.

OR

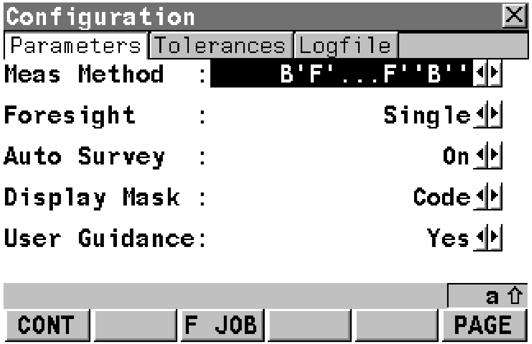
Press **PROG**. Highlight Traverse. **CONT (F1)**. In **TRAVERSE Traverse Begin** press **CONF (F2)** to access **TRAVERSE Configuration**.

OR

Press **SHIFT CONF (F2)** in **TRAVERSE Traverse Information**.

TRAVERSE Configuration, Parameters page

This screen consists of the **Parameters** page, the **Tolerances** page and the **Logfile** page. The explanations for the softkeys given below are valid for all pages, unless otherwise stated.



CONT (F1)
To accept changes and to return to the screen from where this screen was accessed.

F JOB (F3)
To update the **<Fixpoint Job:>** previously selected in **TRAVERSE Traverse Begin** during runtime. To access a separate set of points to check or close on. Available on the **Parameters** page.

DMASK (F3)
To edit the display mask currently being displayed in this field. Accesses **CONFIGURE Define Display Mask n**. Available for **<Display Mask:>** being highlighted on **Parameters** page.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<MeasMethod:>	**B'F'...F''B''**	All points are measured in face I, then measured in face II in reverse sequential order.
	B'F'...B''F''	All points are measured in face I, then measured in face II.
	B'B''F'F''	Backsight point is measured in face I immediately followed by face II. Other points are measured in face I, face II order.
	B'B''F''F'	Backsight point is measured in face I immediately followed by face II. Other points are measured in alternating face order.
	B'F'...	All points are measured in face I only.
<Foresight:>	**Single** or **Multiple**	Option to define if only one foresight point or multiple points are used during the sets.

Field	Option	Description
<Auto Survey:>	**On** or **Off**	For instruments with ATR and **<Auto Survey: On>** ATR search and ATR measurements are done to specified targets and subsequent sets.
<Display Mask:>	Choicelist	The user defined display mask to be shown in **TRAVERSE XX, Set:X/X**. All display masks of the active configuration set defined in **CONFIGURE Display Settings** can be selected.
<User Guidance:>	**Yes** or **No**	To activate/deactivate helpful message dialogs to assist in using the Traverse program.

Next step

PAGE (F6) changes to **Tolerances** page. Refer to paragraph "TRAVERSE Configuration, Tolerances page".

TRAVERSE Configuration, Tolerances page

Description of fields

Field	Option	Description
<Use Tolerance:>	**Yes** or **No**	The entered horizontal, vertical and distance tolerances are checked during the measurements to verify accurate pointing and measurements.
<Hz Tolerance:>	User input	Tolerance for horizontal directions.

Field	Option	Description
<V Tolerance:>	User input	Tolerance for vertical directions.
<Dist Tol:>	User input	Tolerance for distance.
<BS Ht Tol:>	User input	Tolerance for the backsight height.

Next step

PAGE (F6) changes to **Logfile** page. Refer to paragraph "TRAVERSE Configuration, Logfile page".

TRAVERSE Configuration, Logfile page

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited. A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file.

Field	Option	Description
		Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file. Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

Next step

PAGE (F6) changes to the first page on this screen.

46.4 Traverse Information and Traverse Management

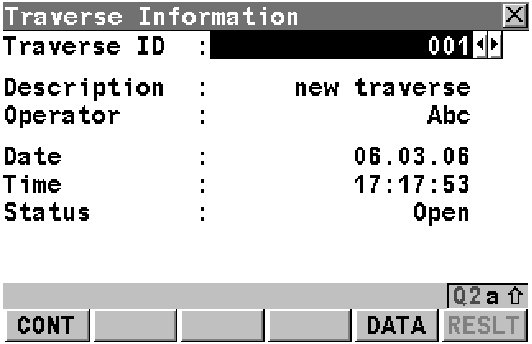
Description

The **TRAVERSE Traverse Information** screen provides an easy way to review and control the traverses inside a job. In **TRAVERSE Traverse Management**, it is possible to manage the different traverses which may be created in a given job.

Access

In **TRAVERSE Traverse Begin** press **CONT (F1)**.

TRAVERSE Traverse Information



CONT (F1)
To begin traverse measurement.

DATA (F5)
To display traverse data. Accesses **TRAVERSE Traverse Data**. Refer to "46.5 Traverse Data". Not available for adjusted traverses.

RESLT (F6)
To view results of the traverse. Accesses **TRAVERSE Traverse Results**. Refer to "46.7 Traverse Results". Not available for open traverses.

Description of fields

Field	Option	Description
<Traverse ID:>	Choicelist	The ID of the traverse. **ENTER** to access **TRAVERSE Traverse Management**.
<Status:>	**Open**	The traverse is not closed in position.

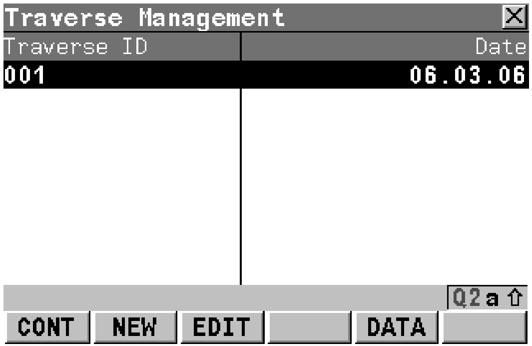
Field	Option	Description
	Position Closed	The traverse has been closed in position on a control point.
	Pos & Ang Closed	The traverse has been closed both in position and angularly.
	Adjusted	The traverse data is the result from an adjustment.

Next step

ENTER when the **Traverse ID** is highlighted. Accesses **TRAVERSE Traverse Management**.

TRAVERSE Traverse Management

All traverses of the active job are displayed.



CONT (F1)
To confirm selection of highlighted traverse and return to **TRAVERSE Traverse Information**.

NEW (F2)
To create a new traverse.

EDIT (F3)
To edit the traverse ID and description of the highlighted traverse.

DATA (F5)
To display traverse data. Refer to paragraph "46.5 Traverse Data" for more information.

Next step

CONT (F1) to return to **TRAVERSE Traverse Information**.

46.5 Traverse Data

Description

The **TRAVERSE Traverse Data** screen allows the review and editing of traverse stations inside of a traverse and allows the user to access **TRAVERSE Point Results** for editing.

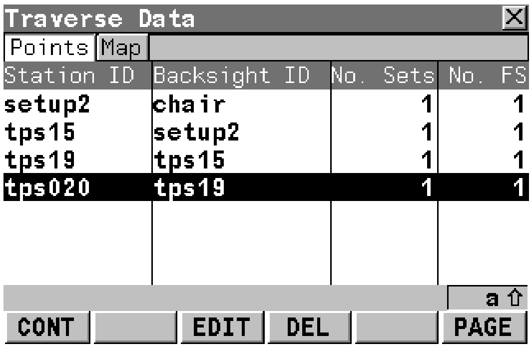
Access

DATA (F5) in **TRAVERSE Traverse Information**.

OR

DATA (F5) in **TRAVERSE Traverse Management**.

TRAVERSE Traverse Data



CONT (F1)
To return to where this screen was accessed from.

EDIT (F3)
To access the **TRAVERSE Traverse Point Results** screen. Refer to "46.6 Traverse Point Results".

DEL (F4)
To permanently delete the LAST traverse station.

PAGE (F6)
To change to another page on this screen.

Description of columns

Column	Description
Station ID	Point ID of the station ID.

Column	Description
Backsight ID	The backsight point measured from the current station ID.
No. Sets	Number of measured sets.
No. FS	Number of measured foresight points.

Next step
CONT (F1) returns to the previous screen.

46.6 Traverse Point Results

Description

Point observation results are displayed on this screen.

Access

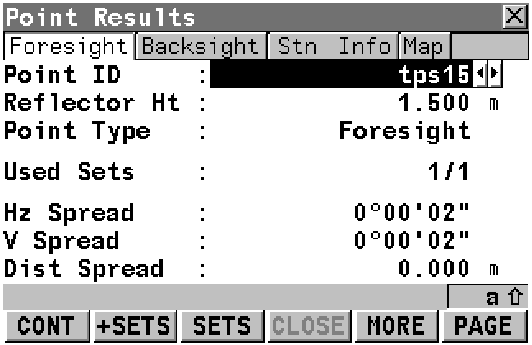
Is displayed automatically after measuring all sets from the current station.

OR

DATA (F5) in **TRAVERSE Traverse Information**. **EDIT (F3)**.

TRAVERSE Point Results, Foresight page and Backsight page

This screen consists of the **Foresight** page, **Backsight** page, the **Stat Info** page and the **Map** page. The softkeys are explained except those for the **Map** page.



CONT (F1)

While measuring a traverse: Displays a confirmation window with traverse measurement options. Otherwise: To return to **TRAVERSE Traverse Data**.

+SETS (F2)

To add more sets while still at the setup. It might be necessary on particular legs of a traverse that more than the designated number of sets is required. Possibly some of the sets from the first run exceeded the tolerance limit and needed to be disabled.

SETS (F3)

To include or exclude measured sets in the calculation of a foresight point. In the **TRAVERSE Sets, Point** screen **USE (F3)** to include or exclude a set and **SPRD (F4)**/**RESID (F4)** to review the affect of using the set.

CLOSE (F4)

To set a point as a closing point if not selected before measurement. Or to revert a closing point to a normal foresight.

MORE (F5)

To display additional information.

PAGE (F6)

To change to another page on this screen.

SHIFT CONF (F2)

To configure the Traverse application program. Refer to "46.3 Configuring Traverse".

SHIFT EDIT (F3)

To edit point code and annotations.

SHIFT CHECK (F4)
To check inverse distances and closure between the selected point in the **TRAVERSE Traverse Results**, **Foresight** page and a point from the fixpoint job. Available on the **Foresight** page. Fields and keys are identical with those in **TRAVERSE Traverse Results**. Refer to "46.7 Traverse Results".

SHIFT CTRL (F5)
Available on the **Backsight** page of the initial station. Refer to "46.8.4 Creating a Control Point from Backsight by Azimuth".

SHIFT QUIT (F6)
To return to **Zoom80 Main Menu**.

Description of fields

Field	Option	Description
<Point ID:>	Choicelist	Selected point ID.
<Reflector Height:>	User input	The reflector height of the target point. Editable.
<Point Type:>	**Foresight**, **Close** or **Close Angle**	The current point type.

Field	Option	Description
<Used Sets:>	Output	The number of sets out of all measured sets used for the calculation. Available for the **Foresight** page.
<No. of Sets:>	Output	The number of sets the point was measured in. Available for the **Backsight** page.
<Hz Arc Avg:>	Output	Average horizontal angle.
<V Avg:>	Output	Average vertical angle.
<Dist Avg:>	Output	Average distance.
<Hz Arc StdDev:>	Output	Standard deviation of horizontal angle.
<V StdDev:>	Output	Standard deviation of vertical angle.
<Dist StdDev:>	Output	Standard deviation of distance.
<Hz Spread:>	Output	Spread of horizontal angle.
<V Spread:>	Output	Spread of vertical angle.
<Dist Spread:>	Output	Spread of distance.

Next step

PAGE (F6) changes to the **Stat Info** page. Refer to "TRAVERSE Point Results, Stat Info page".

TRAVERSE Point Results, Stat Info page

Description of fields

Field	Option	Description
<Station ID:>	Output	The station ID of the instrument station.
<Instrument Ht:>	User input	Current instrument height. Editable.
<Easting:>	Output	Easting value of the station position.
<Northing:>	Output	Northing value of the station position.
<Height:>	Output	Orthometric height of the station position.
<Tempera-ture:>	Output	Temperature set on the instrument.
<Scale:>	Output	Scale factor used in the calculation.
<Pressure:>	Output	Atmospheric ppm set on the instrument.

Next step

PAGE (F6) changes to the **Stat Info** page. Refer to "TRAVERSE Point Results, Map page".

TRAVERSE Point Results, Map page

The Map page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

IF accessed	THEN
after sets meas-urement	**CONT (F1)** opens a confirmation window with options that are dependant on traverse status: • For an open traverse: Move to next station, return to **TRAVERSE Point Results**, to survey a sideshot, to view traverse data or to quit the traverse application. • For a closed traverse: Move to close angle, return to **TRAVERSE Point Results**, to survey a sideshot or to quit the traverse application.
from **TRAVERSE Traverse Data**	**CONT (F1)** returns to **TRAVERSE Traverse Data**.

46.7 Traverse Results

Description

Traverse closure results are displayed on this screen.

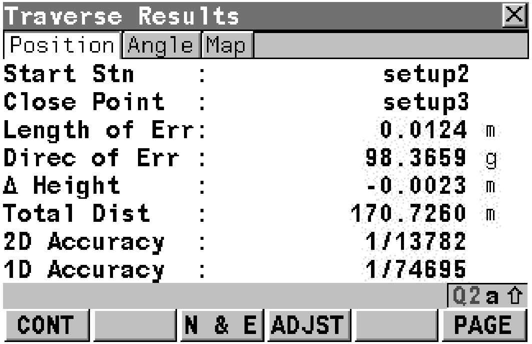
Access

Is displayed automatically after the traverse closing point is measured or selected.

OR

RESLT (F6) in **TRAVERSE Traverse Information** when a traverse is closed.

TRAVERSE Traverse Results, Position page



CONT (F1)
To move to close angle, to return to **TRAVERSE Traverse Results**, to survey a sideshot, to adjust the traverse or to quit the Traverse application.

N & E (F3) or **L & D (F3)**
To view the misclosure error in north/east or length/direction.

ADJST (F4)
To adjust the traverse.

DATA (F5)
To display traverse data.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Start Stn:>	Output	The point ID of the traverse start point.
<Close Point:>	Output	The point ID of the traverse closing point.
<Length of Err:>	Output	The length of the misclosure error.
<Direc. of Err:>	Output	The direction of the misclosure error.
<Δ North:>	Output	Error in north.
<Δ East:>	Output	Error in east.
<Δ Height:>	Output	Error in height.
<Total Dist:>	Output	Total length of the traverse.
<2D Accuracy:>	Output	Position ratio of misclosure.
<1D Accuracy:>	Output	Height ratio of misclosure.

Next step

PAGE (F6) changes to the **Angle** page. Refer to paragraph "TRAVERSE Traverse Results, Angle page".

TRAVERSE Traverse Results, Angle page

Description of fields

Field	Option	Description
<Foresight ID:>	Output	Point ID of the closing angle point. Displays ----- if no values are available.

Field	Option	Description
<Known Azimuth:>	Output	Defined azimuth of closing line. Displays ----- if no values are available.
<Azimuth Avg:>	Output	Mean value of the measured azimuth closing line. Displays ----- if no values are available.
<Angular Misc:>	Output	Angular misclosure of traverse. Displays ----- if no values are available.

Next step

CONT (F1) to move to close angle, to return to **TRAVERSE Traverse Results**, to survey a sideshot, to adjust the traverse or to quit the Traverse application.

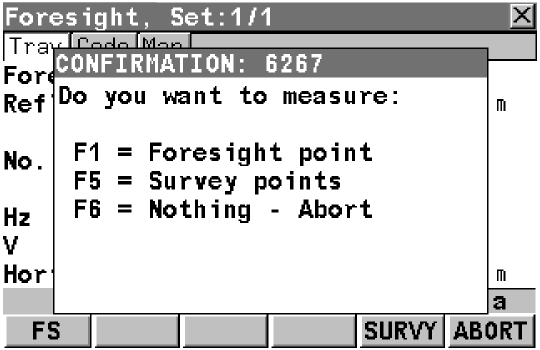
46.8 Traverse Methods

46.8.1 Starting Traverse

Start traverse step-by-step

The quickest setup method is described.

Step	Description	Refer to chapter
1.	Start the Traverse application program.	46.2
2.	**TRAVERSE Traverse Begin** Check the settings.	
3.	**CONT (F1)** to access **TRAVERSE Traverse Information**.	
4.	**TRAVERSE Traverse Information** **<Traverse ID:>** The name of the new traverse.	
☞	**ENTER** to select an existing traverse or to create a new one.	46.4
5.	**CONT (F1)** to access **TRAVERSE Traverse Configuration**. Check the settings.	46.3
6.	**CONT (F1)** to access **SETUP Station Setup**. Any standard setup method can be used.	40.4
7.	**SET (F1)** to set the station and orientation.	

Step	Description	Refer to chapter
8.	If User Guidance is active, a confirmation window is displayed.  **FS (F1)**	
9.	**TRAVERSE Foresight, Set:X/X** **<Foresight ID:>** The name of the foresight point. **<Reflector Ht:>** The reflector height of the foresight point. **<No. of Sets:>** The number of sets to be measured.	
10.	**ALL (F1)** to measure and record. The measurement settings for the first measurement to each point are used for all further sets.	

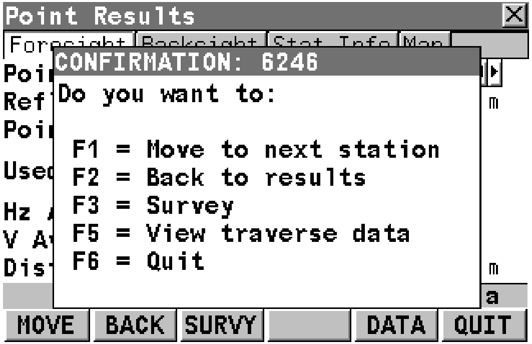
Step	Description	Refer to chapter
11.	**TRAVERSE Point Results** **CONT (F1)** to move to the next station, to return to the **TRAVERSE Point Results** screen (and set a point as a closing point), to survey a sideshot, to view traverse data or to end the traverse.	46.6
12.	**MOVE (F1)** to move to the next station.	
☞	After pressing **MOVE (F1)** Traverse is exited. To continue with the Traverse from the next Station refer to "Measure traverse step-by-step".	46.8.2

46.8.2 Continuing an ExistingTraverse

Measure traverse step-by-step

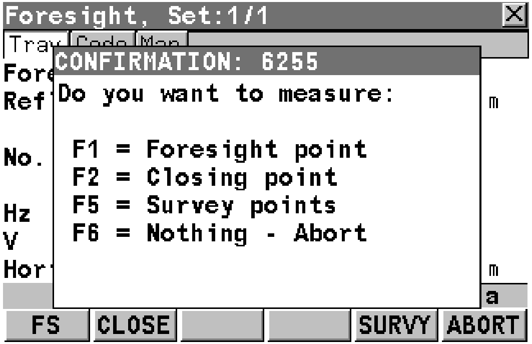
Step	Description	Refer to chapter
1.	Start the Traverse application program.	46.2
2.	**TRAVERSE Traverse Begin** Check the settings.	
3.	**CONT (F1)** to access **TRAVERSE Traverse Information**.	
4.	**TRAVERSE Traverse Information** **<Traverse ID:>** The name of the traverse. **ENTER** to select a different existing traverse.	46.4
	DATA (F5) to view data of the active traverse.	46.6
	SHIFT CONF (F2) to change the configuration settings.	46.3
5.	**CONT (F1)** to access **TRAVERSE Backsight, Set:X/X**. Enter **<Instrument Ht:>**. **<Hz:>**, **<V:>** and **<Horiz Dist:>** The measured values are displayed. **<Calc Azimuth:>** The calculated azimuth from the current station point to the backsight point. **<Δ Horiz Dist:>** and **<Δ Height:>** The difference between the computed and measured values.	
	MORE (F5) to change between the displayed values.	

Step	Description	Refer to chapter
6.	**ALL (F1)** to measure and record the backsight point.	
7.	**FS (F1)** to measure a foresight point.	
8.	**TRAVERSE Foresight, Set:X/X** **<Foresight ID:>** The name of the foresight point. **<Reflector Ht:>** The reflector height of the foresight point. **<No. of Sets:>** The number of sets to be measured.	
	SURVY (F5) to measure sideshot points.	
9.	**ALL (F1)** to measure and record the foresight points. The measurement settings for the first measurement to each point are used for all further sets.	
10.	**TRAVERSE Point Results** **CONT (F1)**	46.6

Step	Description	Refer to chapter
11.	A Confirmation window is displayed.  **MOVE (F1)** to move to the next station.	
12.	Repeat steps 1. to 11. until traverse is ready to be closed.	

46.8.3 Closing Traverse

Close traverse step-by-step

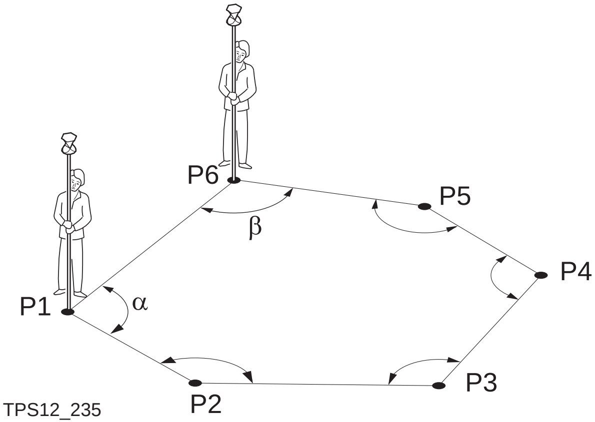
Step	Description	Refer to chapter
1.	Refer to paragraph "Measure traverse step-by-step" to measure a traverse. Measure a backsight on a new station.	46.8.2
2.	The Confirmation window in **TRAVERSE Foresight, Set:X/X** is displayed.  **CLOSE (F2)**	
3.	**OK (F4)**	
4.	**TRAVERSE Data** Highlight the closing point.	
5.	**CONT (F1)**	
6.	**TRAVERSE Foresight, Set:X/X**	

Step	Description	Refer to chapter
	ALL (F1) to measure and record the closing point.	
7.	**TRAVERSE Point Results** **CONT (F1)** to view traverse results.	46.6
8.	**TRAVERSE Traverse Results** **CONT (F1)**	46.7
9.	**C ANG (F1)** to close the traverse with angular closure.	
	Optionally the traverse can be adjusted.	46.9
10.	Move to the closure point and start Traverse application program.	46.2
11.	**TRAVERSE Traverse Begin** Check the settings.	
12.	**CONT (F1)** to access **TRAVERSE Traverse Information**.	
13.	**TRAVERSE Traverse Information** The existing traverse is shown	
14.	**CONT (F1)** to access **TRAVERSE Close Angle**.	
15.	**TRAVERSE Close Angle** **<FS Type:>** To measure onto a known point or a known azimuth. **<Foresight ID:>** The point ID of the foresight point.	

Step	Description	Refer to chapter
	<Known Azimuth:> Available for **<FS Type: Known Azimuth>**. Known azimuth for foresight point.	
16.	**CONT (F1)** to access **TRAVERSE Backsight, Set:X/X**.	
17.	**ALL (F1)** to measure all sets.	
18.	**TRAVERSE Point Results** **CONT (F1)** to view traverse results.	46.6
19.	**TRAVERSE Traverse Results** **CONT (F1)** to exit viewing traverse results.	46.7
20.	**QUIT (F6)** to quit the Traverse application.	
☞	Optionally the traverse can be adjusted.	46.9

Close traverse on internal reference

This option is used for determining the closure of a closed loop traverse, consisting of a single control point with an arbitrary backsight azimuth. This allows completion of a traverse without having to reoccupy the initial station setup to measure a closing angle. The positional closure is calculated by comparing the control position of the initial station setup to the measured position of the final foresight. The angular closure is calculated by comparing the set azimuth of the initial backsight to the azimuth of the final measured leg.



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The first station setup is on P1, and an assumed direction to backsight P6. Upon closing this traverse, with the last setup over P6, the closing point is P1. In this case the only point that is considered as a control is P1.

Step	Description
1.	When on the last setup point (P6 in the above example), measure a backsight.
2.	**CLOSE (F2)**
3.	**TRAVERSE Data** Select the closing point from the available list (P1 in the above example). **CONT (F1)**
4.	Measure all of the sets to the closing point as per a standard traverse.

Step	Description
5.	**TRAVERSE Point Results** **CONT (F1)** when the review of the results is completed.
6.	**YES (F6)** to confirm the automatic calculation.
7.	**TRAVERSE Traverse Results** The traverse closure is shown with positional and angular values.

46.8.4 Creating a Control Point from Backsight by Azimuth

Description

If a traverse is to be established on existing control points, two control points must be defined to start the traverse. If the traverse absolute position is arbitrary, it can be convenient to define the control in the field with arbitrary values. This functionality is an option to turn the averaged position value into a control point when a backsight by azimuth is collected.

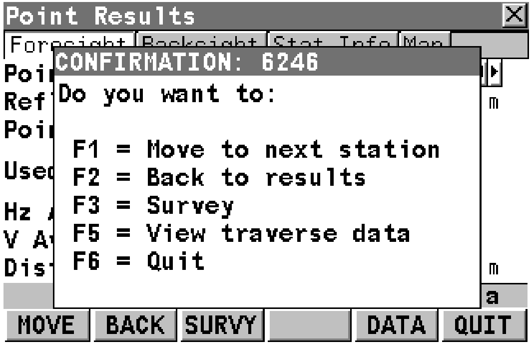
Access

At the beginning of a traverse when all the measurements are completed to the BS: On the **TRAVERSE Point Results** screen select **PAGE (F6)** to reach the **Backsight** page. **SHIFT CTRL (F4)**.

OR

Anytime during the traverse: On the **TRAVERSE Traverse Data** screen, highlight the first station setup then **EDIT (F3)**. On the **TRAVERSE Point Results** screen select **PAGE (F6)** to reach the **Backsight** page. **SHIFT CTRL (F5)**.

TRAVERSE
Point Results
CONFIRMATION



NO (F4)
To close the confirmation window without further action.

YES (F6)
To store the point as control point.

46.9 Traverse Adjustment

46.9.1 Accessing Traverse Adjustment

Description

- A traverse adjustment can be performed on three components: 2D positions, angles and elevations.
- Various adjustment methods are available for selection. Once the adjustment is performed, the results can be reviewed. Adjusted points are stored into a new job, and a report can be generated.

☞ Survey points have to be measured while Traverse is running to be part of the adjustment calculations.

Access

The traverse adjustment option can be reached in different ways based on specific conditions.

Upon completing the observations onto the closing point, **ADJST (F4)** to access **TRAVERSE Adjustment Method**.

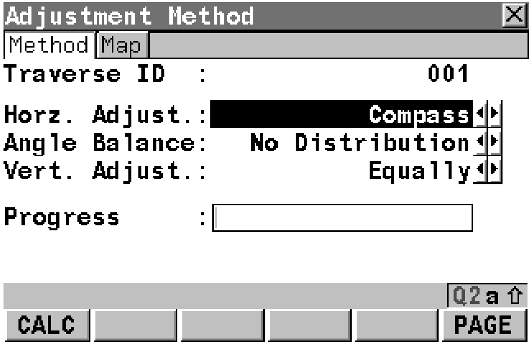
OR

After the measurements are done on the closing line for angular closure, **ADJST (F4)** to access **TRAVERSE Adjustment Method**.

OR

When the traverse is closed: **RESLT (F6)** in **TRAVERSE Traverse Information**, then **ADJST (F4)** in **TRAVERSE Traverse Results** to access **TRAVERSE Adjustment Method**.

TRAVERSE
Adjustment Method



CALC (F1)
To calculate the result.

PAGE (F6)
To change to another page on the screen.

Description of fields

Field	Option	Description
<Traverse ID:>	Output	The point ID of the traverse start point.
<Horz. Adjust:>	**Compass**	Suitable for surveys, where angles and distances were measured with equal precision.
	Transit	Suitable for surveys, where angles were measured with a higher precision than the distances.
	No Distribution	No distribution is made.
<Angle Balance:>	**Equally**	The angle misclosure is distributed equally.

Field	Option	Description
	No Distri-bution	No distribution is made.
<Vert. Adjust:>	**Equally**	The height error is distributed equally.
	By distance	The height error is distributed by distance.
	No Distri-bution	No distribution is made.

Next step
CALC (F1) starts the adjustment calculation.

46.9.2 Adjustment Results

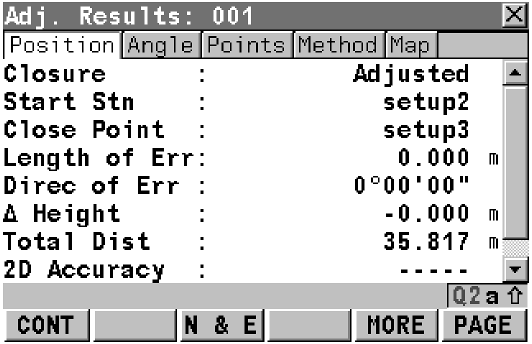
Description

The results of the adjustment calculations can be reviewed by accessing the different pages.

Access

CALC (F1) in **Traverse Adjustment Methods**.

TRAVERSE Adj. Results, Position page



CONT (F1)
To access the next screen.

N & E (F3) or **L & D (F3)**
To view the misclosure error in north/east or length/direction.

MORE (F5)
To display the values for the unadjusted, the balanced and the adjusted solution.

PAGE (F6)
To change to another page on this screen.

Description of fields

Field	Option	Description
<Closure:>	**Adjusted**, **Unadjusted** or **Balanced**	**MORE (F5)** to change between the options and display the values accordingly.
<Start Stn:>	Output	The point ID of the traverse start point.
<Close Point:>	Output	The point ID of the traverse close point.

Field	Option	Description
<Length of Err:>	Output	The length of the misclosure error.
<Direc of Err:>	Output	The direction of the misclosure error.
<Δ North:>	Output	Error in north.
<Δ East:>	Output	Error in east.
<Δ Height:>	Output	Error in height.
<Total Dist:>	Output	Total length of the traverse.
<2D Accuracy:>	Output	Position ratio of misclosure.
<1D Accuracy:>	Output	Height ratio of misclosure.

Next step
PAGE (F6) changes to the **Angle** page.

TRAVERSE Adj. Results, Angle page

Description of fields

Field	Option	Description
<Closure:>	Output	**MORE (F5)** to change between the options.
<Known Azimuth:>	Output	Defined azimuth of closing line. Displays ----- if no values are available.
<Azimuth Avg:>	Output	Mean value of the measured azimuth closing line. Displays ----- if no values are available.

Field	Option	Description
<Angular Misc:>	Output	Angular misclosure of traverse. Displays ----- if no values are available.

Next step
PAGE (F6) changes to the **Points** page.

TRAVERSE Adj. Results, Points page

The adjusted points are listed. The **Point Type** column shows the function for each point.
VIEW (F3) shows the coordinate values of the highlighted point.

Next step
PAGE (F6) changes to the **Method** page.

TRAVERSE Adj. Results, Method page

The adjustment methods previously selected in **TRAVERSE Traverse Method** and used for the adjustment are displayed.

Next step
PAGE (F6) changes to the **Map** page.

TRAVERSE Adj. Results, Map page

The Map page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step
CONT (F1) accesses **TRAVERSE Adjustment Store**.

TRAVERSE Adjustment Store

Description of fields

Field	Option	Description
<Traverse ID:>	Choicelist	The point ID of the traverse start point.
<Store to Job:>	User input	Once adjustment results have been reviewed and accepted, the adjusted position of the points can be stored in a separate job.
<Incl. Srvy Pt:>	**Yes** or **No**	Survey points can be included or not. Adjusted points are stored in the new job as a triplet of class ADJ (adjusted).
<Add Identi-fier:>	**Yes** or **No**	Activates the use of additional identifiers for the point ID's of the adjusted points.
<Identifier:>	User input	The identifier with up to four characters is added in front of or at the end of the ID of the adjusted points.
<Prefix/Suffix:>	**Prefix**	Adds the setting for **<Identifier:>** in front of the original point ID's.
	Suffix	Adds the setting for **<Identifier:>** at the end of the original point ID's.

Next step

STORE (F1) stores the results.

REPRT (F4) to generate an adjustment report. The adjustment report is stored into an XML file. For the XML file to be viewable as HTML a XSL file named adjust_report.xsl has to be placed in a directory named SRC in the folder containing the XML file.

47 Volume Calculations

47.1 Overview

Description

The Volume Calculations application program allows surfaces to be measured and volumes (and other information) to be computed from these surfaces.

Calculation tasks

The Volume calculations application program can be used for the following tasks:

- Measuring points (surface points and boundary points) defining a new surface or extending existing surfaces from the active job.
- Calculating the triangulation of the measured surface points to establish the surface.
- Calculating volumes from a reference (3D point, entered elevation) or by a stockpile method.

The surface calculation can be made from:

- existing point data in the job.
- manually measured points.
- entered coordinates.

Activating the application program

The Volume Calculations application program must be activated via a licence key. Refer to "26 Tools...\Licence Keys" for information on how to activate the application program.

Point types

Heights and positions are always taken into account. Points must have full coordinate triplets.

Properties of measured points

The properties stored with staked points are:

- Class: **MEAS**
- Sub class: **TPS**
- Source: **Survey**
- Instrument source: **TPS**.

47.2 Accessing Volume Calculations

Access

Select **Main Menu: Programs...\Volume Calculations**.

OR

Press **PROG**. Highlight **Volume Calculations**. **CONT (F1)**.

Refer to "31.2 Accessing the Programs Menu" for information on **PROG** key.

OR

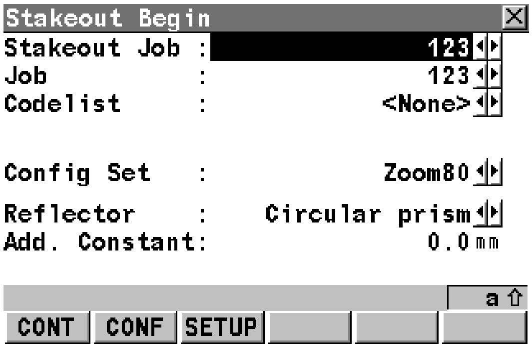
Press a hot key configured to access **VOLUMES Volume Calculations Begin**.

Refer to "2.1 Hot Keys" for information on hot keys.

OR

Press **USER**. Refer to "2.2 USER Key" for information on the **USER** key.

VOLUMES Volume Calculations Begin



CONT (F1)

To accept changes and access the subsequent screen. The chosen settings become active.

CONF (F2)

To access **VOLUMES Configuration**.

SETUP (F3)

To set up station. Accesses **SETUP Station Setup**.

Description of fields

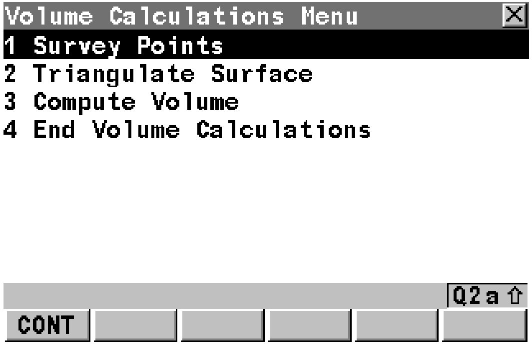
Field	Option	Description
<Job:>	Choicelist	The active job. All jobs from **Main Menu: Manage...\Jobs** can be selected.
<Codelist:>	Choicelist	No codes are stored in the selected **<Job:>**. All codelists from **Main Menu: Manage...\Codelists** can be selected.
	Output	Codes have already been stored in the selected **<Job:>**. If codes had been copied from a System RAM codelist, then the name of the codelist is displayed. If codes have not been copied from a System RAM codelist but typed in manually, then the name of the active job is displayed.
<Config Set:>	Choicelist	The active configuration set. All configuration sets from **Main Menu: Manage...\Configuration Sets** can be selected.
<Reflector:>	Choicelist	The reflector currently set in the selected configuration set. All reflectors from **Main Menu: Manage...\Reflectors** can be selected.
<Add. Constant:>	Output	The additive constant stored with the chosen reflector.

Next step

CONT (F1) accepts changes and accesses **VOLUMES Volume Calculations Menu**.

VOLUMES Volume Calculations Menu

The **Volume Calculations Menu** lists all of the necessary steps and the option to close the program.



CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

SHIFT CONF (F2)
To access **VOLUMES Configuration**.

Description of the items in the Volume Calculations Menu

Volume Calculations menu options	Description	Refer to chapter
Step 1) Survey Points	To measure points defining a new surface or extending existing surfaces currently stored in the active job.	47.4.1
Step 2) Triangulate Surface	To triangulate (delauny triangulation) the measured surface points to establish the surface.	47.4.2
Step 3) Compute Volume	To compute the volume of a surface by a reference (3D point, entered elevation) or by the stockpile method.	47.4.3

Volume Calculations menu options	Description	Refer to chapter
Step 4) End Volume Calculations	To end Volume Calculations and return to the screen from where Volume Calculations was accessed.	

Next step

IF	THEN
to start the program	highlight the relevant option and press **CONT (F1)**. Refer to the chapters stated above.
to configure the program	press **SHIFT CONF (F2)**. Refer to "47.3 Configuring Volume Calculations".
to close the program	highlight **End Volume Calculations** and press **CONT (F1)**.

47.3 Configuring Volume Calculations

Access

Select **Main Menu: Programs...\Volume Calculations**. In **VOLUMES Volume Calculations Begin** press **CONF (F2)** to access **VOLUMES Configuration**.

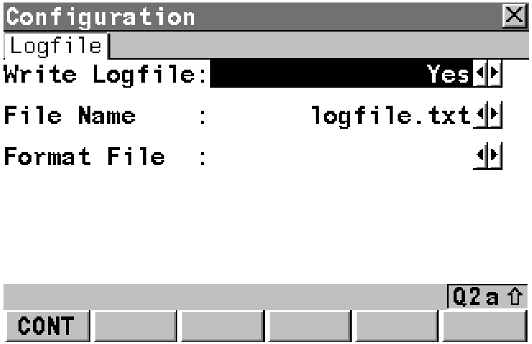
OR

Press **PROG**. Highlight **Volume Calculations**. **CONT (F1)**. In **VOLUMES Volume Calculations Begin** press **CONF (F2)** to access **VOLUMES Configuration**.

OR

Press **SHIFT CONF (F2)** in **Volume Calculations XX VOLUMES**.

VOLUMES Configuration, Logfile page



CONT (F1)
To accept changes and return to the screen from where this screen was accessed.

SHIFT ABOUT (F5)
To display information about the program name, the version number, the date of the version, the copyright and the article number.

Description of fields

Field	Option	Description
<Write Logfile:>	**Yes** or **No**	To generate a logfile when the application program is exited.
		A logfile is a file to which data from an application program is written to. It is generated using the selected **<Format File:>**.
<File Name:>	Choicelist	Available for **<Write Logfile: Yes>**. The name of the file to which the data should be written. A logfile is stored in the \DATA directory of the active memory device. The data is always appended to the file. Opening the choicelist accesses **XX Logfiles** where a name for a new logfile can be created and an existing logfile can be selected or deleted.
<Format File:>	Choicelist	Available for **<Write Logfile: Yes>**. A format file defines which and how data is written to a logfile. Format files are created using GGO. A format file must first be transferred from the CompactFlash card to the System RAM before it can be selected. Refer to "22 Tools...\Transfer Objects..." for information on how to transfer a format file.

Field	Option	Description
		Opening the choicelist accesses **XX Format Files** where an existing format file can be selected or deleted.

47.4 Calculating the Volume

47.4.1 Step 1) Surveying the Points

Description

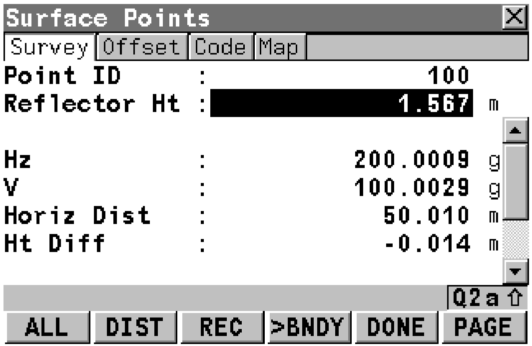
To measure points to a new surface or to an existing surface in the active job. If no surfaces currently exist in the active job, the user has to enter a **New Surface** first in **VOLUMES Choose Task & Surface**. The menu items **Triangulate Surface** and **Compute Volume** within the **VOLUMES Volumes & Surfaces Menu** are marked grey if no surface exists in the active job.

Access

Refer to "47.2 Accessing Volume Calculations" to access **VOLUMES Surface Points**.

VOLUMES Surface Points, Survey page

The pages shown are those from a typical configuration set. An additional page is available when a user defined display mask is used.



ALL (F1)
To measure and store distances and angles.

STOP (F1)
Available if **<EDM Mode: Tracking>** and **DIST (F2)** was pressed. Stops the distance measurements. **(F1)** changes back to **ALL**.

DIST (F2)
To measure and display distances. Available unless **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, after the tracking or logging is started.

REC (F3)
To record data.
If **<EDM Mode: Tracking>** and/or **<Log Auto Pts: Yes>**, records measured point and continues tracking.

>BNDY (F3) / **>SURF (F3)**
To change the class of the point to be measured between surface point and boundary point.

DONE (F5)
To finish measuring and to return to the **Volumes Calculations Menu**.

PAGE (F6)
To change to another page on this screen.

SHIFT INDIV (F5) and **SHIFT RUN (F5)**
To change between entering an individual point ID different to the defined ID template and the running point ID according to the ID template. Refer to "15.1 ID Templates".

Description of fields

Field	Option	Description
<Point ID:>	User input	The identifier for manually occupied points. The configured point ID template is used. The ID can be changed in the following ways: • To start a new sequence of point ID's type over the point ID.

Field	Option	Description
		• For an individual point ID independent of the ID template **SHIFT INDIV (F5)**. **SHIFT RUN (F5)** changes back to the next ID from the configured ID template. Refer to "15.1 ID Templates".
<Reflector Ht:>	User input	The last used reflector height is suggested when accessing the Survey application program. An individual reflector height can by typed in.
<Hz:>	Output	The current horizontal angle.
<V:>	Output	The current vertical angle.
<Horiz Dist:>	Output	The horizontal distance after **DIST (F2)** was pressed. No distance is displayed when accessing the screen and after **REC (F3)** or **ALL (F1)**.
<Ht Diff:>	Output	The height difference between station and measured point after **DIST (F2)**. Displays ----- when accessing the screen and after **REC (F3)** or **ALL (F1)**.

Next step

Press **ESC** returns to the **VOLUMES Choose Task & Surface** screen.

Press **ESC** again to return to the **VOLUMES Volume Calculations Menu** screen.

47.4.2 Step 2) Triangulating the Surface

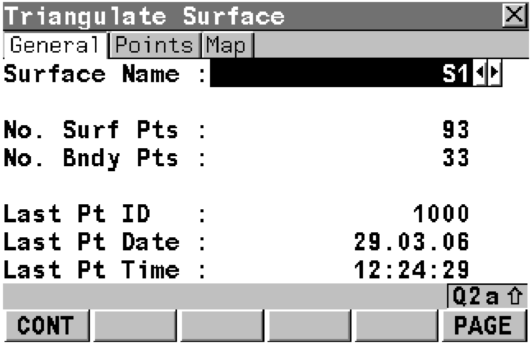
Description

To calculate a surface by establishing a triangulation (triangulation method: delauny) of the measured surface points.

Access

Refer to "47.2 Accessing Volume Calculations" to access **VOLUMES Triangulate Surface**.

VOLUMES Triangulate Surface, General page



CONT (F1)
To access **VOLUMES Boundary Definition**. **(F1)** changes to **CALC**.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To access **VOLUMES Configuration**.

SHIFT DEL S (F4)
To delete the surface.

Description of fields

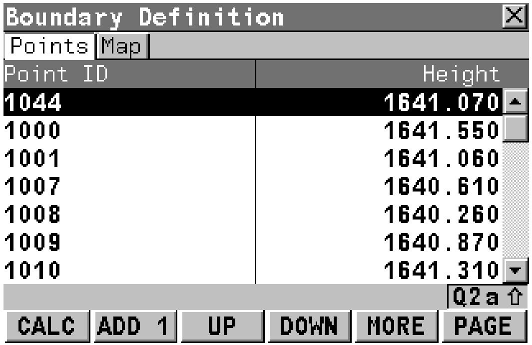
Field	Option	Description
<Surface Name:>	Choicelist	Name of the surface to be triangulated.
<No. Surf Pts:>	Output	Number of the measured surface points.
<No. Bndy Pts:>	Output	Number of the measured boundary points.

Field	Option	Description
<Last Pt ID:>	Output	ID of the last measured point of the chosen surface.
<Last Pt Date:>	Output	Date of the last measured point of the chosen surface.
<Last Pt Time:>	Output	Time of the last measured point of the chosen surface.

Next step

CONT (F1) continues to **VOLUMES Boundary Definition**.

VOLUMES Boundary Definition, Points page



CALC (F1)
To start calculating the triangulation and to access to the **VOLUMES Triangulation Results**.

ADD 1 (F2)
To add points from the active job to the surface.

UP (F3)
To move the focused point one step up within the boundary definition.

DOWN (F4)
To move the focused point one step down within the boundary definition.

MORE (F5)

To display information about the code group, the code type, the code description and the quick codes if available.

PAGE (F6)

To change to another page on this screen.

SHIFT HOME (F2)

To move the focus to the top of the points list.

SHIFT END (F3)

To move the focus to the bottom of the points list.

SHIFT REM 1 (F4)

To remove the marked point from the surface.

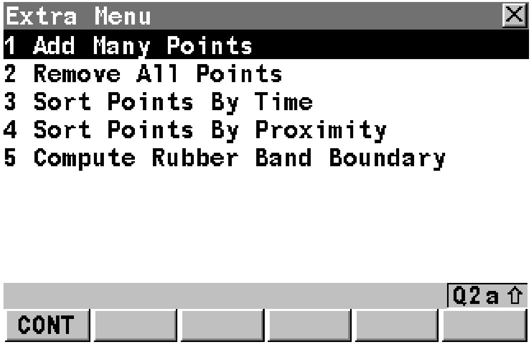
SHIFT EXTRA (F5)

To access to the **VOLUMES Extra Menu**.

Next step

SHIFT EXTRA (F5) continues to **VOLUMES Extra Menu**. Refer to"VOLUMES Extra Menu".

VOLUMES Extra Menu



CONT (F1)
To enter the highlighted option from the **VOLUMES Extra Menu**.

Description of fields

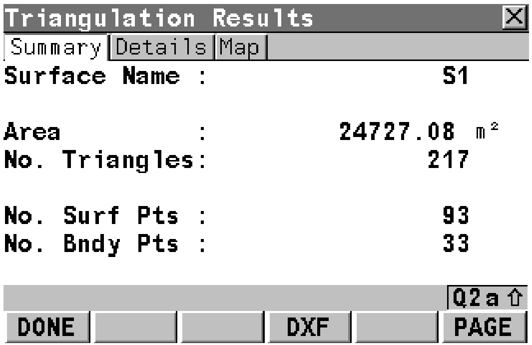
Field	Description
<Add Many Points>	Access Data Manage and all points that are in the list.
<Remove All Points>	Method to remove all points that are indicated in the **Boundary Definition** points page.
<Sort Points by Time>	Method to sort all points in the **Boundary Definition** points page by the time they were stored.
<Sort Points by Proximity>	Method to sort all points in the **Boundary Definition** points page by the closest proximity.
<Compute Rubber Band Boundary>	Method to define a new boundary as if a rubber band was placed around the points. The current list of boundary points will be ignored.

Next step

CONT (F1) returns to the screen

CALC (F1) calculates the triangulation and continues to **VOLUMES Triangulation Results**.

VOLUMES Triangulation Results, Summary page



DONE (F1)
To close the triangulation of the surface and return to **Volumes Calculations Menu**.

DXF (F4)
To export the triangulation results to a DXF file on the data or root directory of the CompactFlash card.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To access **VOLUMES Configuration**.

Description of fields

Field	Option	Description
<Surface Name:>	Output	Name of the surface.
<Area:>	Output	Area of the base plane.
<No. Triangles:>	Output	Number of triangles used within the triangulation.
<No. Surf Pts:>	Output	Number of points inside the surface.

Field	Option	Description
<No. Bndy Pts:>	Output	Number of boundary points of the surface.

Next step

PAGE (F6) changes to the **Details** page.

Refer to "VOLUMES Triangulation Results, Details page".

VOLUMES Triangulation Results, Details page

Description of fields

Field	Option	Description
<No. Points:>	Output	Total number of points from the surface.
<Min Elevation:>	Output	Minimal elevation of the triangulated surface.
<Max Elevation:>	Output	Maximal elevation of the triangulated surface.
<Longest Side:>	Output	Value of the longest triangle side.
<Area (3D):>	Output	Surface area (3D).

Next step

PAGE (F6) changes to the **Map** page.

Refer to "VOLUMES Triangulation Results, Map page".

VOLUMES Triangulation Results, Map page

The **Map** page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

DONE (F1) returns to **Volume Calculation Menu** page.

Refer to "VOLUMES Volume Calculations Menu".

47.4.3 Step 3) Computing the Volume

Description

To calculate a surface by establishing a triangulation (triangulation method: delauny) of the measured surface points.

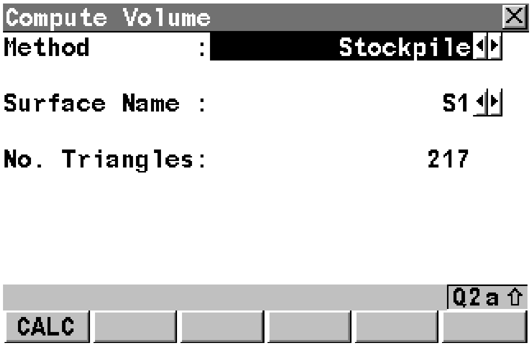
To compute the volume of the triangulated surface by using either:

- the stockpile method,
- an elevation plane as a reference,
- a single point as a reference.

Access

Refer to "47.2 Accessing Volume Calculations" to access **VOLUMES Compute Volume**.

VOLUMES Compute Volume



CALC (F1)
Computing the volume and access to the **VOLUMES Volume Calculation Results page**. **(F1)** changes to **CONT**.

SHIFT CONF (F2)
To access **VOLUMES Configuration**.

Description of fields

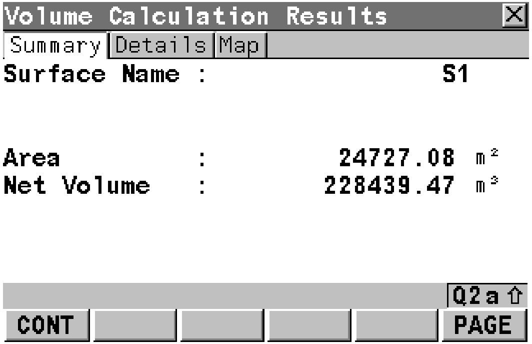
Field	Option	Description
<Method:>	Choicelist	To calculate the volume of the triangulated surface.
	Stockpile	To calculate a volume between the triangulated surface and the surface defined by the boundary points of the surface.
	Surface to Elev	To calculate a volume between the triangulated surface and the height entered by the user.
	Surface to Point	To calculate a volume between the triangulated surface and the height of a selected point.
<Surface Name:>	Choicelist	The surface chosen from the triangulated surfaces currently stored to the active job.
<No. Triangles:>	Output	The number of triangles from the triangulated surface
<To Elevation:>	User Input	To enter a height for the elevation plane. This height will be used as the reference when **<Method: Surface To Elev>** is selected.
<To Point:>	Choicelist	To select a point from the active job. This point height will be used as the reference when **<Method: Surface To Point>** is selected.

Field	Option	Description
<Elevation:>	Output	The elevation of the selected point.

Next step

CALC (F1) calculates the volume and continues to **VOLUMES Volume Calculation Results**.

VOLUMES Volume Calculation Results, Summary page



CONT (F1)
Computing the volume and access to the **VOLUMES Volume Calculation Results page**. **(F1)** changes to **CONT**.

PAGE (F6)
To change to another page on this screen.

SHIFT CONF (F2)
To access **VOLUMES Configuration**.

Description of fields

Field	Option	Description
<Surface Name:>	Output	Surface.
<Area:>	Output	Area of the base plane.
<Net Volume:>	Output	Volume of the surface.

Next step

PAGE (F6) changes to the **Details** page. Refer to "VOLUMES Volume Calculation Results, Details page".

VOLUMES Volume Calculation Results, Details page

Description of fields

Field	Option	Description
<Min Elevation:>	Output	Minimal elevation of the calculated volume.
<Max Elevation:>	Output	Maximal elevation of the calculated volume.
<Avg Thickness:>	Output	Average thickness of the calculated volume.
<Perimeter:>	Output	Perimeter of the measured surface area (intersection of the measured surface to the reference datum).

Next step

PAGE (F6) changes to the **Map** page.

Refer to "VOLUMES Triangulation Results, Map page".

VOLUMES Volume Calculation Results, Map page

The **Map** page provides an interactive display of the data. Refer to "30 MapView Interactive Display Feature" for information on the functionality and softkeys available.

Next step

CONT (F1) returns to **Volume Calculation Menu** page.

Refer to "VOLUMES Volume Calculations Menu".

Appendix A Menu Tree

Menu tree

MAIN MENU

- SURVEY
- PROGRAMS...
- MANAGE...
  - JOBS
  - DATA
  - CODELISTS
  - CONFIGURATION SETS
  - REFLECTORS
- CONVERT...
  - EXPORT DATA FROM JOB
    - EXPORT ASCII
    - EXPORT DXF
  - IMPORT DATA TO JOB
    - IMPORT ASCII/GSI
    - IMPORT DXF
- CONFIG...

- SURVEY SETTINGS...
  - ID TEMPLATES
  - DISPLAY SETTINGS
  - CODING & LINEWORK SETTINGS
  - OFFSETS
  - TARGET CHECK
- INSTRUMENT SETTINGS...
  - EDM & AIM360 SETTINGS
  - SEARCH WINDOWS
  - AUTOMATIC PRISM SEARCH
  - TPS CORRECTIONS
  - COMPENSATOR
  - INSTRUMENT ID
  - TELESCOPE ACCESSORIES
- GENERAL SETTINGS...
  - UNITS & FORMATS
  - WIZARD MODE
  - HOT KEYS & USER MENU
  - LANGUAGE
  - LIGHTS, DISPLAY, BEEPS, TEXT
  - START UP & POWER DOWN

- INTERFACES...
  - GSI OUTPUT
  - GEOCOM MODE
  - EXPORT JOB
- TOOLS...
  - FORMAT MEMORY DEVICE
  - TRANSFER OBJECTS...
    - CODELISTS
    - CONFIGURATION SETS
    - FORMAT FILES
    - SYSTEM RAM CONTENTS
  - UPLOAD SYSTEM FILES...
    - APPLICATION PROGRAMS
    - SYSTEM LANGUAGES
    - INSTRUMENT FIRMWARE
  - CALCULATOR
  - FILE VIEWER
  - LICENCE KEYS
  - CHECK & ADJUST...
    - COMBINED (l, t, i, c, Aim)

- TILTING AXIS (a)
- COMPENSATOR (l, t)
- CURRENT VALUES
- END CHECK & ADJUST

Appendix B Memory Types

Types of memory available

<table>
<tr><td colspan="2">CompactFlash card
• Jobs
  • Points
  • Codes
• TPS raw observations
• ASCII output files
• Logfiles
• ASCII files to be imported (CompactFlash card)

The information is managed in the job database and in the measurement database.</td></tr>
<tr><td>Application programs memory, 8 MB
• System language
• Font files
• Application programs
  • Language files
  • Font files</td><td>System RAM, 1 MB
• Codelists
• Configuration sets
• Format files
• ID templates
• Sort and filter settings</td></tr>
</table>

Appendix C Directory Structure of the Memory Device

Description

On the memory device, files are stored in certain directories.

Directory structure

Directory	Contents
CODE	• Codelists various files
CONFIG	• TPS configuration files (*.xfg)
CONVERT	• Format files (*.frt)
DATA	• ASCII files for import/export to/from job (*.*) • DXF files for import/export to/from job (*.*) • Logfiles created from application programs
DBX	• Job files, various files • DTM jobs, various files
GSI	• GSI files (*.gsi) • ASCII files for export from job (*.*)
SYSTEM	• Application program files (*.a*) • Firmware files (*.fw) • Language files (*.s*) • Licence file (*.key) • System files (System.ram)

Appendix D Cables

Description

Some applications require the connection of instruments, devices or accessories to the Zoom80. In this chapter, the required cables and their use are listed.

Cables connecting instruments, devices or accessories

The table shows in alphabetical order which instruments, devices or accessories can be connected using cables. Refer to paragraph "Cables and product names" for a full description of these cables.

From	To	Cables
RS232 9 pin on PC	Zoom80	ZDC223
USB on PC	Zoom80	ZDC224
USB on PC	Getac	ZDC226

Cables and product names

The product names of the cables in the above table are explained in detail below in ascending order.

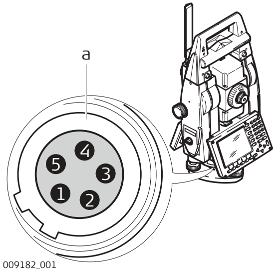
Name	Description
ZDC223	Data cable Zoom80 to RS232 9 pin
ZDC224	Data cable Zoom80 to USB
ZDC226	Data cable 1.65 m, Getac to USB A

Appendix E PIN Assignments and Sockets

Description

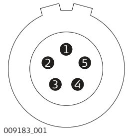
Some applications require knowledge of the pin assignments for the instrument port. In this chapter, the pin assignments and socket for the port 1 of the instrument are explained.

Ports at the TPS instrument



a) Port 1

Pin assignments for port P1



Pin	Signal Name	Function	Direction
1	PWR	Power input, +12 V nominal (11 V - 16 V)	In
2	-	Not used	-
3	GND	Single ground	-
4	RxD	RS232, receive data	In
5	TxD	RS232, transmit data	Out

Sockets

Port 1: LEMO-0, 5 pin, LEMO ENA.OB.305.CLN

GeoMax AG Zoom80

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