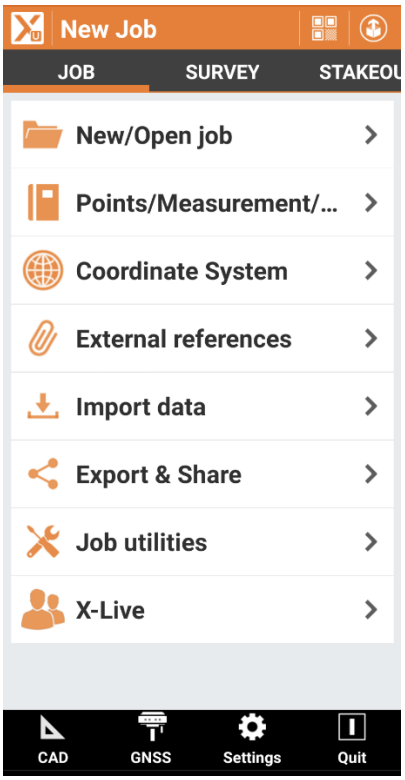


Getting Started Guide for iGage GNSS RTK Receivers used with:

X-PAD Ultimate

This manual is for use with iG GNSS Receivers sold by iGage Mapping Corporation.
Other receivers will have significantly different profiles.

9 March 2021

X-PAD_GNSS_GSG_R031.docx

What is in this FAQ?

The History of X-PAD

X-Pad was originally introduced in 2012 for use with GPS and Total Stations and was available for use on Windows Mobile devices.

The next 8-years produced significant upgrades:

2013	Zoom 80 Robotic Module, Road Module, Android devices
2014	Auto Measurements (Monitoring), 3D for Zoom3D, PicPoint, X-Pad Office
2015	X-Pad Construction, Zipp20, GIS Module, Bathymetry Module, Locators Module
2016	Zoom 90, X-Pole
2017	X-Pad Fusion, Masterplan
2018	X-Pad Survey Ultimate, X-Pad Build Ultimate
2019	Survey GO
2020	Extensive support for the USA: Bearings, US and International Feet

X-Pad has been translated to over 20 languages and has over 7,000 current deployments worldwide.

While X-Pad Ultimate is only targeted for the Android platform, X-Pad is still available for Windows Mobile and an X-PAD standard copy is included with every Zoom 90 robot installed on the onboard controller.

Because both X-Pad and the Zoom 90 are from GeoMax, support for Zoom 90 Robots is unparalleled.

As support for the Windows Mobile operating system has been terminated, the Android OS presents a platform with a future, the majority of new handheld devices, faster operation, more memory, brighter screens, longer range Bluetooth, better battery life, better connectivity, better security and a well-defined forward path.

X-PAD Ultimate GNSS has the best Robotic Total Station support for GeoMax Zoom 90 Robots.

X-PAD Ultimate supports a variety of GNSS devices, Total Stations and Robots.

X-PAD Deployment

X-PAD Ultimate software can be installed on most Android phones and tablets eliminating the need for a dedicated data collector. The Android platform is significantly faster, enjoys continued development and is substantially more robust than Windows Mobile Devices providing you with a powerful field solution.

Understanding X-PAD: Licensing, Maintenance, Modules

X-PAD Ultimate GNSS field software is licensed as a main product including GNSS or TPS (Total Station) support:

(All prices 2021 Q1)

877734	X-PAD Ultimate Survey GNSS	$ 1,187.50
877735	X-PAD Ultimate Survey TPS Manual	$ 1,187.50
877736	X-PAD Ultimate Survey Auto Measuring (Monitoring) TPS	$ 1,150.00
877738	X-PAD Ultimate Survey Premium (GNSS, TPS and ROBOTIC)	$ 2,625.00

To these main products you can license additional task-oriented modules.

877740	X-PAD Ultimate Survey Volume Module: Create and import 3D surfaces to be used for all stakeout operations. It includes functions for the calculation of the volumes according to different methods.	$ 250.00
877741	X-PAD Ultimate Survey Bathometry Module: Manage bathymetric surveys by acquiring depth data from echo sounder and GNSS positions. This includes a route control.	$ 1,025.00
877743	X-PAD Ultimate Survey Road Module: Import road design data from different formats, stakeout any element in the alignment with a variety of methods.	$ 432.00
877745	X-PAD Ultimate Survey PicPoint Module: Captures and photo processes allow you to place the measurement of points directly on the photos themselves.	$ 250.00
877746	X-PAD Ultimate Survey Robotic TPS Module: Extend the TPS main module with features that allow full control of motorized and robotic total stations.	$ 210.00
877747	X-PAD Ultimate Survey X-Pole (option): Flexibly work with TPS and GNSS at the same time, by using the best features of each system.	$ 625.00
877748	X-PAD Ultimate Survey GIS Module: Define GIS features and attributes to be assigned to measured points. It includes import and export functions of GIS data.	$ 62.50
877749	X-PAD Ultimate Survey Locator Module: Connect to utility locators and record depths at corresponding GNSS positions.	$ 62.50
877753	X-PAD Ultimate Survey BIM Module: Import BIM models, display, navigate and extract information (points, lines, surfaces) for checking and stakeout operations.	$ 250.00
877754	X-PAD Ultimate Survey Build Module: Extend the Survey version with all the features that are exclusively made for the Build version.	$ 462.50
902526	X-PAD Ultimate Survey: Set of commands designed for mechanical, electrical and plumbing, transfer heights, create parallel lines, on surfaces, and scan lines.	$ 250.00

Software Maintenance

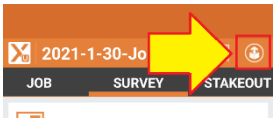
Your purchase of X-Pad Ultimate includes software updates and patches for 1-year.

This feature is called X-PERT. After the first year you can extend maintenance annually for a nominal fee.

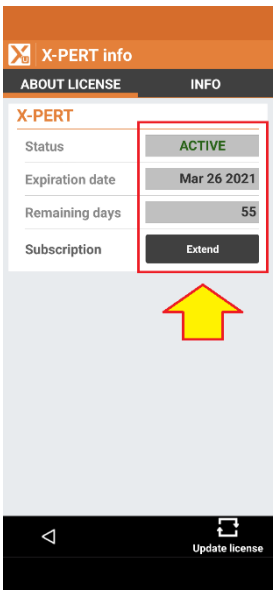
6015421	1-year X-PERT Option to receive Service Packs and have access to major updates for one year	$ 250.00

If maintenance has only expired for a few months then reinstatement will retroactively be applied to the previous expiration date. If your license falls out of maintenance for more than 1-year, there is an additional $250 reinstatement charge and the new expiration date will extend for 1-year from the time of reinstatement.

Once X-Pad is installed on a device, you can check the status of X-PERT:



Click on the X-PERT icon at the top of the main menu.



If you have recently extended X-PERT, you can click on Update license to synchronize your subscription.

Is X-PAD best with a Phone or Tablet?

X- PAD should work great with most modern Android phones and tablets. When deciding what device to use with X-PAD you might consider:

- Purchase a new device vs. using an existing device.
- Ability to ruggedize with an external case or protection system.
- Screen size and brightness
- Battery life
- Device memory
- Bluetooth range to Robotic Total Station

In addition to common consumer and prosumer devices, GeoMax (and other vendors) offer extremely rugged, field ready data Android based collectors like the 'Zenius800' ($1,800):

If you choose to use a phone, there are great lightweight pole mounting options:

Network Rover Applications

Because the Android device's internet connection can be used for Network Rover applications, *a phone or tablet that is activated with cellular data can be easier to use with Network rover applications*.

While you can connect the collector to a Wi-Fi hotspot while in the field for access to server-based corrections, or you can put a SIM card in the GNSS receiver, using an Android device with an activated cellular modem enables data for job sharing and GNSS Network server access.

The phone data connection also assists in transferring files between the data collector and office with cloud accounts like Google Drive.

Transferring X-PAD to a New Device

Your X-PAD license can be installed on a single device. If the device fails or is replaced, X-PAD can be moved to a new device. Because the transfer process is non-trivial, it is best to carefully choose the device that you install X-PAD on to minimize license transfers.

Step-by-step instructions are provided in the 'Transfer License' document found in the FAQ folder:

https://iggps.com/XPad/out/FAQ/index.htm

for transferring your X-PAD license to a new device. If a device is rendered non-functional prior to transferring the X-PAD license to a new device, you will need to contact the factory for assistance and authorization in moving your license.

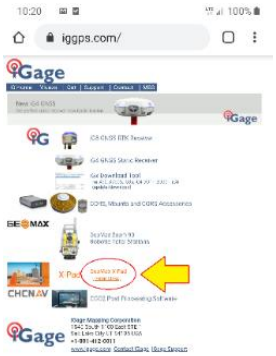
Installing X-PAD on your Android Device

Internet access is required to download, install and activate X-PAD on your device. Because the files are quite large, a Wi-Fi connection to an unmetered internet source will be better.

On the Android device use the device's default browser and go to the web address:

www.iGGPS.com

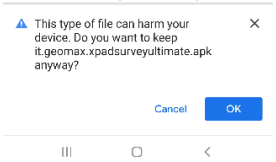
Look for the X-PAD logo near the bottom:



Find and click on the GeoMax X-PAD [Install Links]

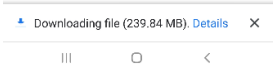
On the 'Links' page, find the 'X-PAD Ultimate Survey' link and click on the large 'Download' button:

A system warning message will be displayed:



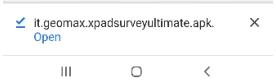
Click on OK.

The installer will be downloaded:



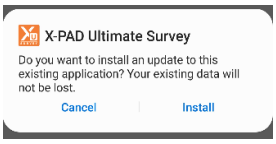
Wait for the download to complete.

Your device will offer to Open the installer:



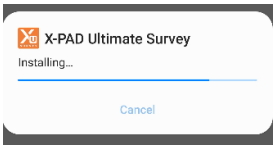
Click on 'Open'.

After a few seconds of staging this confirmation screen will be shown:



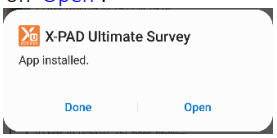
Click on 'Install'.

It will take almost a minute to install X-PAD:



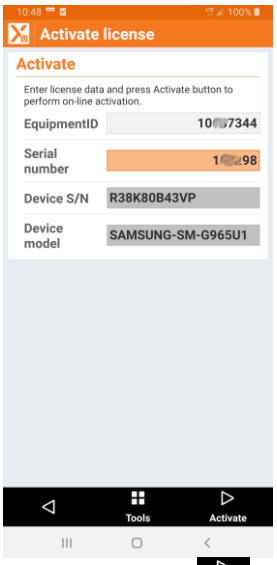
Wait for the installation to complete.

Click on 'Open':



The 'Activate license' dialog is shown:

You should have *X-PAD License Certificate* or numbers on your invoice, find your unique **Equipment ID** and **Serial Number** on the certificate then enter them on the activation screen:

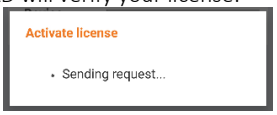


Click the Activate button 

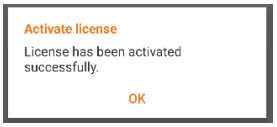
in the lower right-hand corner.

Your X-PAD license can only be installed on one device at a time.

X-PAD will verify your license:



After a few moments, a success message will be shown:



Click on 'OK'.

The activated modules will be shown:

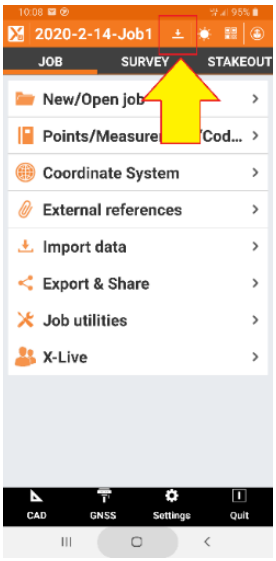
Only the options purchased will initially be active on your installation.

X-PAD has a great total station module for both manual and robotic total stations. It is likely that it will work with your existing equipment.

There are also many additional task-specific modules for saving time in the field.

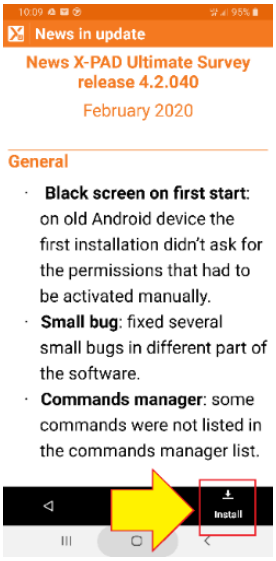
Updating X-PAD to the Latest Version

On the main X-PAD screen:



If the  icon is displayed (as shown above) a new software version is available. Click on the down arrow to retrieve a description of the updates.

After a few seconds the enhancements and bug fixes included in the new version will be shown:



Click on the Install button to download and then install the latest X-PAD version automatically.

If the update downloads, but does not automatically install you may need to use the device's file 'Explorer' to manually run the .APK file. This occurs on some devices with tightened security profiles.

You will find the downloaded update in this system folder:

/Storage/emulated/0/X-PAD/_Data/Update

The file will be named in this fashion:

it.geomax.xpadsurveyultimate_X_X_XX.apk

X-PAD: Loading GEOIDS and Local Coordinate Systems

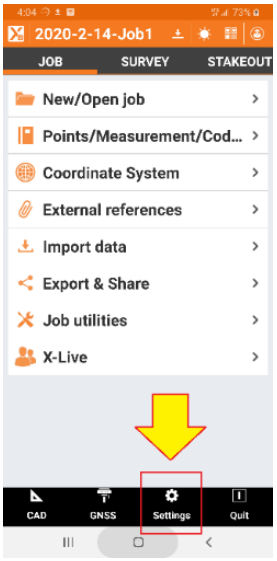
Immediately after installing X-PAD you should add the United States Localization Package to the base installation.

This will download and install location specific GEOIDS and Coordinate Systems (like the Oregon and Iowa specific county systems) into the X-PAD program.

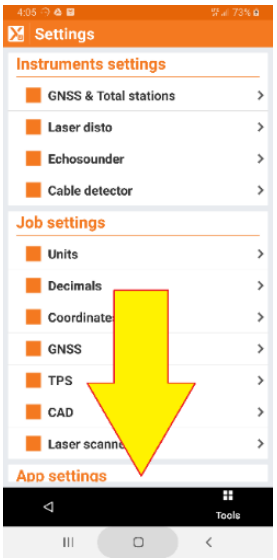
Loading the USA Localization Package

Internet access is required for this procedure.

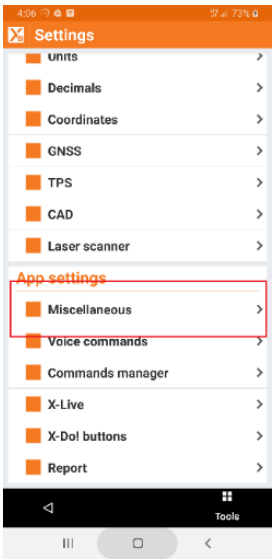
From the main menu click on 'Settings':



The Instrument settings dialog will be shown:

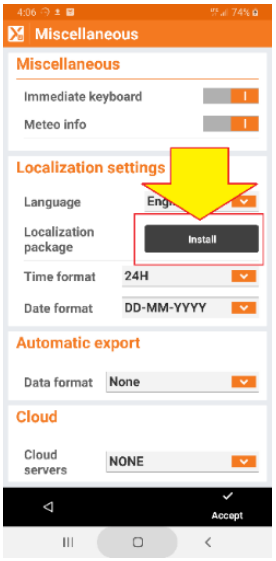


Drag the menu down up so that you can see the 'Miscellaneous' item under 'App settings':



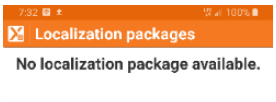
Click on Miscellaneous.

The Miscellaneous menu will be shown:



click on the 'Localization package Install' button.

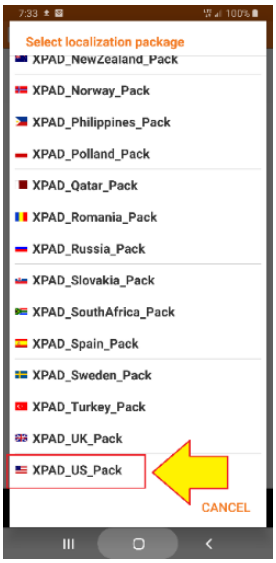
Previously downloaded / saved packages (if any) will be listed:



Click on the 'Download' button to retrieve an updated list of all available packages.

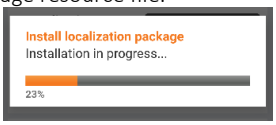
Wait while the list of packages is retrieved from the internet:

After a while a list of all localization packages will be shown:



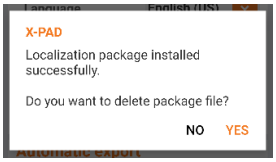
Scroll to the bottom of the list, then click on the XPAD_US_Pack package.

X-PAD will begin downloading and then installing the package resource file.



Wait for the package to download. Click on Yes if asked to install.

When complete:



If your device is low on memory click on 'YES' to delete the package source. Otherwise keep the localization package source available by clicking 'NO'.

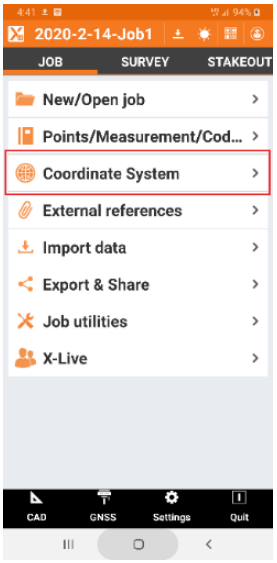
Using Special County or State Projections

There are many State Plane Coordinate (SPC), State, County, Region specific projections in use in the USA. These are all available as predefined projections in the US localization pack:

NAD27 SPC	NAD83 SPC
Iowa County Projections	Las Vegas NV Projections
Kansas County Projections	Minnesota County Projections
Main Statewide Projections	Oregon Statewide Projections
Wisconsin WCCS Projections	Wisconsin WISCRS Projections

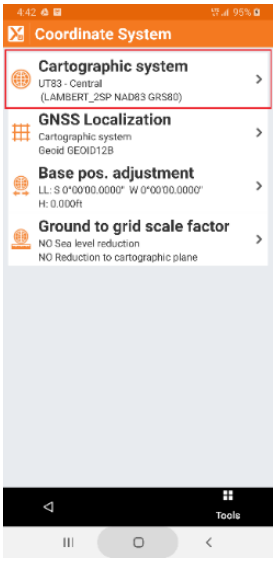
The following example shows the steps to load the Portland Oregon coordinate projection.

From the main ‘Job’ menu:



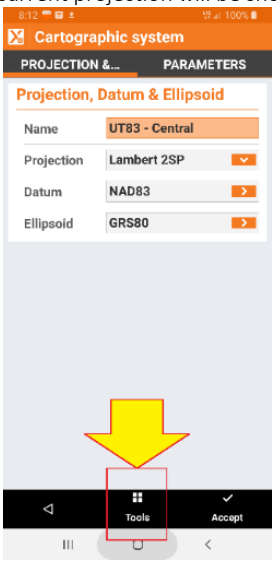
Click on Coordinate System.

The Coordinate System menu will be shown:



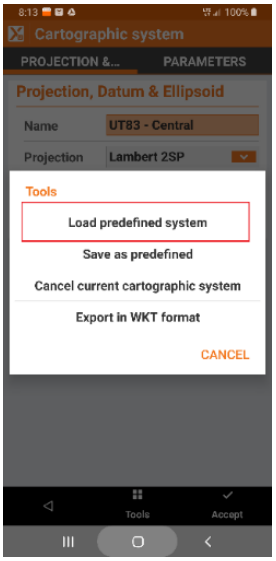
Click on ‘Cartographic system’.

The current projection will be shown:



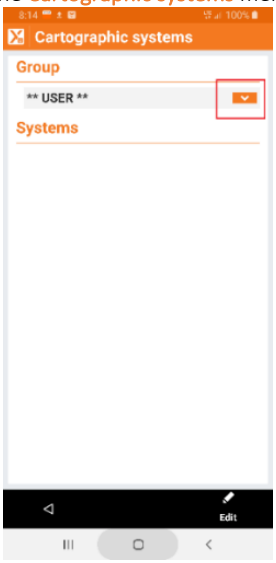
Click the Tools button at the bottom of the menu.

On this Tools menu:



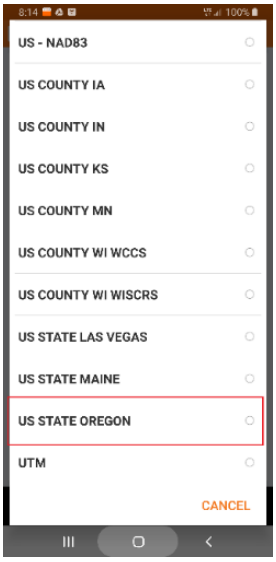
Click on ‘Load predefined system’.

On the Cartographic systems menu:



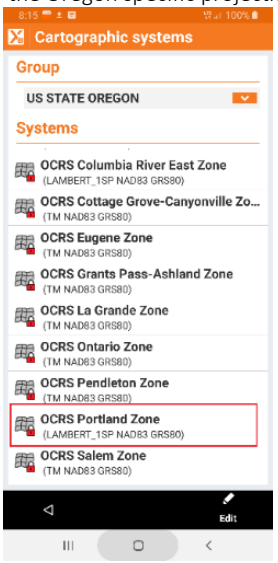
Click on the drop-down arrow for the USER group.

Scroll down to the bottom of the US list:



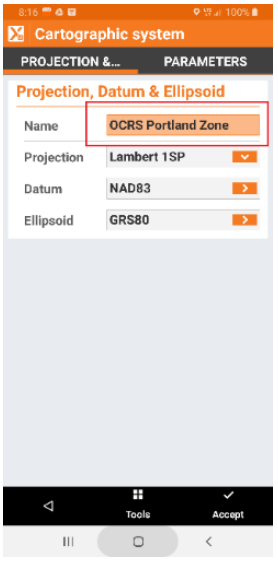
Then click on US STATE OREGON.

The Cartographic systems menu will be shown listing all of the Oregon specific projections:



Click on the 'OCRS Portland Zone' option.

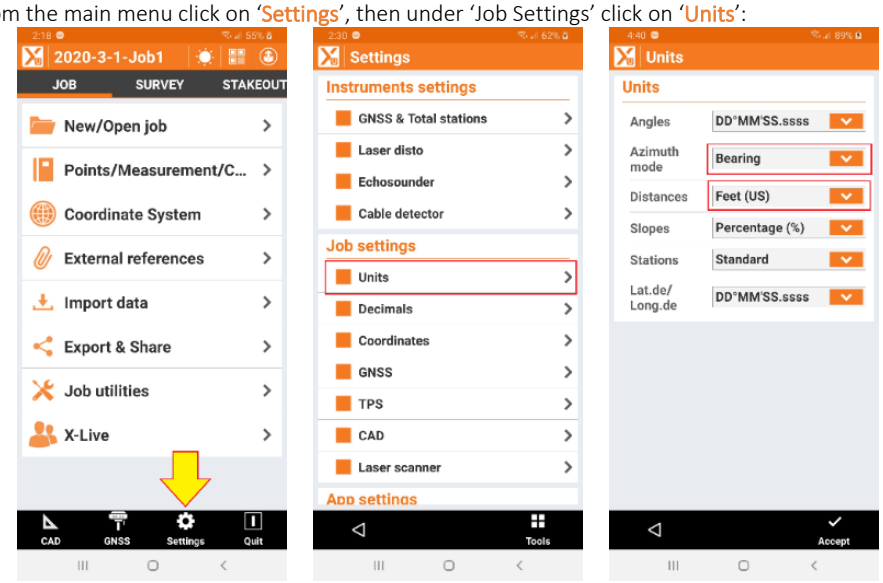
The Portland zone will be selected and activated:



X-PAD: Initial Job Setup

US Survey Feet, International Feet, Meters; Bearing vs. Azimuth

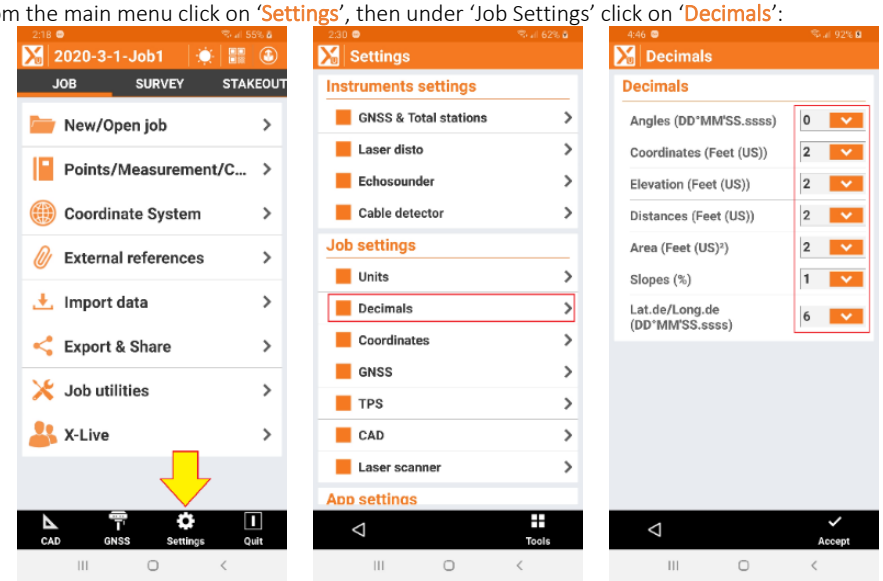
From the main menu click on 'Settings', then under 'Job Settings' click on 'Units':



You will probably want to change the 'Azimuth mode' to 'Bearing' and the 'Distances' to either 'Feet (US)' or 'Feet (International)'. You can also select fractional feet (inches and fractional inches) for building units.

Default Display Precision

From the main menu click on 'Settings', then under 'Job Settings' click on 'Decimals':



For GNSS/GPS based jobs you will probably want to set:

Angles	0	N 45 12 34 W	even minutes
Coordinates	3	0.000	hundredths of a foot
Elevation	2	0.00	hundredths of a foot
Distance	3	0.000	hundredths of a foot

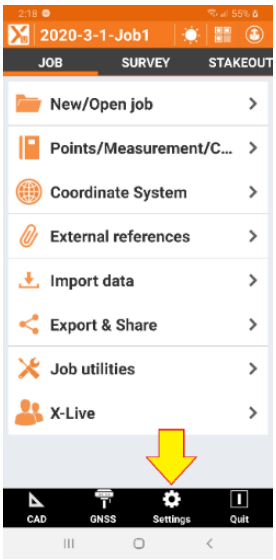
Lat/Lon	5	DDD MM SS.sssss	5-decimals of seconds

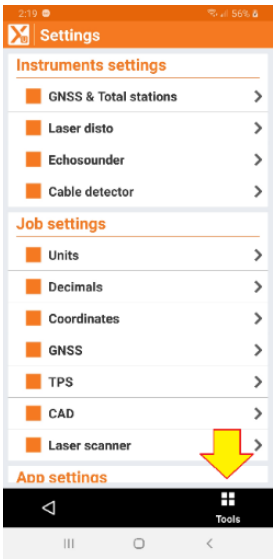
Saving Settings and Coordinate System Configurations

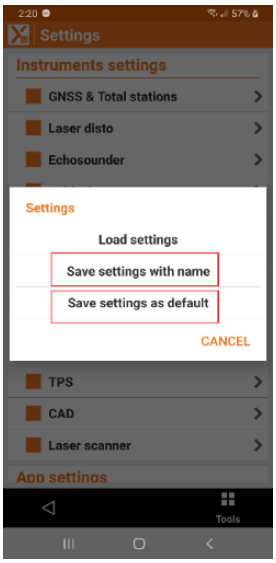
After installing X-PAD, take a moment to configure your typical jobs and then store them as X-PAD defaults. Both 'General Settings' and 'Coordinate Systems' can be saved. Coordinates can be saved on a Site-by-Site basis (see 'X-PAD: Sites' on page 15), and you can save both settings and coordinate systems to the 'default' or to a named file.

Storing 'Settings'

From the main menu click on 'Settings', then 'Tools', then 'Save settings with name' or 'Save settings as default':

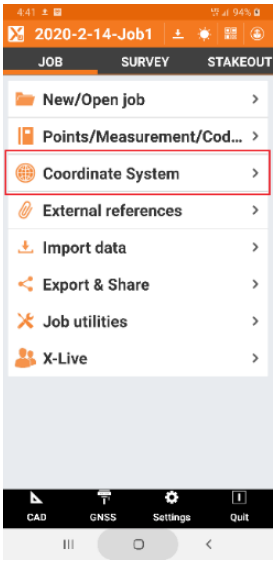


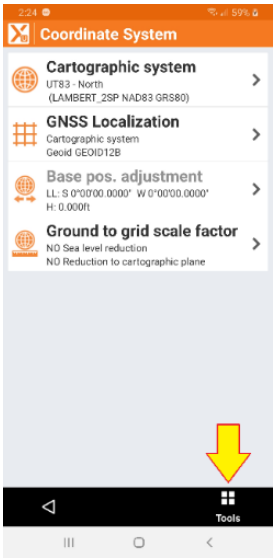


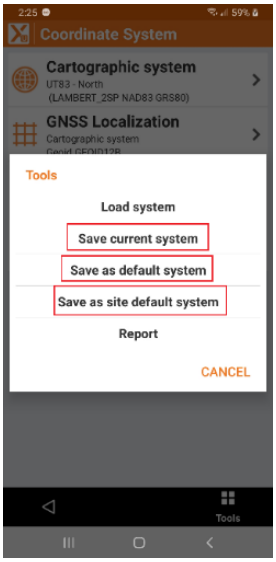


Storing 'Coordinate Systems'

From the main menu click on 'Coordinate System', then 'Tools' then choose how to save the coordinate system:





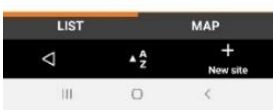


X-PAD: Sites

You can organize your jobs into ‘Sites’ where multiple jobs are contained under defined Site Names.

This ‘site selection’ button:

Allows you to organize jobs into an unlimited number of Sites:



Each site can have a unique default coordinate system.

X-PAD: Existing Job Display

The Job menu can display jobs four ways, selected by the icon in the right-hand corner of the top gray bar:

Gallery Thumbnails of jobs contained in a Site are shown in a cascading carousel	
List A list of jobs contained in a Site are shown with the Size and last edit date.	

Map

A map showing the sites in a job is shown.

The plotted point is the location where the job was started.

You can change the background map using the Map Selection button:

Calendar

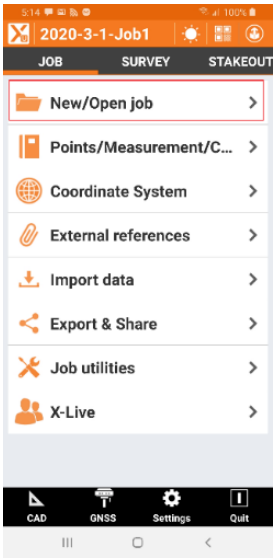
A calendar is shown with the last changed dates highlighted in orange.

Note that the calendar is organized with workdays left and weekends right:

MTWHFSS

X-PAD: New Job

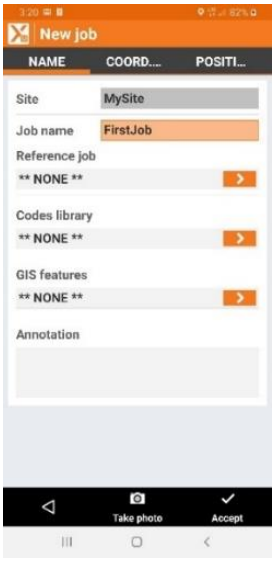
From the main menu:



Click on 'New/Open job',
choose a different site if wanted,

Click on the 'New job' button in the lower right corner to make a new job in the selected site.

X-PAD will prompt for a job name (the default is the Year-Month-Day-Job X):



Give the new job a reasonable name ('FirstJob' above).

Take a Site Photo with the 'Take Photo' button at the bottom that represents the new job.

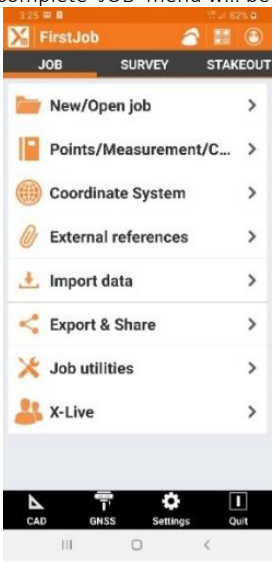
Select 'COORD...' at the top to display the default coordinate projection. This can be changed later.

Select 'POSITI...' to display the Address, job base Lat/Lon and job location on map.

Select 'PHOTO' to display the site photo.

After entering the initial metadata, click 'Accept' to create the new job.

The complete 'JOB' menu will be shown:

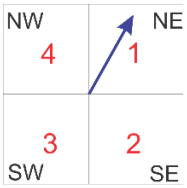


X-PAD: Using Quadrant Bearings

In the USA, for both rectangular and metes-and-bounds surveys it is common to describe courses by angle and distance.

Because it is difficult to compute the reciprocal of angles in Deg-Min-Sec.sss we use Quadrant Bearings where the angle is described as an angle East or West of North or South. This has the benefit of just exchanging the N/S and E/W to describe a line 'going the other way.'

For example:



The blue vector above describes a course:

246.501 feet 60.700813 degrees
246.501 feet 60 d 42 m 02.9294 s

In the US this course is described as:

246.501 feet N 29 d 17 m 57.0706 s W (normally rounded to nearest second)

Reversing the direction is simple:

246.501 feet S 29 d 17 m 57.0706 s E

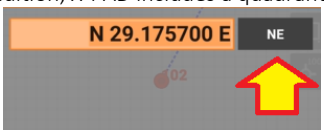
Most survey jobs begin with the entry of a parcel, described as a series of courses.

X-PAD automates the quadrant for a direction using the numbers in red in the diagram above:

1 NE 2 SE 3 SW 4 NW

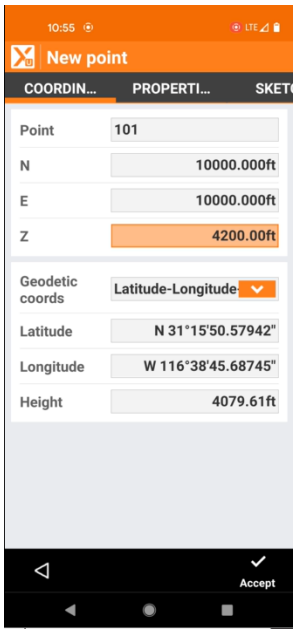
So, to enter N 29 17 57 E you can use the shortcut: 129.1757. The reverse bearing would be 329.1757.

In addition, X-PAD includes a quadrant increment button:



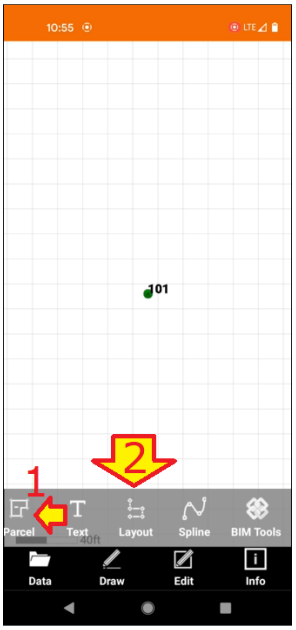
which when clicked changes the existing bearing through NE, SE, SW and NW.

Here is an example a 'straight line' course entry in X-PAD:

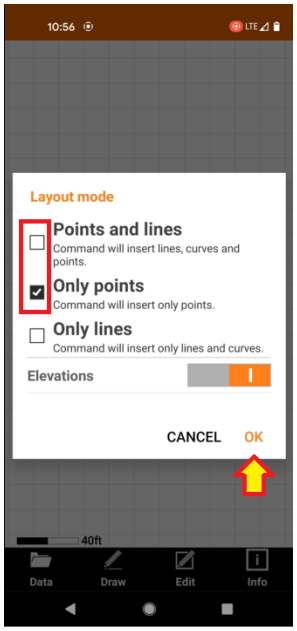


New Starting Point

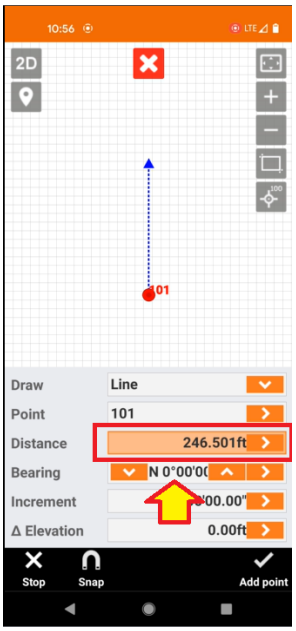
CAD, then Draw



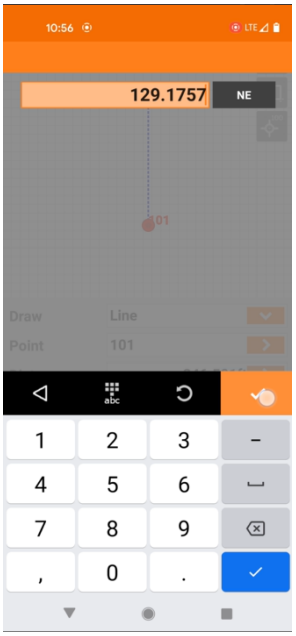
Drag left, then Layout



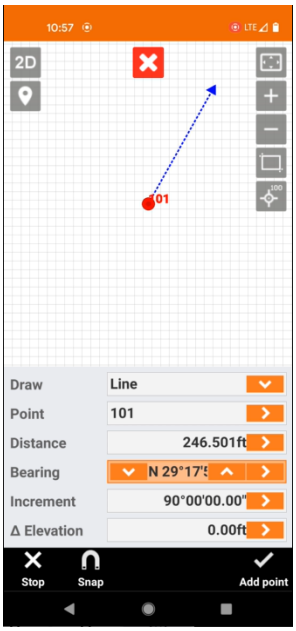
Choose Points, Lines or Both



Enter Distance, then click on the Bearing



Enter the Quadrant “1” then the Bearing. ☑



Visually check the course, click on Add Point

Inversing is called 'Distance'

If you want to inverse between two existing points, COGO: Distances is not what you want. This COGO option computes an inverse from your current position to a feature.

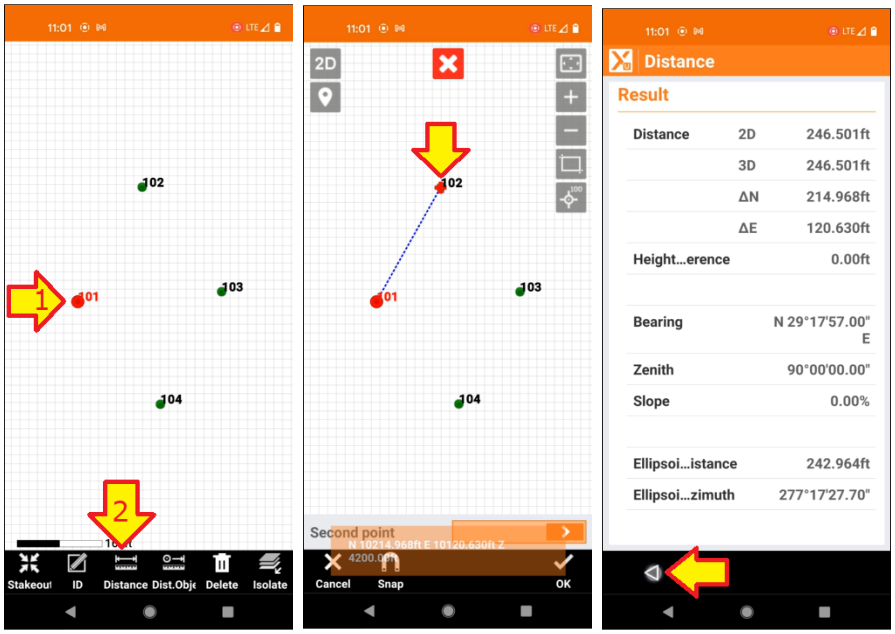
Instead, click on CAD from the main menu.

There are two ways to Inverse:

1. From Point method: click on a point, then choose Distance. Subsequent point clicks will compute from the First point to each subsequent points holding the First point constant.
2. Traverse method: click on Info: Distance. Select the First point, then select the Second point. Subsequent point clicks will compute from the previously clicked point so you can traverse around a parcel checking each course in order.

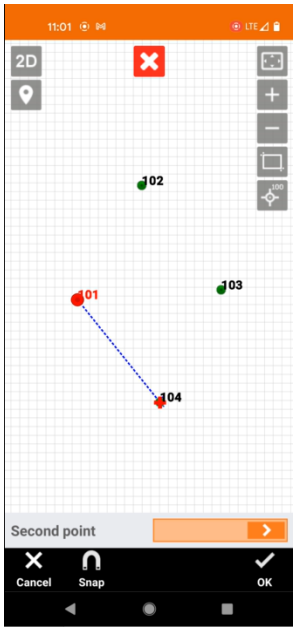
Inverse from a Point

First click on CAD from the main menu.



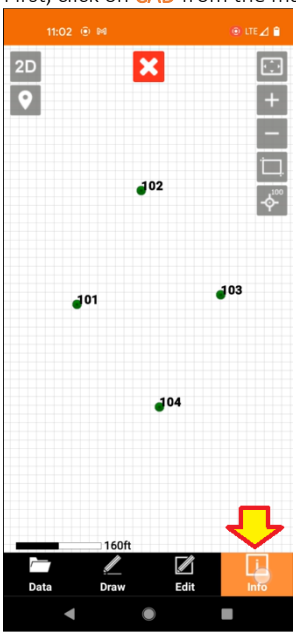
Click on a point (1), Click on the Second point Check the course then click on Distance (2)

You can then click on another point and inverse from the First point to another feature:

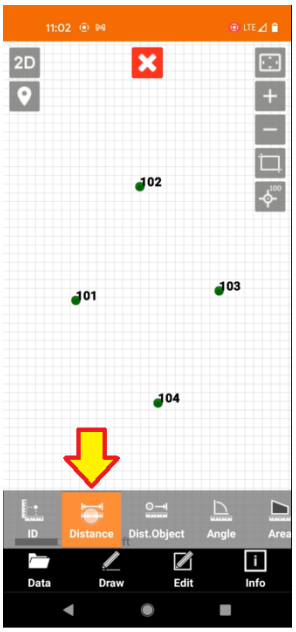


Inverse along a Traverse

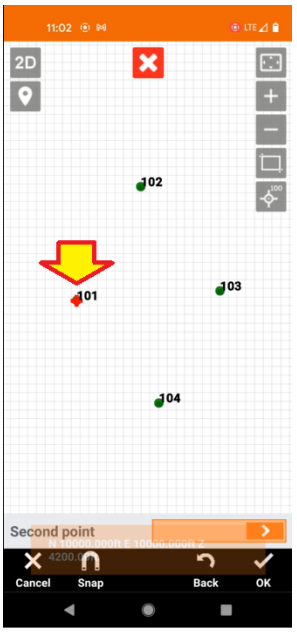
First, click on CAD from the main menu.



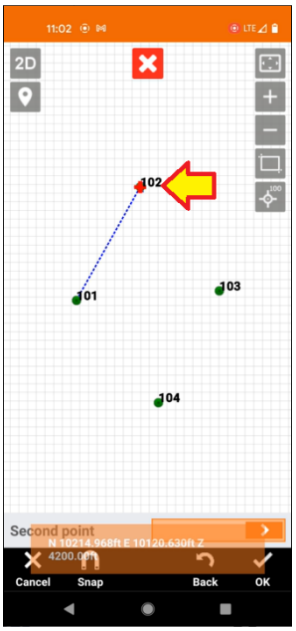
Click Info



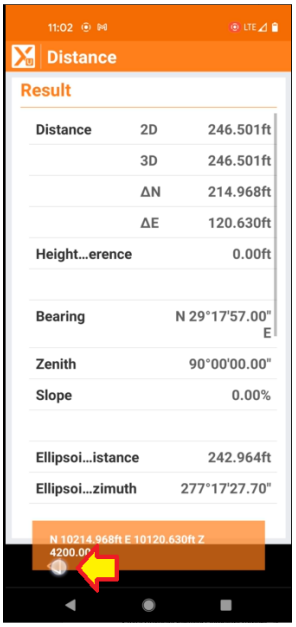
then Distance



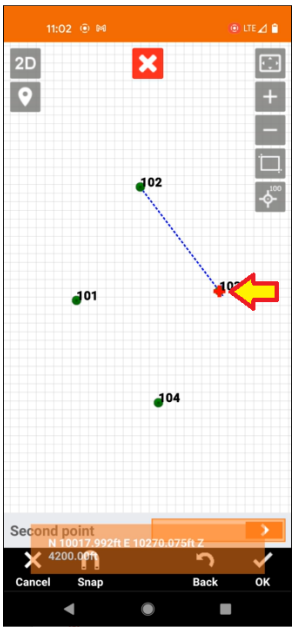
then click on the First Point



Then click on Second point



Click back,



Click on the next traverse leg endpoint to move ahead

X-PAD: Choosing an appropriate Coordinate System

X-PAD makes it very simple to setup jobs in a variety of common projection types. The USA specific localization package preloads most State Plane Zones and special County and State zones.

Each of the following coordinate systems is described below:

For many applications you would like to survey with local Ground scaled coordinates, but also export accurate State Plane Coordinates.

Switching an existing job between projection type is very simple and point-coordinates automatically recompute on the fly.

In addition, it is very easy to adjust a job and base position with an NGS OPUS provided position.

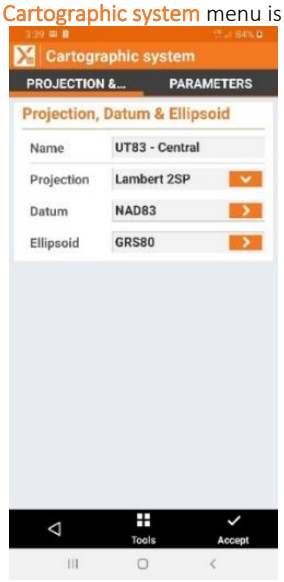
This is handy when you setup a base at an autonomous position (Read GPS or Here), collecting static data; perform a survey at Ground with local coordinates (like 5000, 5000) and then later want to adjust the base position to match an OPUS solution and then export out State Plane Coordinates that are OPUS based.

X-PAD: Coordinate System: State Plane Coordinates at Grid

From the main menu, click on Coordinate System > to define the job projection:

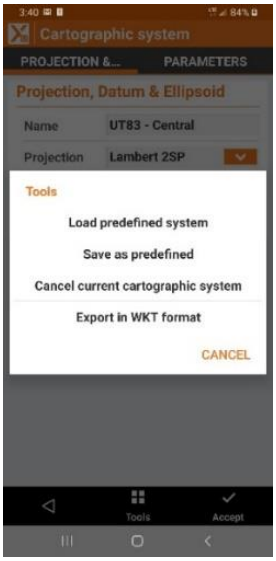
Click on Cartographic system >

The Cartographic system menu is shown:



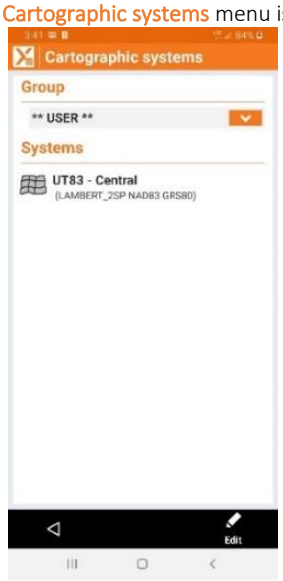
If the current projection is not correct, click on Tools at the bottom.

From this Tools menu:

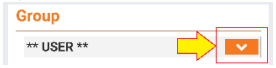


Click on Load predefined system.

The Cartographic systems menu is shown:

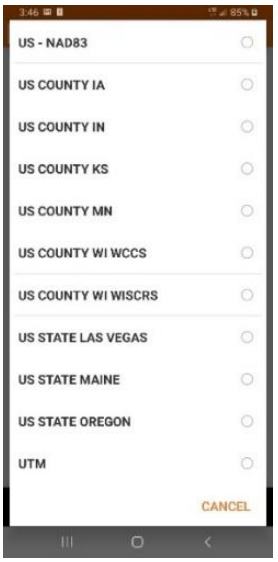


All of the previously used systems will be in the **USER** list, if the projection you need is not already listed, click on the down arrow:



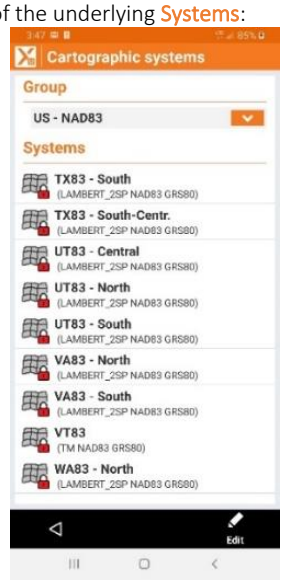
A list of all countries and US special projections will be shown.

Typically, you will want to choose 'US-NAD83', however if you are in Iowa, Indiana, Kansas, Minnesota, Wisconsin, Las Vegas Nevada or Oregon the local projections will be at the bottom of this list:



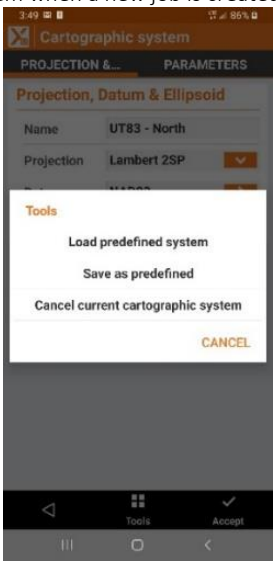
There are also entries for UTM and 'US-NAD27'.

After you select the correct Group, X-PAD will load all of the underlying Systems:



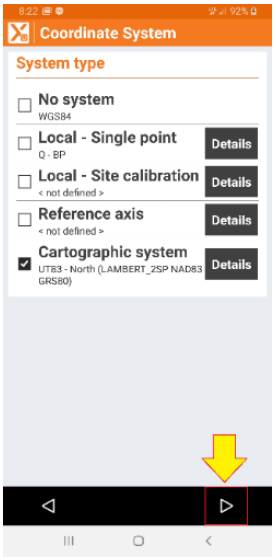
For this example, click on 'UT83 – North' loads the Utah North NAD83 SPC:

If you would like the new system to be the default system when a new job is created, click on Tools:



then Save as predefined. Future jobs will default to this projection.

Click the Accept button to return to the Coordinate System dialog:



Click the right-arrow at the bottom of the screen.

The Vertical system dialog will be shown:

Choose an appropriate GEOID (1), then click Accept (2) at the dialog bottom.

If USA specific GEOIDS are not available, follow the procedures in the chapter "Loading the USA Localization Package" on page 9 to download the USA Localization Package from the internet.

X-PAD: Coordinate System: Single-Point Localizations at Ground

X-PAD has two distinct scale factor mechanisms:

Ground to Grid

Used to convert Total Station Ground measurements down to Grid.

This is
NOT WHAT YOU WANT
for GPS / GNSS jobs!

This is for scaling
Ground Total Station
Measurements to Grid ➔

Grid to Ground

Available when a Local Single point system is selected.

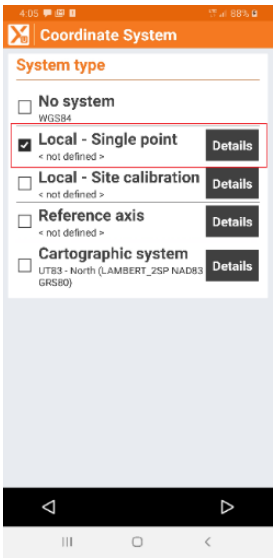
If you want to set local coordinates like:

10,000, 10,000

with a computed grid-to-ground scale factor that results in distances being Ground, then

This is the method
that you want!

😊



This section describes how to configure a job with:

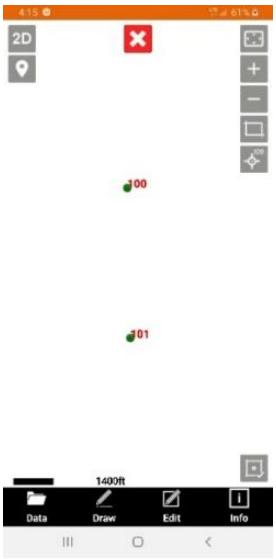
Local Coordinates like 10000, 10000, 5600

True / Geodetic North at a base point

Ground Distances: inversed distances will exactly match a total station

From a new job or an existing job, in State Plane or any other coordinate system store a point or setup a base at the location that you would like to be the local coordinate base.

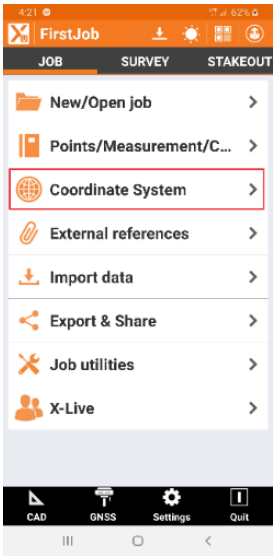
For this example, we will use an existing job with two points: Pt 101, the East Quarter of a section and Pt 100, the Section Corner a ½ mile to the North:



We want to assign the horizontal coordinates 10,000, 10,000 to point 100 where we have already set the base.

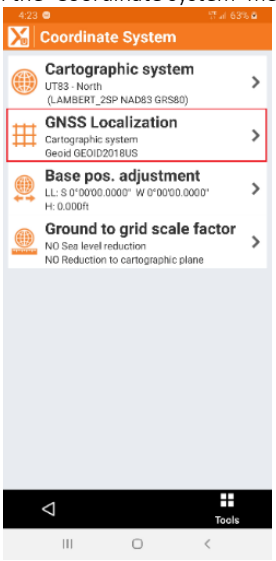
The UHF base was set with approximately the correct height so the elevation of point 100 is nearly correct, we will honor this measured height in our new projected system.

From the main JOB menu:



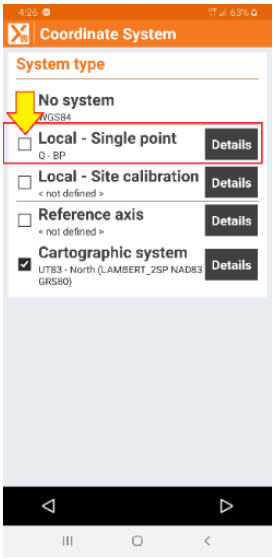
Click on Coordinate System.

From the 'Coordinate system' menu:



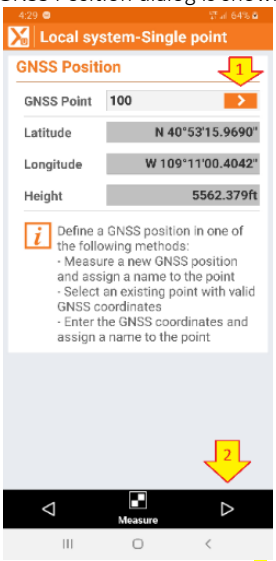
Click on 'GNSS Localization'.

The Coordinate System. System type selection menu is shown:



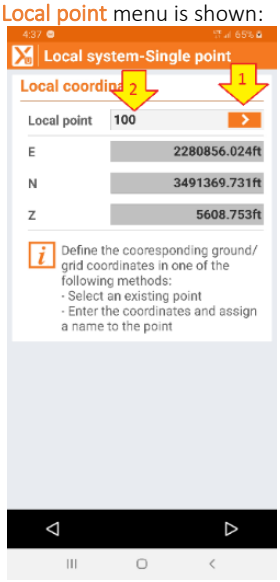
Check the 'Local – Single Point' checkbox, then click on the 'Details' button to the right.

The GNSS Position dialog is shown:

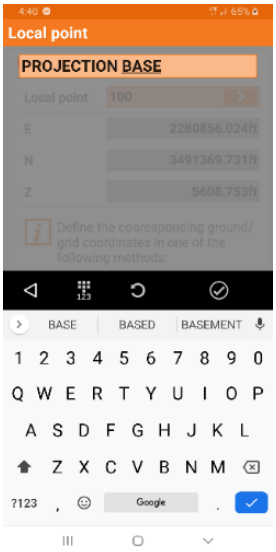


Click on the orange '>' button (1) and choose the measured point 100:
Then click on the right-arrow (2).

The Local point menu is shown:

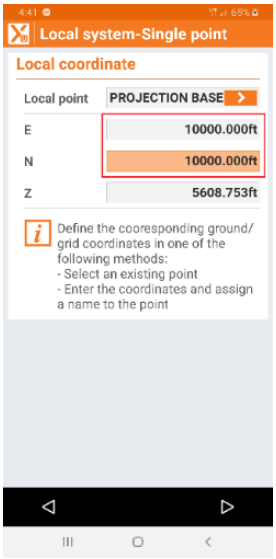


X-PAD asks for the Local point coordinates. We would like to reuse the existing height, so use the orange '>' button (1) to recall the State Plane coordinates for point 100.
Then click on the Local Point name (2) and enter a unique code:



Click the checkmark (blue or circled)

to return to the Local coordinate dialog:

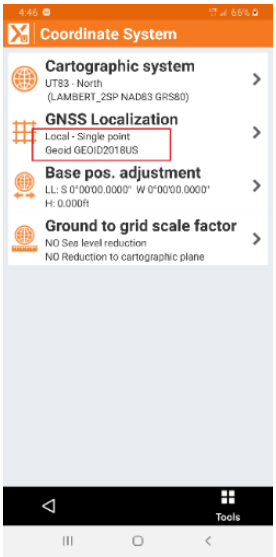


Now edit the Easting (E) and Northing (N) to be '10,000'. Then click the Next button on lower right corner.

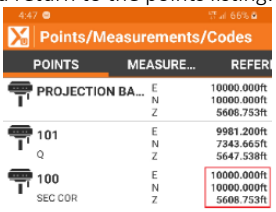
The Vertical system dialog is shown:

Choose an appropriate Geoid the latest GEOID (currently GEOID2018) is best, then click the Accept button lower-right.

The 'Coordinate system' screen is shown again with 'Local – Single point; Geoid. The selection 'GEOID2018US' is shown under the localization type:



If you return to the points listing:



You will find new horizontal coordinates have been automatically computed for the existing points.

The job is now ready to survey additional points.

If you inverse distances between points, they will be Ground distance.

The basis of bearings will be True / Geodetic North at the projection base point.

X-PAD: Coordinate Systems: Multiple-Point Site Calibrations

If you have two or more known coordinates on a job then you can match a coordinate system to best-fit your known coordinates.

The easiest way to build a multiple point site calibration is to

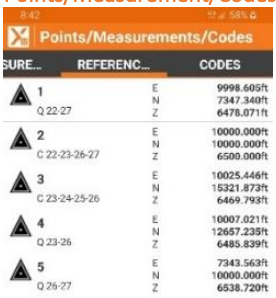
build a new job with a State Plane Coordinate system that matches your survey area

import the local coordinates that you will be calibrating to

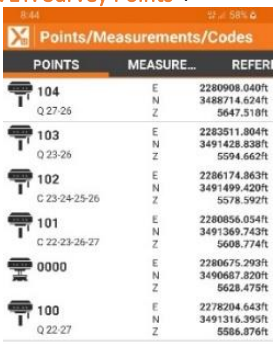
survey/store the points that match the calibration coordinates

Typically, you will use: JOB: Import Data: Text File (ASCII) to import the known positions as REFERENCE POSITIONS. There are many other file formats available for direct import.

Once points are imported you can view them from JOB: Points/Measurement/Codes:



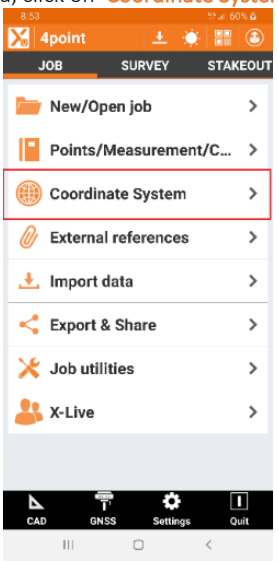
Either connect the rover to a network base, or setup your base at a known or unknown point. Once your rover has a FIXED position, store corresponding points for each of the measurement points using SURVEY: Survey Points":



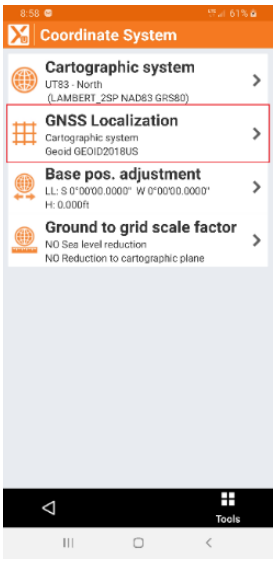
In this example the Reference points and Measured Points match this table:

Corner / Quarter	Reference Local Coordinates	GNSS Measured
Q 22-27	1	100
C 22-23-26-27	2	101
C 23-24-25-26	3	102
Q 23-26	4	103
Q 26-27	5	104

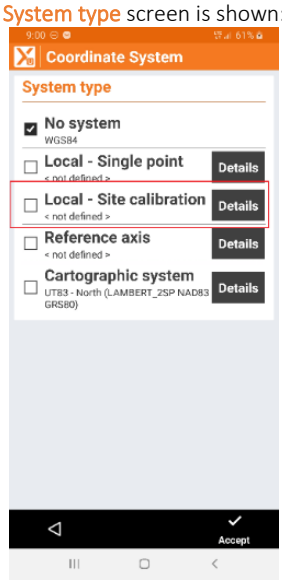
To build a multiple point calibration, from the JOB menu, click on 'Coordinate System':



The Coordinate System dialog is shown, click on 'GNSS Localization':

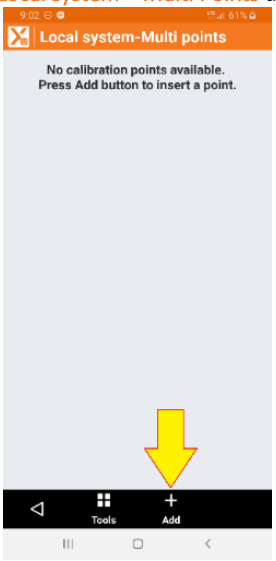


The System type screen is shown:



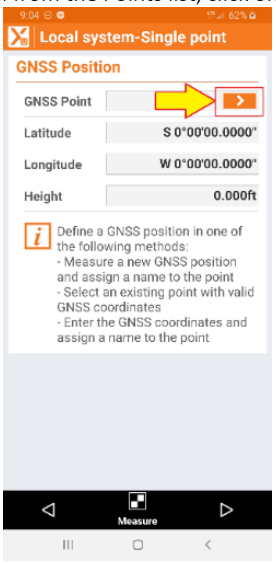
Click on Local – Site calibration, then click Details.

The Local system – Multi Points dialog is shown:

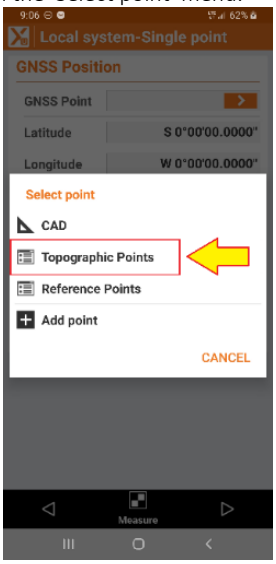


Click on + Add on the bottom.

X-PAD asks for the GNSS position which you can recall from the Points list, click on the '>' button:

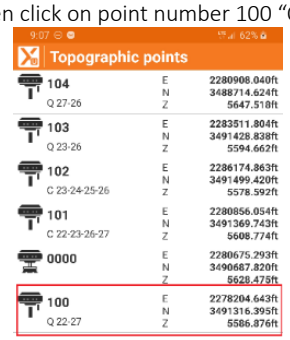


From the ‘Select point’ menu:

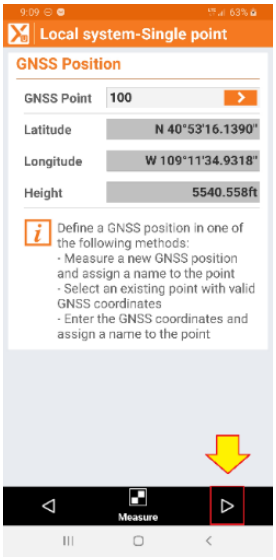


choose Topographic Points.

Then click on point number 100 “Q22-27”:

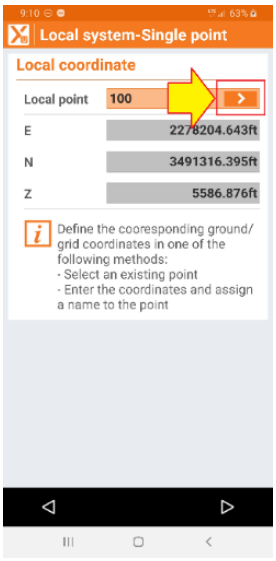


X-PAD confirms the GNSS Position:



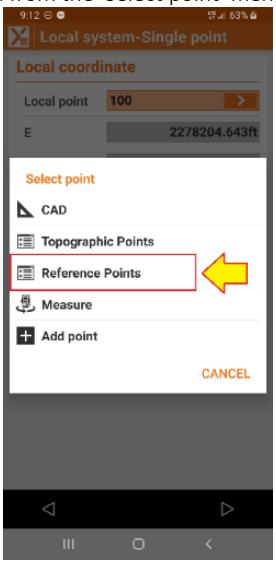
Confirm by clicking the right-arrow at the bottom.

X-PAD will ask for the Local coordinate:



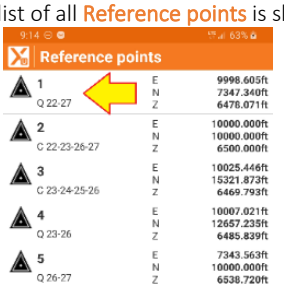
Click on the ‘>’ button.

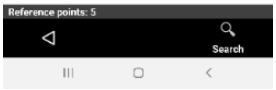
Then from the ‘Select point’ menu:



Choose Reference Points.

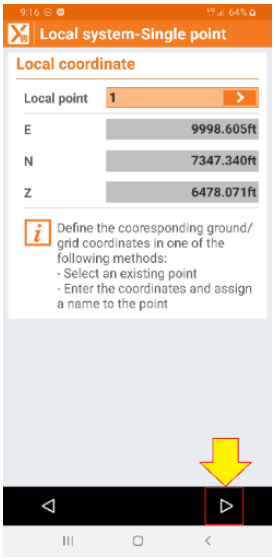
The list of all Reference points is shown:





Click on Reference point #1 which corresponds to GNSS point #100.

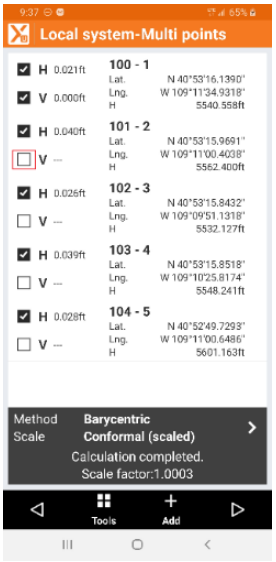
The Local coordinate menu is shown again:



Then verify the local coordinate by clicking the next button.

The first point pair has been successfully added. Click the ‘Add’ button and repeat this process for the remaining 4 points.

After adding all 5 point-pairs, the calibration will look similar to this:

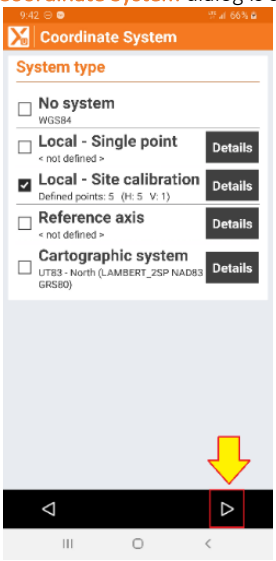


It is customary to only check one Vertical control box to avoid a tilted plane calibration unless the polygon formed by the control points completely encloses the entire job.

You can enable / disable horizontal checkboxes to narrow down any coordinate blunders.

Once the site calibration is acceptable, click on the Next button.

The Coordinate System dialog is shown again:

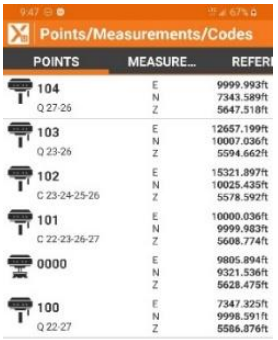


Click the Next button.

The Vertical system menu is shown:

Choose an appropriate GEOID for your project.

When you return to the Points list, you will find that your measured points have been adjusted based on the new site calibration:



X-PAD will have computed a coordinate system that best matches your record (Local) data and applied it to all of the data.

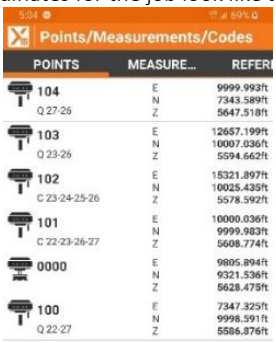
X-PAD: Switching between Coordinate Systems

Often when you configure a job for local ground coordinates, at the completion of the job you would like to also export out State Plane Coordinates (SPC) for the surveyed points to use as metadata for a plat. This allows distances and bearings to be in the local ground system, but still have coordinate annotations or tables that list the SPC grid coordinates.

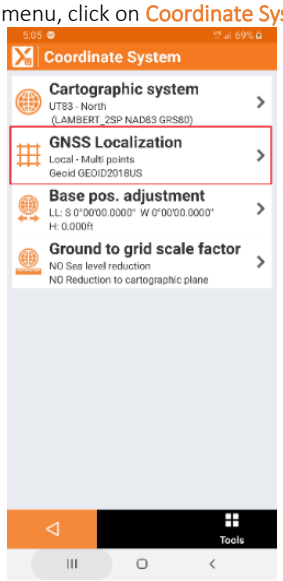
X-PAD makes it trivial to switch back to SPC, and then return to the local ground system if needed.

As an example, consider the Multiple-Point Site Calibration from the previous section. The local

coordinates for the job look like this:

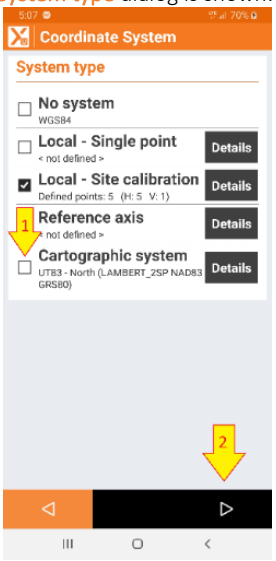


To switch back to SPC coordinates from the main JOB menu, click on Coordinate System:



Then click on GNSS Localization.

The System type dialog is shown:

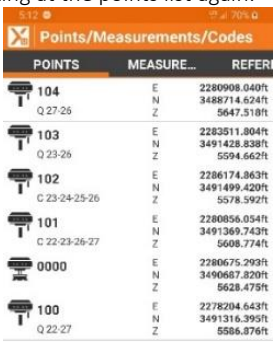


Check the Cartographic system checkbox (1) and if the displayed system is correct click on the Next arrow (2).

Choose an appropriate 'Vertical system', then click the Accept button:

All of the coordinates are automatically recomputed.

Looking at the points list again:



The job is now State Plane projected.

After exporting these State Plane coordinates, it is just as easy to reselect the Multi Point GNSS Localization and return to Ground measurements.

X-PAD: Adjusting a Job to an OPUS Position

Often you must setup a base at an unknown position and use an autonomous GPS position to initialize the base.

If you enable raw data recording you can submit the collected raw data file to NGS OPUS and get a very reliable known position for the base position.

With X-PAD it is simple to then translate the original base position and all of the stored points to the OPUS position.

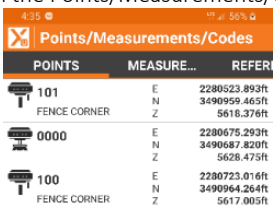
Here is a simple example:

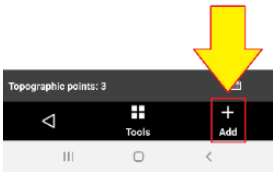
This job has two stored points 100 and 101, and an autonomous base position 0000.

After submitting the raw data from the base to OPUS these coordinates are returned by the OPUS processing system:

```
          LAT:    40 53 09.29261        0.006(m)
    E     LON:    70 48 57.02629        0.008(m)
    W     LON:   109 11 02.97401        0.008(m)
   EL     HGT:          1700.944(m)     0.011(m)
ORTHO     HGT:          1715.076(m)     0.024(m)
```

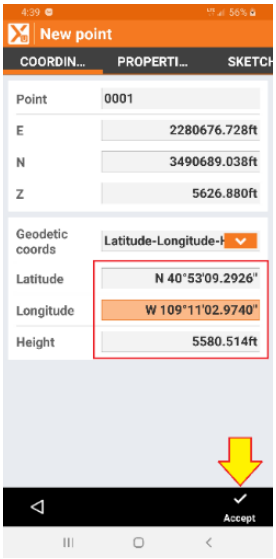
From the Points/Measurements/Codes screen:



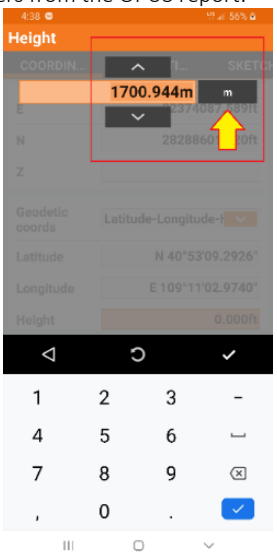


Click the Add button.

Enter the Lat, Lon and Ellipsoid Height from the OPUS solution as the Geodetic coordinates for a new point 0001:



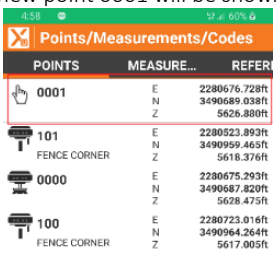
When entering the **Latitude**, enter as “40.53092926” (DD.MMSSssssss). When entering **Longitude** enter as “-109.11029740”. When entering the **Height** use the units’ box to directly enter the ellipsoid height in meters from the OPUS report:

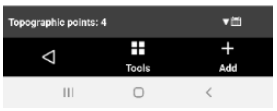


When you complete entering the Latitude, Longitude and Ellipsoid height; X-PAD automatically computes the matching State Plane Coordinates at the top of the point entry.

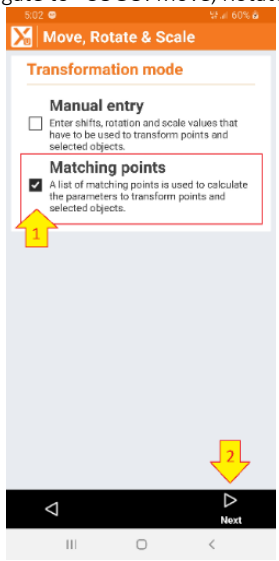
The projected point (SPC) always shows the orthometric height, the geographic coordinate (Lat Lon Height) always shows the ellipsoid height.

The new point 0001 will be shown in the POINTS list.



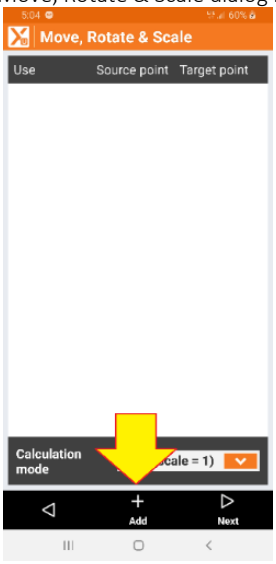


Navigate to “COGO: Move, Rotate & Scale”:



Click on (1) Matching points then click on (2) Next.

The Move, Rotate & Scale dialog is shown:



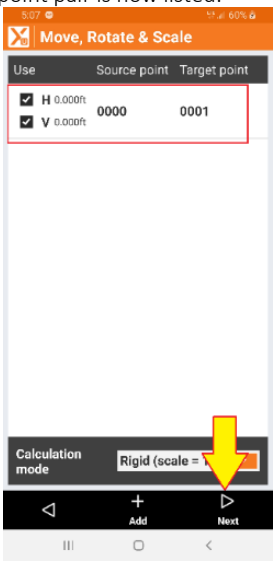
Click on the Add button.

Select the original point 0000 as the Source and the OPUS solution 0001 as the Target:

Set Use HV to H+V.

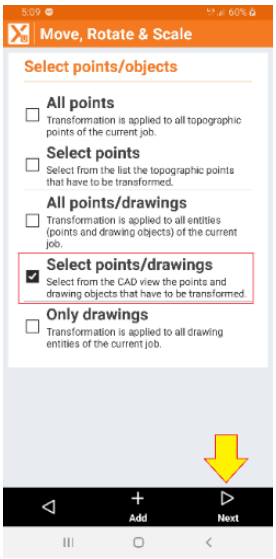
Click on ADD.

The point pair is now listed:



Click on Next to continue.

Select what entities (Points and Objects) you want to move:



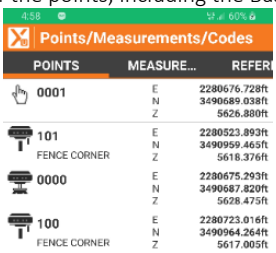
Then click Next.

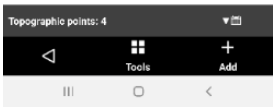
Choose where to put the translated points:

Then click on Next.

Then click on Accept.

All of the points, including the Base will have been translated to the OPUS solution coordinates:





BEFORE

AFTER

Not only are the points translated in the projected coordinate system, the underlying Geodetic coordinates are also translated. This allows you to setup the base on subsequent days using the translated Geodetic coordinates so that future work will match the translated points.

Instrument Profiles in X-PAD

Each of your instruments will have one or more Instrument profiles in X-PAD.

A GNSS receiver might have both a UHF Rover profile, a UHF Base profile and a Network Rover profile.

Once you setup a profile, it can be reused over and over as needed for multiple jobs.

Profiles are added from 'Settings: Instrument Settings'.

This manual covers these instrument profile types:

X-PAD: Network Rover Instrument Profile

Your iGage receiver makes a great Network Rover coupled with X-PAD on a data connected device like a cell phone. Corrections are received by the Android device and passed through Bluetooth to the RTK head.

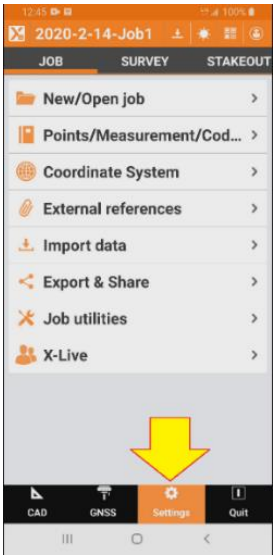
You can also provision a GSM card for your GNSS receiver and use its internal cell modem for the data connection.

Start a new job following the steps in the section 'X-PAD: New Job' on page 17.

Turn the receiver on and make a note of its 'Serial Number'.

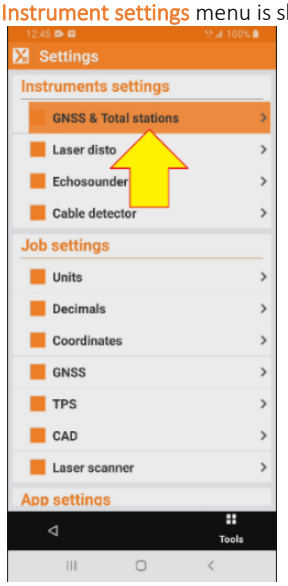
The first time you make a connection to a server, you need to create a new instrument configuration that includes the network settings.

In X-PAD from the main menu:



click on Settings.

The Instrument settings menu is shown:



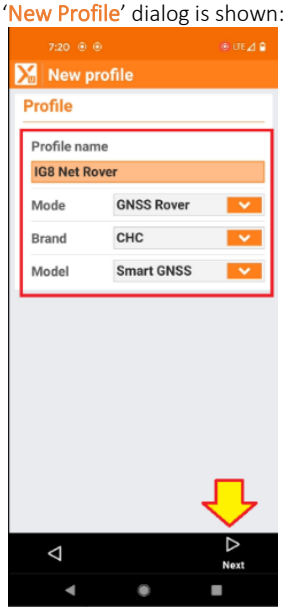
Click on GNSS & Total stations.

On the Instruments menu:

Click on 'Add' to configure a new instrument.

Choose GNSS Receiver (GNSS) as the instruments type.

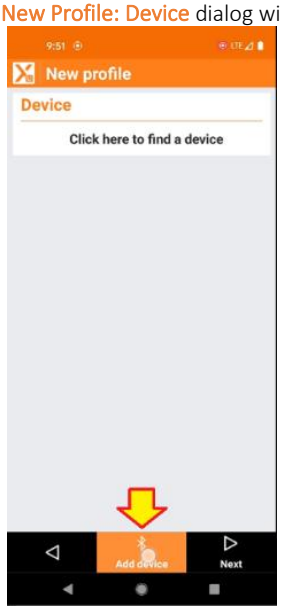
The 'New Profile' dialog is shown:



Enter a Profile Name, set the Mode to GNSS Rover, set the Brand to CHC.

Finally press Next.

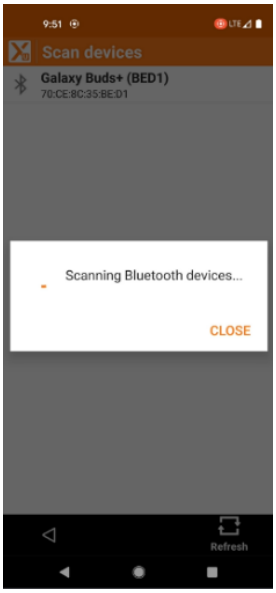
The New Profile: Device dialog will be shown:



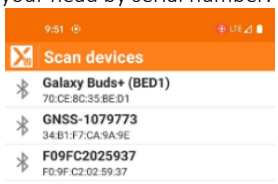
If you have already bonded to the Base receiver, use the drop-down button to select your device by serial number and proceed to the RTK- receive corrections section below.

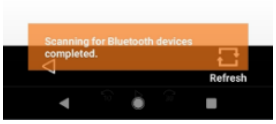
If your device is not listed (as shown above), click on the Add Device button at the bottom.

X-PAD will scan for Bluetooth devices:



After 15-seconds the available devices will be listed, find your head by serial number:



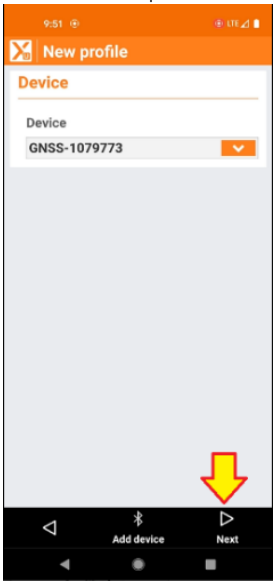


Click on the device.

The Bluetooth Manager will be shown again:

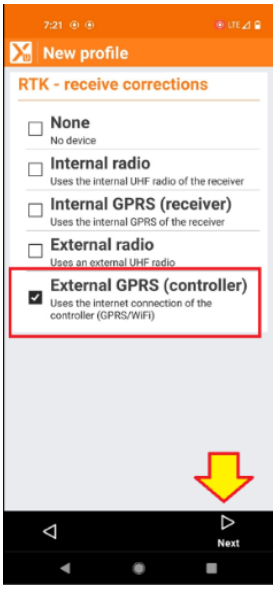
Click on Next.

The New Profile dropdown will be shown again:



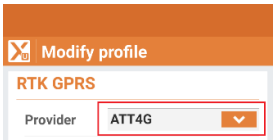
Verify that the correct Bluetooth device is selected. Then click 'Next'.

The 'New Profile Device' screen will be shown:



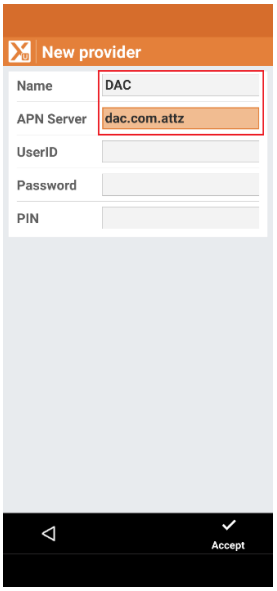
Select External GPRS (controller) to use the internet connection in the Android data collector or click on Internal GPRS (receiver) to use the GSM modem in the receiver.
Then click on Next.

If you choose Internal GPRS (receiver) you will need to set the cellular Provider which sets the APN in the receiver's internal GSM modem:



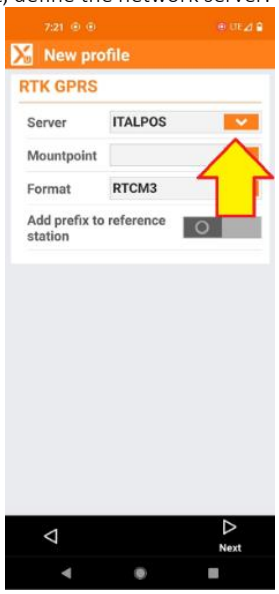
X-PAD includes common worldwide cellular providers:

for ATT 3G use AT&T (broadband)
for ATT4G use ATT4G (Broadband)
for iGage DAC supplied cards make a custom provider by clicking:
Providers...
then click +Add



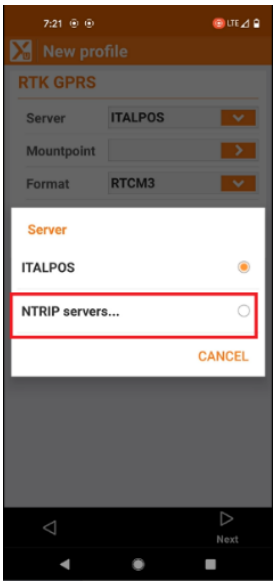
enter Name = DAC with the APN Server = dac.com.attz as shown above.
Click Accept to continue.

Next, define the network server:



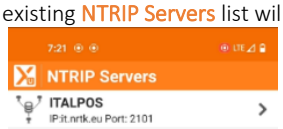
Click on the drop-down arrow in the Server selection.

The Server list is shown:



Click on NTRIP servers... to define a new network server.

The existing NTRIP Servers list will be shown:



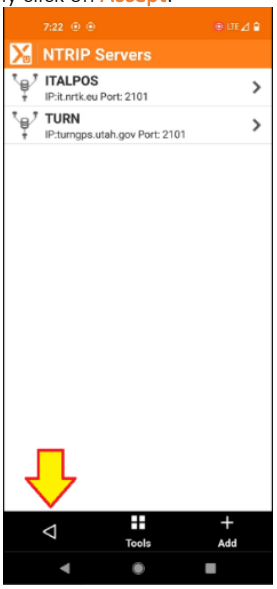
Click on + Add to add a new server.

The New NTRIP server dialog is shown:

Enter the server Name,
choose a mode: NTRIP or Point-to-Point,
enter the IP as either an internet address or dotted numerical address,
enter a Port number and if NTRIP enter the UserID and Password.

Before accepting, please **double-check** the IP address, Port and UserID and Password. The UserID and Password are case sensitive, a single transposed or missing digit will prevent the connection from succeeding.

Finally click on Accept.



Click on the Back arrow.

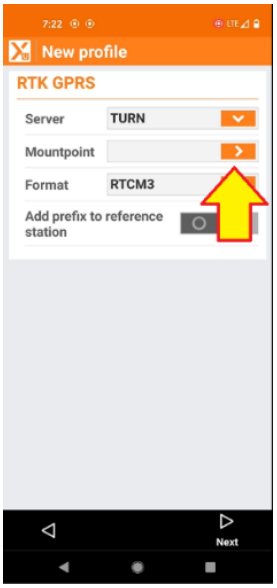
Returning to the RTK Profile screen:

Click on the Server drop down arrow again.

From the Server list:

Select the newly entered server.

And it will be listed as the Server:

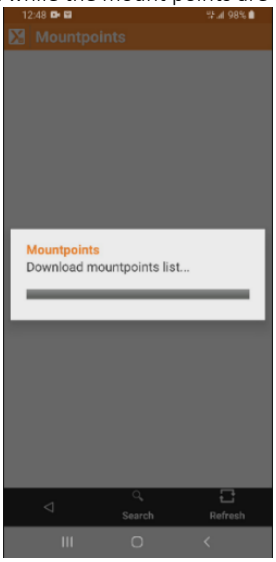


Click on the Mountpoint selection arrow >.

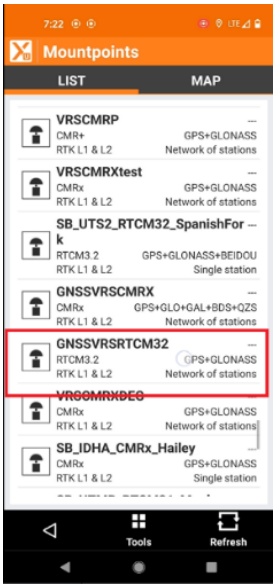
The empty Mountpoints list is shown:

Click on the Refresh button to connect to the network server and download the complete server mount table.

Wait while the mount points are downloaded:



After a moment the server's available Mountpoints: LIST will be shown:

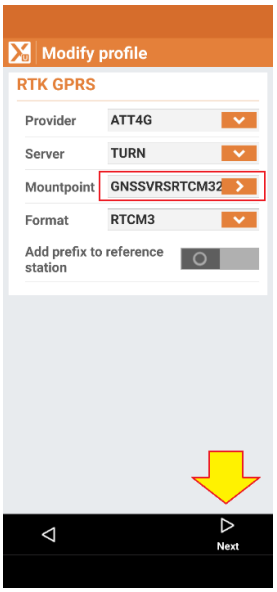


Scroll through the mount point list and click on the best correction source.

Typically, the best mount point will be a RTCM3.2 VRS selection which has the possibility of containing corrections for GPS + GLONASS + Galileo + BeiDou constellations with support for L2C, L3 and L5 signals.

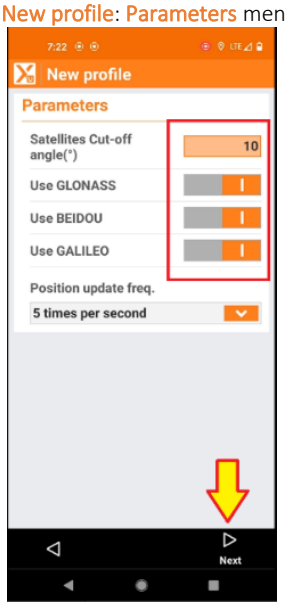
An RTCM2 or CMR+ mount point will typically only include corrections for GPS and GLONASS without the benefit of L2C, L3 and L5.

When you click on a mount point selection, you will return back to the RTK GPRS menu:



Click Next.

The New profile: Parameters menu will be shown:



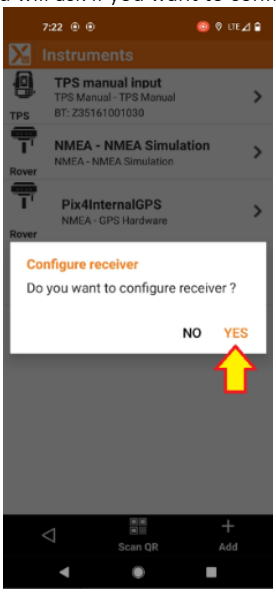
Set a reasonable Cut Off angle (10 or less), enable all the constellations, choose Position update freq. = 5 times per second, then click on Next.

The Antenna Height menu will be shown:

Enter the instrument Height in Meters or Feet. The Height is the distance from the bottom most part of the receiver to the point on the pole. If you have used a quick-connect, don't forget to add the adapter's height to the pole height.

Finally click on Accept.

X-Pad will ask if you want to configure the receiver:

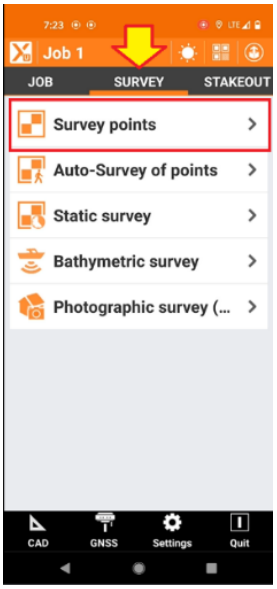


Click on Yes.

After a few moments the Instrument panel is shown with the new configuration selected:

Press the Back arrow,

to return to the main menu:



Select the SURVEY tab, then click on Survey points.

After a few moments the receiver should report a RTK FIXED solution:

If the Rover receiver is not FIXED, check the following items:

- Does the Android controller or receiver have internet access?
- Is the Server configuration exactly correct? (IP address, Port, UserID and Password must be exact.)
- Is the receiver outside and tracking satellites? Does it have a position?
- Is the receiver within the service area footprint for the network server?

X-PAD: UHF Base Instrument Profile

X-PAD has a variety of ways to configure a Base receiver broadcasting corrections over UHF.

The primary difference is how the initial coordinate for the base is obtained:

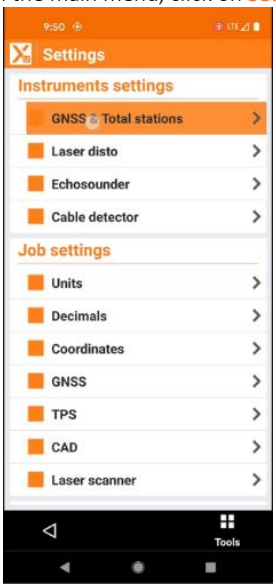
- Known Position: The position of the Ground Mark under the Base can be entered as a Geographic (Lat/Lon/Height), Projected Northing, Easting, Height or recalled from any of the Topographic or Reference points stored in the job.
- Current Position: The receiver's current position can be used to define the Base location. The receiver's Autonomous location can be used, or you can optionally connect the base receiver to a network server as a rover, get a network position for the base and then start the base with the network position.
- Last Setup: The last successful Base configuration, with possibly a new instrument height, will be used as the Base's broadcast coordinates.
- Automatic RTK Position: The Base receiver will be connected to a network using a matching Network Rover instrument profile and network corrections will be used to generate a FIXED solution which will then automatically be used as the Base's broadcast location.

Each of these Base configuration methods follows a similar configuration path.

X-PAD: Defining a Base Profile

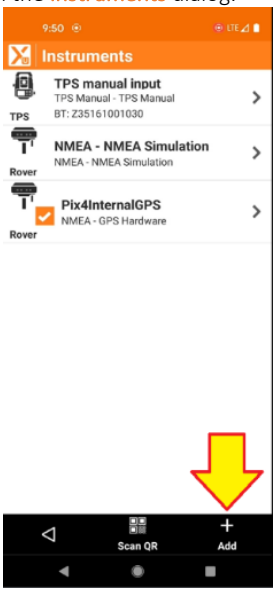
Start by opening an existing or new job.

From the main menu, click on Settings:



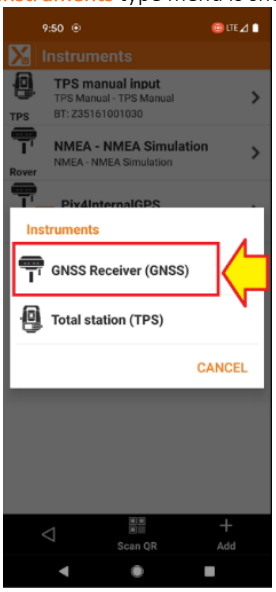
Then click on GNSS & Total Stations

From the Instruments dialog:



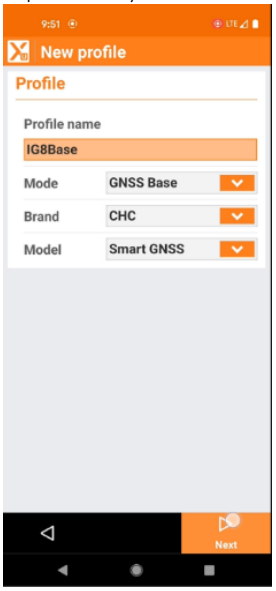
Click on the + Add button.

The Instruments type menu is shown



Choose GNSS Receiver (GNSS).

Build a profile for your receiver:



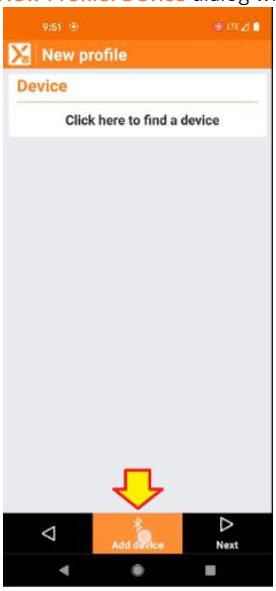
Set the 'Profile name' to reflect this will be a UHF Base.

Set the Mode to 'GNSS Base'.

Set the Brand to 'CHC'.

Then click Next.

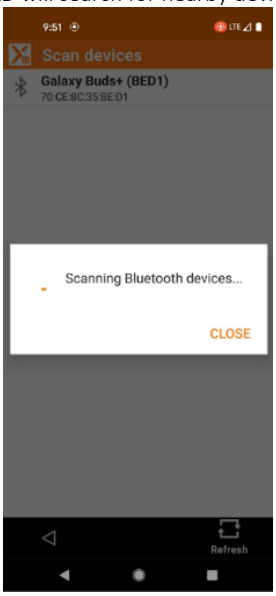
The New Profile: Device dialog will be shown:



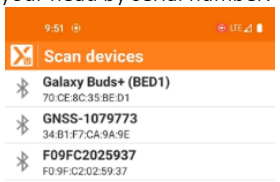
If you have already bonded to the Base receiver, use the drop-down button to select your device by serial number and proceed to the RTK- receive corrections section below.

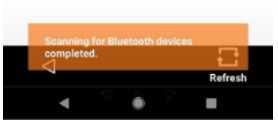
If your device is not listed (as shown above), click the Add Device button:

X-PAD will search for nearby devices:



After 15-seconds the available devices will be listed, find your head by serial number:

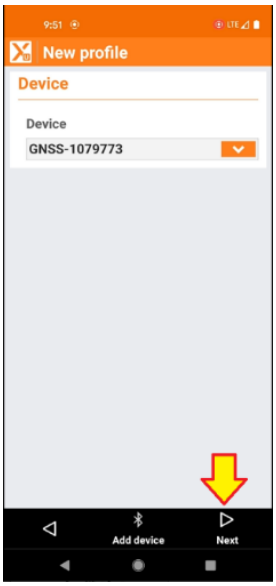




Click on the device, the Bluetooth Manager will be shown:

Click on Next:

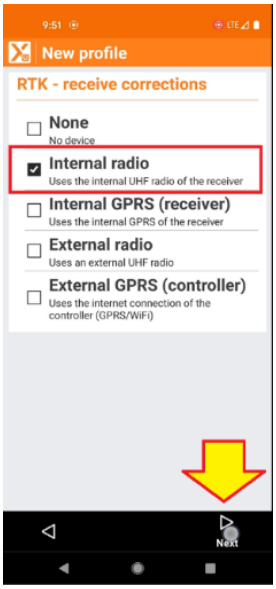
The Device selection is shown:



Verify that the correct receiver is selected.

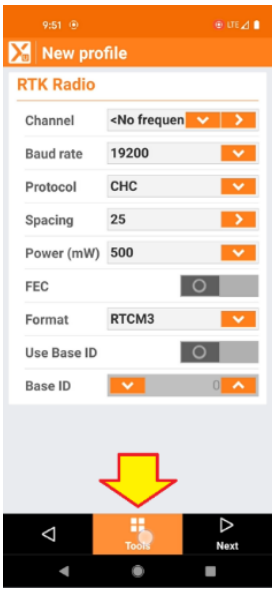
Then click Next.

The New Profile: RTK – receive corrections selection is shown:



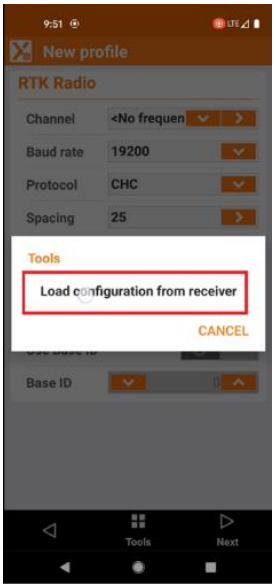
Select Internal radio, then click Next.

The New Profile: RTK Radio menu is shown:



Click the Tools button at the screen bottom

The Tools menu is shown:



Click on Import configuration from receiver.

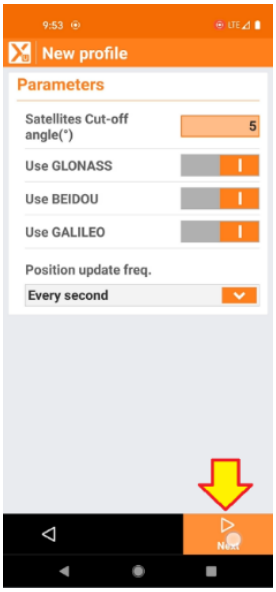
The existing radio profile will be recalled from the receiver's radio:

The Base and Rover settings must match exactly, except for Power which should be high on the Base and low on the Rover.

The settings shown above should be adequate for most applications. Setting FEC = ON for both the Base and Rover may double the radio range.

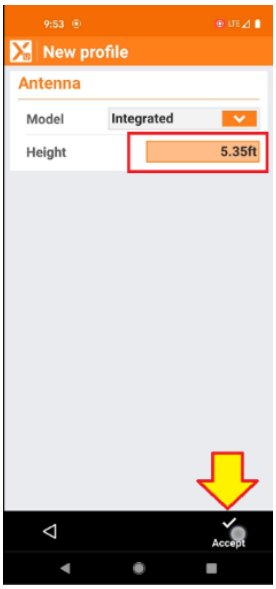
Click Next.

The New Profile Parameters dialog is shown:



Enable all the constellations and set the Satellites Cut off angle (Mask) to a value less than 8.

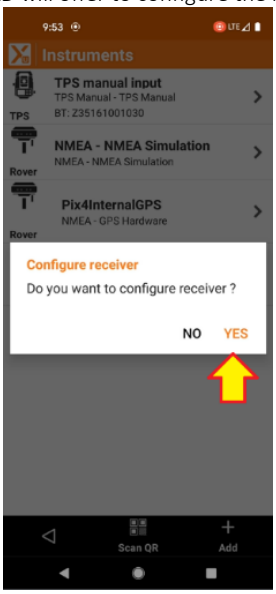
Click Next.



The HI (Height) is the default, you will be able to override it when you start the base.

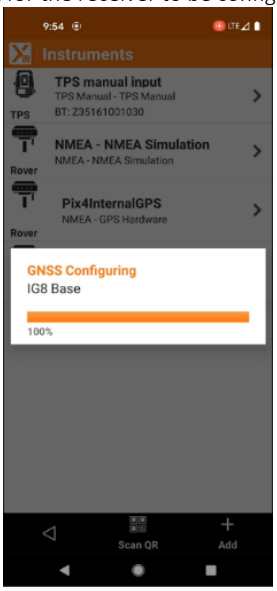
Click Accept.

X-PAD will offer to configure the receiver:



Click YES to apply the settings to the receiver.

Wait for the receiver to be configured:

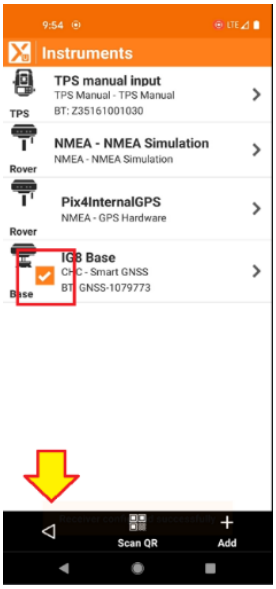


Click the Back arrow to return to the Settings menu.

X-PAD: Starting a UHF Base

Once you have setup a Base profile, you can use the profile to start a base.

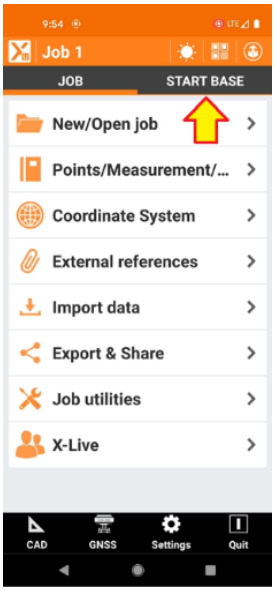
From the main menu click on Settings, then from the Instrument Settings menu click on GNSS and Total Stations, finally ensure that the correct Base profile is selected:



If it is not, click on the desired base profile and click on Current.

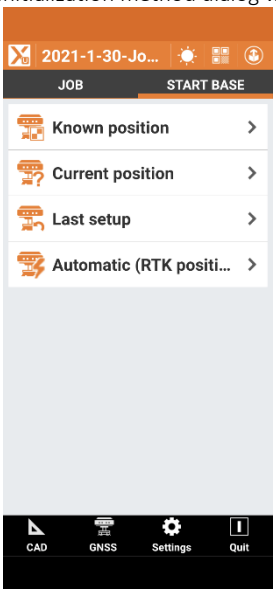
Click on the Back < arrow.

Return to the main menu:



The SURVEY menu item will be replaced with START BASE, click on it.

The initialization method dialog will be shown:



If you have a point in the current job that matches the base location, or you have the geographic (Latitude, Longitude, Height) or projected (Easting, Northing, Height) coordinates use the:

Base Initialization: Known position page 54

If you don't know where the base is and want to read the GPS to configure the base use the:

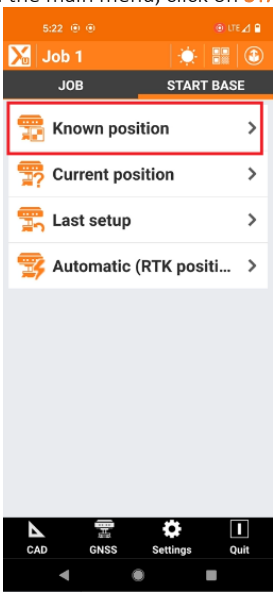
Base Initialization: Current position page 56

If you are starting at the last base position (perhaps on a subsequent day) use the:

Base Initialization: Last Setup page 58

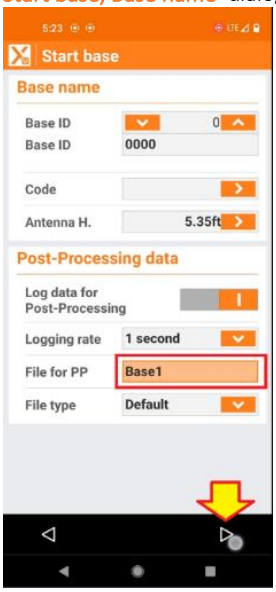
Base Initialization: Known position

If you know the coordinates for the base location, from the main menu, click on START BASE:



Then choose Known position

The 'Start base, Base name' dialog will be shown:



A Base ID of 0 is fine.

Enter the correct antenna height.

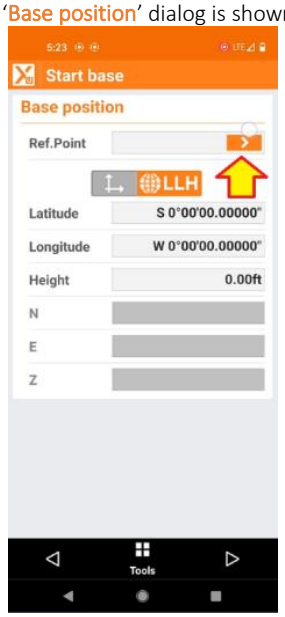
Always enable the 'Log data for Post-Processing' slider, then you will have the opportunity to process the base position in OPUS or against a rover if needed.

A logging rate of 1 or 5-seconds is appropriate. Enter a 'File for PP' filename that will be easy to identify.

Leave the File type set to Default.

Finally click on Next.

The 'Base position' dialog is shown:



You can select an existing point from the current job by clicking the '>' button or hand-enter the Latitude Longitude Height or hand-enter the Northing, Easting and Height.

If you choose to enter Latitude Longitude Height, the Height should be the 'Ellipsoid Height.'

If you enter the projected Easting, Northing, Height then the Height should be the 'Orthometric Height'.

If you have previously entered reference points into the current job, you can click the Tools button at the dialog bottom and automatically choose the nearest reference point.

When the Base position has been entered, click on the Next button.

The 'Create local system on base' option is displayed:

If you want to work at Grid leave the slider OFF. If you want to work at GROUND with a local coordinate, move the slider to the ON position:

If you choose to create a local system, enter the base position (typically 10,000, 10,000) or choose an existing point from the '>' on 'Local point'.

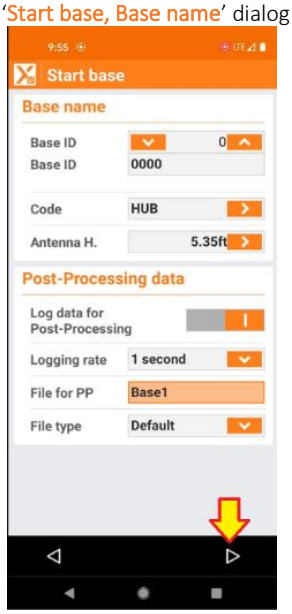
Finally click on 'Start Base'. After a few moments, the base configuration will be complete.

It usually takes 30-seconds for the receiver to begin transmitting corrections.

Base Initialization: Current position

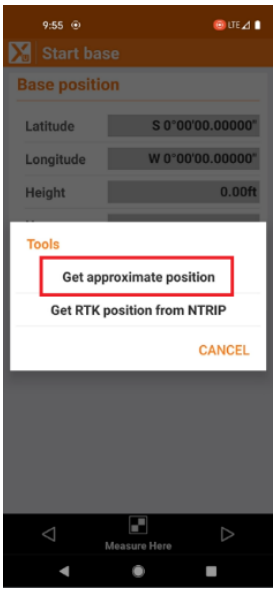
If you don't know the coordinates for the base location, choose 'Current position'.

The 'Start base, Base name' dialog will be shown:



Enter a code for the new base point, set the Antenna Height, move the slider to 'Log data for Post-Processing' so that a raw observation file will be collected to optionally send to NGS OPUS if you need to ground your survey later. Set the logging rate to '1 second', enter a reasonable filename for the observation file. Finally click on Next.

Click on the 'Measure Here' button on the screen bottom.



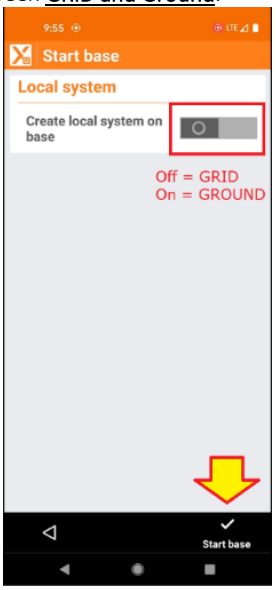
Click on 'Get approximate position' to read the current receiver position.

The approximate position will be shown:

If the receiver has been tracking satellites for longer than 10 minutes, the position will be within a couple feet of the ITRF receiver location (not NAD83.)

Click on the Next button.

The Local system dialog allows you to choose between GRID and Ground:



If you want to survey at GRID in the project coordinate system, leave the 'Create local system on base' slider off.

If you want to survey at GROUND, then move the slider to the ON position and enter the desired local coordinates for the base:

If the coordinate already exists in the job, you can recall it under 'Local Point', otherwise enter a new point code for the newly entered coordinate in Local Point.

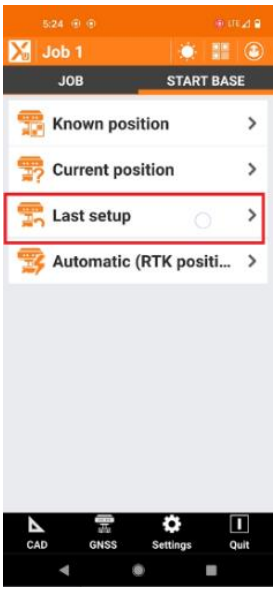
Finally click on the 'Start base' checkmark to compete the Base setup.

It usually takes 30-seconds for the receiver to begin transmitting corrections.

Base Initialization: Last Setup

Last Setup uses the previous Ground Mark location to initialize the base, this allows you to set the base on the previous position with a different instrument height.

Click on Last setup:



The 'Start base' dialog is shown:

Enter a Code for the position, the new Antenna Height, enable data logging, enter a reasonable name for the new day's observation files.

Finally click on the Next button:

The receiver will be loaded with the previous base configuration combined with the new instrument height.

The Create local system on base option is displayed:

If you want to work at **GRID** leave the slider OFF. If you want to work at **GROUND** with a local coordinate, move the slider to the ON position:

If you choose to create a local system, enter the base position or choose an existing point from the '>' on Local point.

Finally click on Start Base. After a few moments, the base configuration will be complete.

It usually takes 30-seconds for the receiver to begin transmitting corrections.

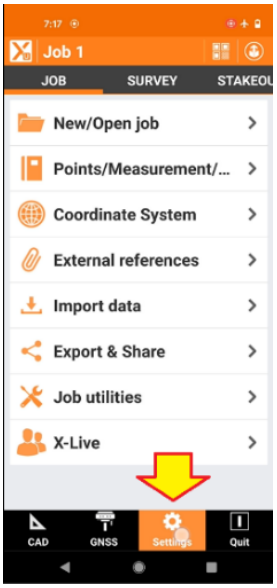
X-PAD: UHF Rover Instrument Profile

The UHF Rover configuration uses the internal UHF radio to receive corrections transmitted by the base. Corrections are transmitted by a UHF Base and received by the UHF radio in the Rover.

Start a new job following the steps in the section 'X-PAD: Starting a New Job'.

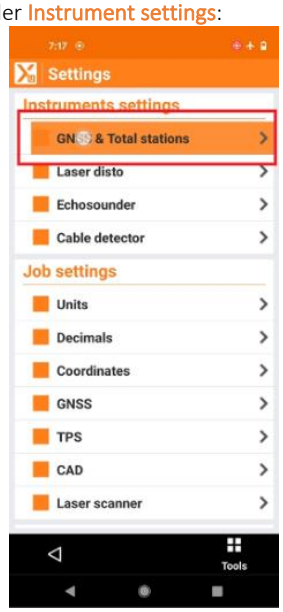
Turn the receiver on and make a note of its 'Serial Number'.

In X-PAD from the main menu:



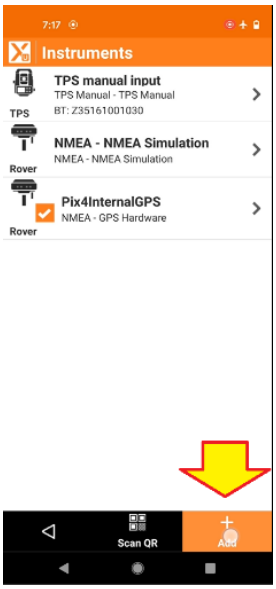
Click on 'Settings'

Under Instrument settings:



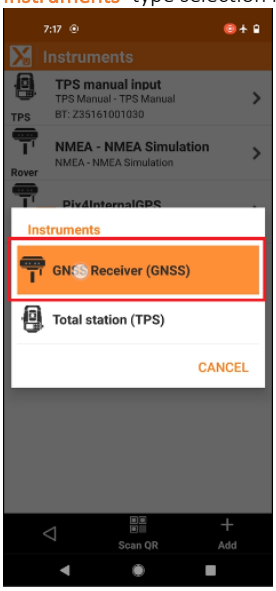
Click on GNSS & Total stations.

The Instruments list is shown:



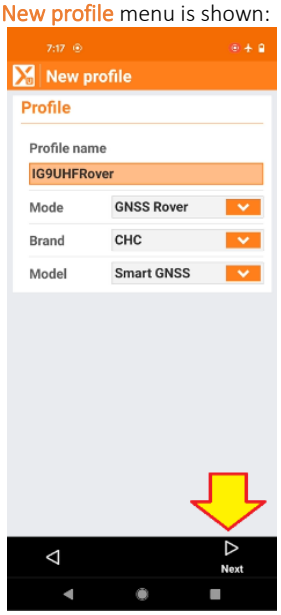
Click on 'Add' to configure a new instrument.

The 'Instruments' type selection is shown:



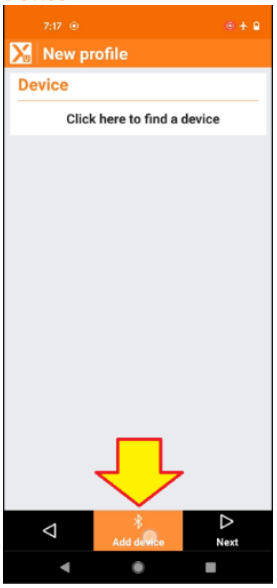
Click on GNSS Receiver (GNSS) to create a 'New profile'.

The New profile menu is shown:



Leave the Mode set to GNSS Rover.
Enter an appropriate 'Profile name' and change the 'Model' to 'CHC'.
Then click 'Next'.

The 'Device' list is shown:

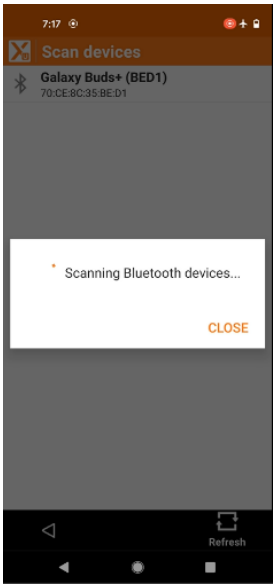


If your receiver is already available in the drop-down box then select it and click Next.

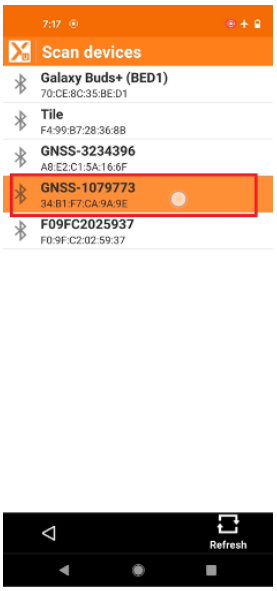
Otherwise, if your receiver is not already listed, use the 'Add device' button at the bottom to show the Bluetooth Manager:

In the Bluetooth Manager click on Search to find nearby devices.

Wait a while (about 15-seconds) for the Android device to search for and list all nearby Bluetooth devices:

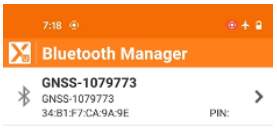


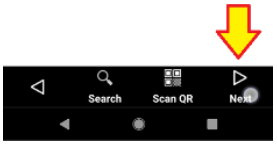
When the search is complete a list of nearby devices is shown:



Click on the correct device with the serial number that matches your receiver.

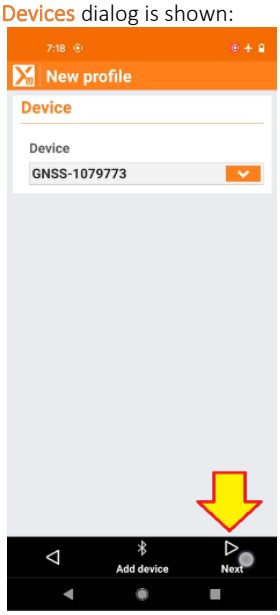
The Bluetooth Manager will be shown with the correct receiver listed:





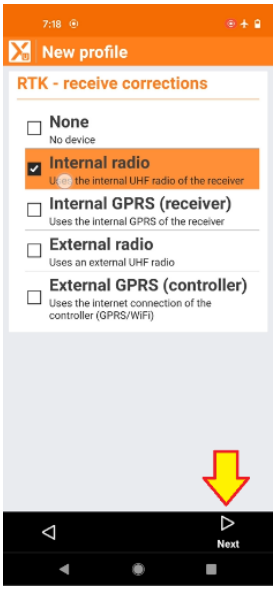
Click on Next.

The Devices dialog is shown:



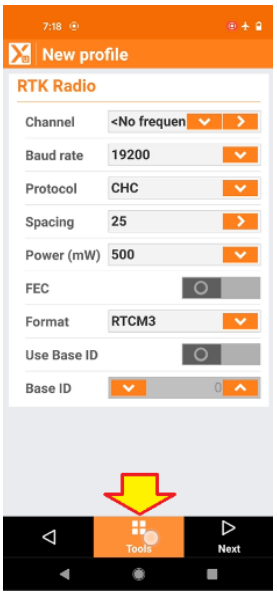
Verify that the correct device is shown, then click Next.

The RTK – receive corrections dialog is shown:



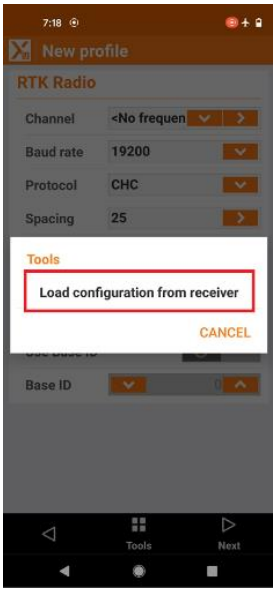
Select Internal radio then click on Next.

The RTK Radio selections are shown:



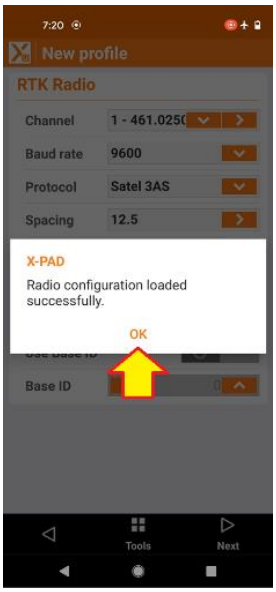
No frequencies will be available, click on the 'Tools' button at the screen bottom.

The Tools menu is shown:



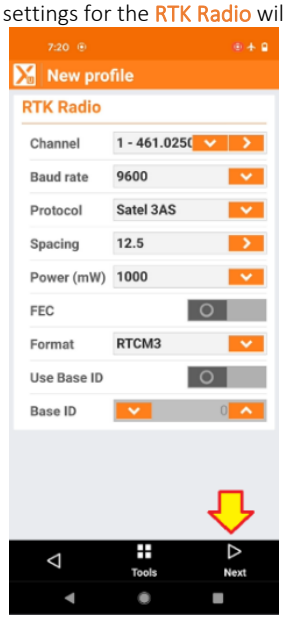
Click on the Load configuration from receiver button at the center of the screen.

Wait while X-PAD retrieves the licensed radio configuration from the receiver:



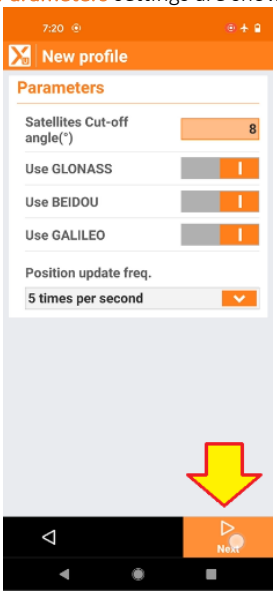
Click on OK.

The settings for the RTK Radio will be displayed:



Make sure the RTK Radio settings match the base exactly.
Then click on Next.

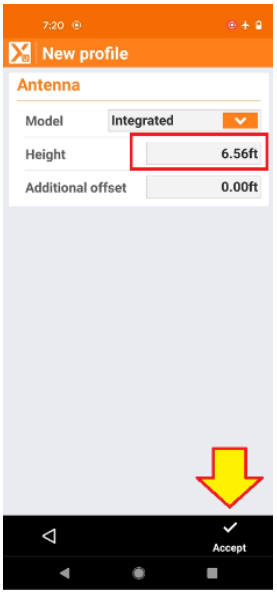
The Parameters settings are shown:



Set an appropriate Cut-off angle (the elevation mask). Enable all of the constellations you want to use.

Finally click on Next.

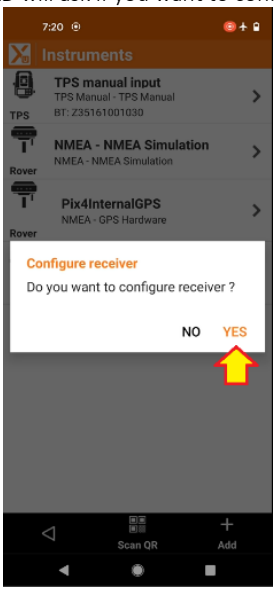
The New Profile: Antenna menu will be shown:



Verify the default / initial instrument Height.

Then click Accept.

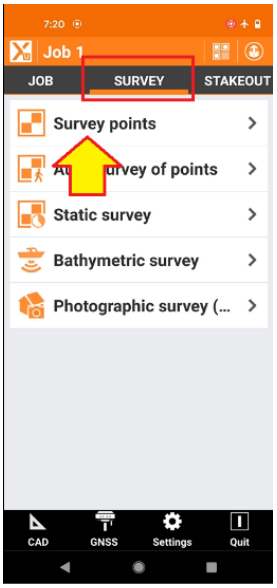
X-PAD will ask if you want to configure the receiver:



Click on YES.

This will configure the receiver and make the UHF Rover profile the default instrument.

Click the back button twice, then select the SURVEY tab:



Next click the Survey points line.

The GNSS Survey map screen is shown:

Wait for the receiver to report RTK Fixed and your programmed accuracy tolerance to be reached.

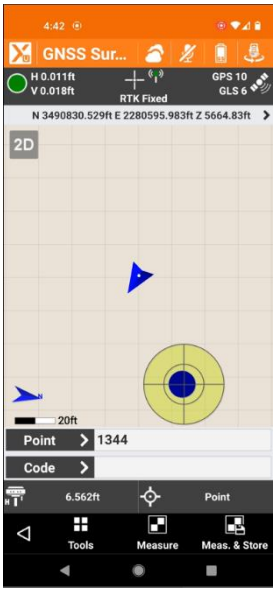
You are now ready to survey!

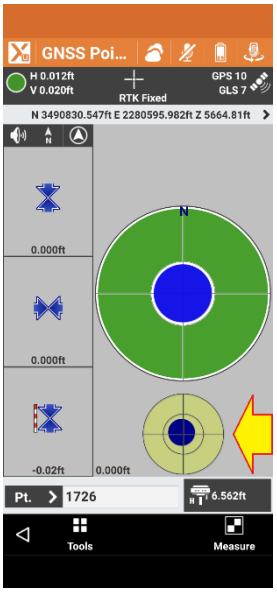
Using GNSS Receivers with E-Bubble and Tilt Compensation

The iG8 receiver has an internal E-Bubble (electronic bubble) to assist in leveling the pole. The E-Bubble operation is described immediately below.

The iG9 receiver has an internal IMU which allows for pole tilt compensation. See page 68 for IMU details.

iG8 / CHC i70 E-Bubble Operation





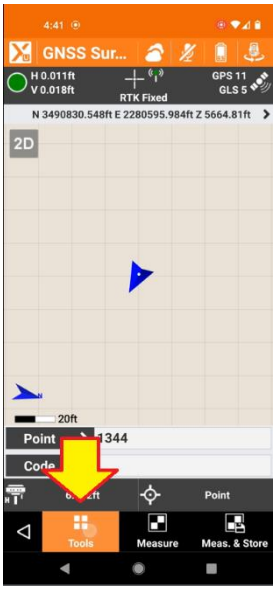
E-Bubble while storing eBubble while Staking

The E-Bubble is useful to keep unleveled shots from being stored and documenting that stored shots utilized a leveled rod. IMU tilt compensation corrects for pole tilt, allowing the operator to store building corners and obscured points.

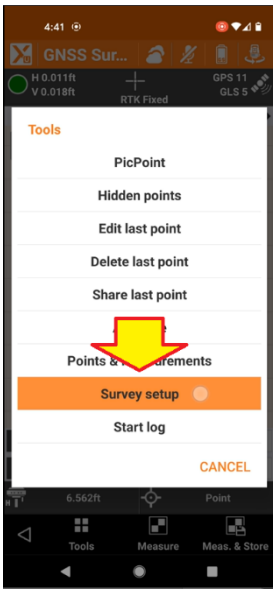
This chapter describes:

- How to enable the Tilt/IMU.
- How to set the maximum pole tilt tolerance.
- How to calibrate the electronic bubble.

To enable the E-Bubble from the Survey or Staking screens, click on the Tools button at the bottom of the screen:

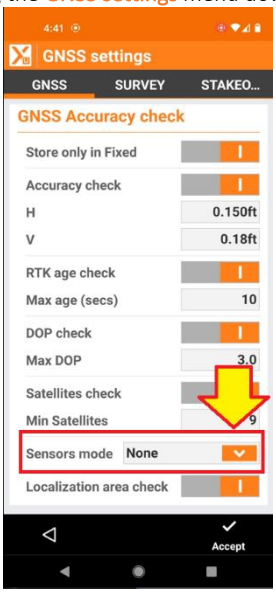


On the Tools menu:



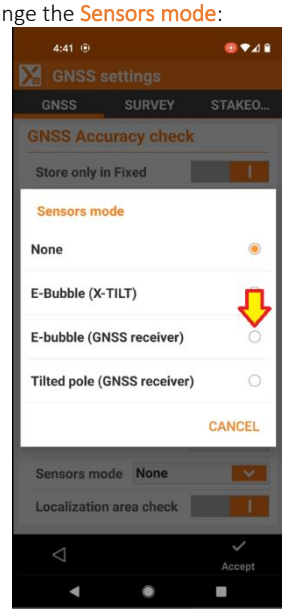
Click on Survey setup.

GNSS settings will be shown.
Drag the GNSS settings menu down to Sensors mode:

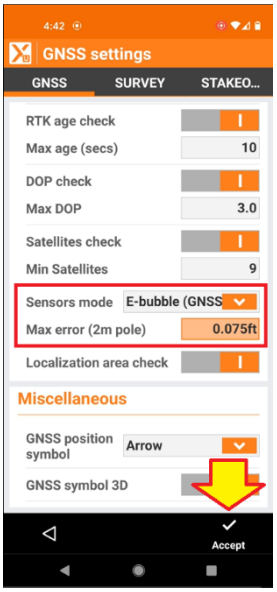


Click on the down button.

Change the Sensors mode:



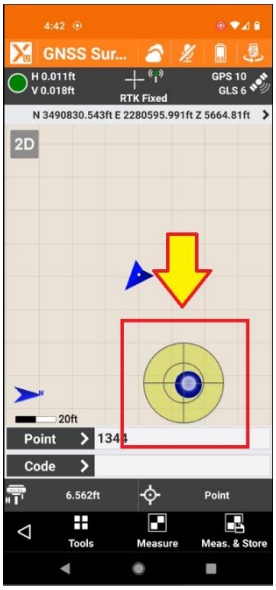
To E-bubble (GNSS receiver).
Next, set a reasonable Max error for the tilt-tolerance:



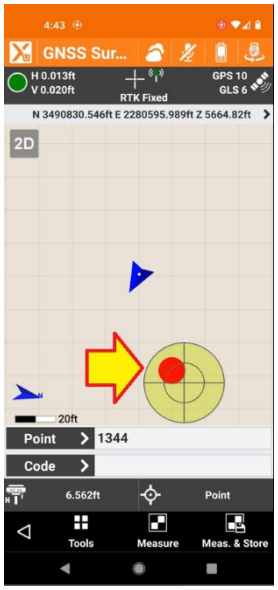
Max error is the horizontal distance from the measured receiver position to the pole tip and is computed based on the HI (Instrument/Pole Height). If you attempt to store a point when the tilt tolerance is exceeded, X-Pad will wait for you to level the pole and accumulate measurement epochs with tilt in tolerance as required by the averaging configuration (see Survey setup, SURVEY tab, Time on point and Time on Master point.

Finally click on Accept.
Note, if you click on the back arrow your changes will not be kept!

A translucent bubble will be shown:



If the pole tilt offset is less than the programmed tolerance the bubble will be shown as a blue-dot. If the tolerance is exceeded the E-Bubble will be shown as a red-dot:

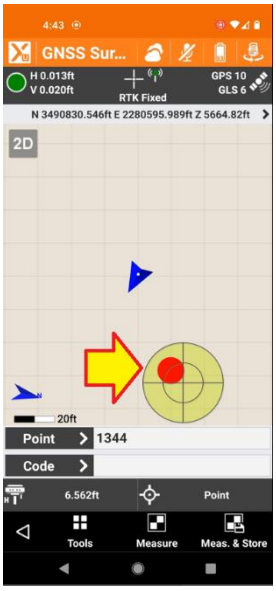


A red-dot will delay measurement epochs from being recorded until the pole is leveled.

E-Bubble Calibration

The E-Bubble needs to be calibrated every few weeks, after shipping and after a large temperature swing.

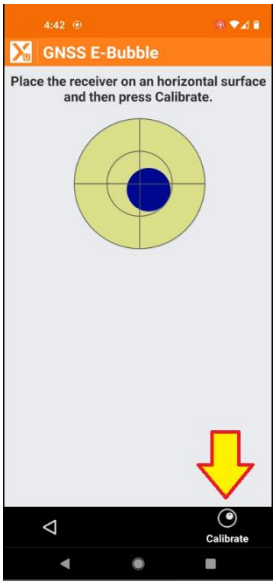
Click-and-hold on the onscreen pole bubble to calibrate the bubble:



On the E-Bubble dialog:

Click on Calibrate E-Bubble (GNSS receiver).

The GNSS E-Bubble calibration screen will be shown:



Precisely level the head, then click the Calibrate button.

Wait 10-seconds for the calibration to complete:

The E-Bubble is now adjusted to match the instrument's current level.

iG9 / CHC i90 IMU Tilted Pole Compensation

Some receivers (iG9 and CHC i90) include an internal IMU (Inertial Measurement Unit) sensor that combines the RTK position solution with inertial movement to compute the position of the pole-point based on head position, receiver heading and receiver tilt.

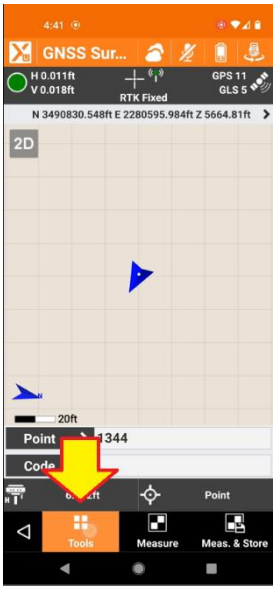
The IMU measurements do not include magnetic compass measurements so they will work near magnetized objects, metal buildings and under powerlines.

These tilted pole corrections happen at an extremely high rate.

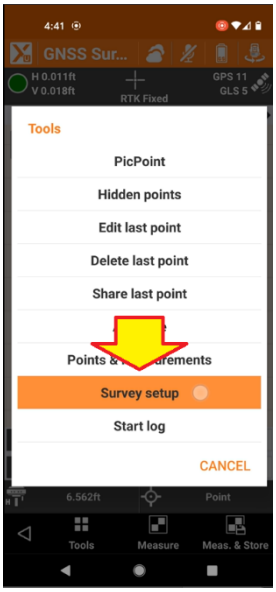
IMPORTANT NOTE: if you enable Tilt Compensation and the IMU is not initialized, a position will not be available in X-PAD until after you achieve initialization.

To enable the IMU Tilted Pole corrections from the Survey or Staking screens, click on the Tools button at

the bottom of the SURVY or STAKING screen:

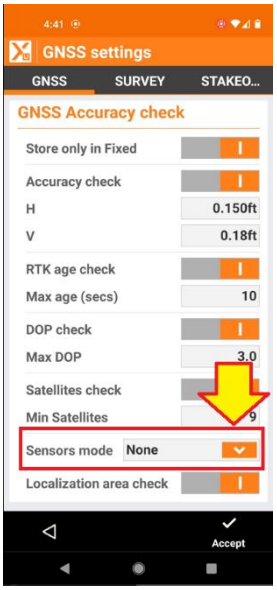


On the Tools menu:



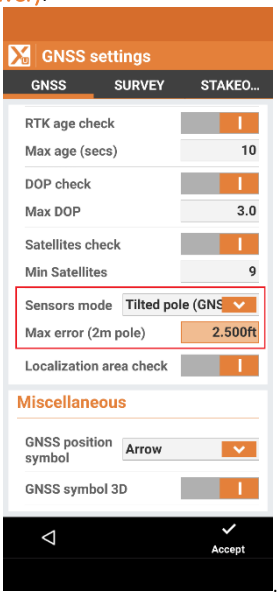
Click on Survey setup.

GNSS settings will be shown.
Drag the GNSS settings menu down to Sensors mode:



Click on the down button.

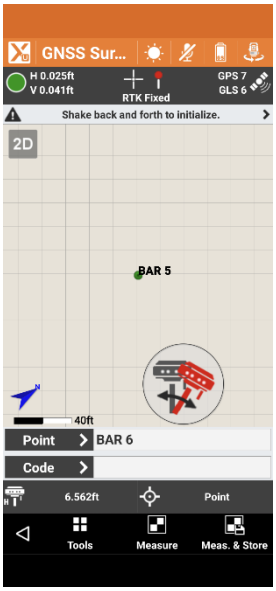
Change the Sensors mode to Tilted Pole (GNSS receiver):



Set the Max error (2m pole) to the maximum horizontal offset of a receiver at the top of the pole from the point on the ground. (A 20° tilt on a 2-meter pole is 2.25' offset.) Tilts that result in a higher offset will pause measurements.

Finally click Accept.

The SURVEY or STAKING screen will be shown:



A translucent tilt indicator will be displayed on the map bottom. As the IMU initializes several prompts are shown. The symbol above requests that you need to rock the receiver back-and-forth on a point.

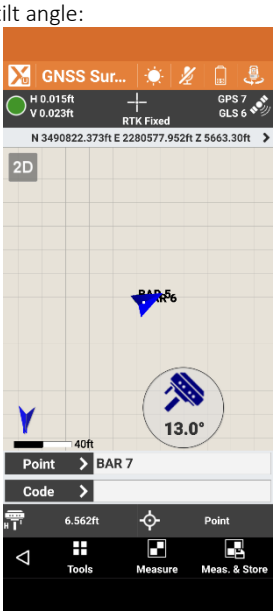
This icon:

requests that you hold the receiver nearly still and level.

Usually, the status goes back and forth between rocking and holding still.

The IMU will usually initialize in the process of moving between points if you ignore the initialization instructions.

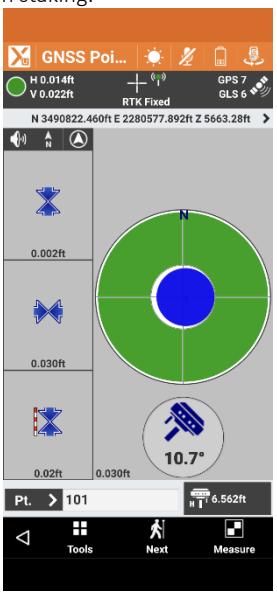
Once the IMU has initialized the screen will display the tilt angle:



When this icon is shown, the tilt compensation is active and you can store a measurement.

If you hold the receiver perfectly still (on a prism pole bipod) for more than 30-seconds, the IMU will lose fine initialization. X-PAD will request that you rock the receiver again. Typically, you only need to shake the receiver 0.01' in one direction to immediately reinitialize the IMU.

When staking:



the tilt angle is shown.

IMU Calibration

There is no calibration routine for the IMU other than the initialization sequence.

Surveying with X-Pad STORE POINTS

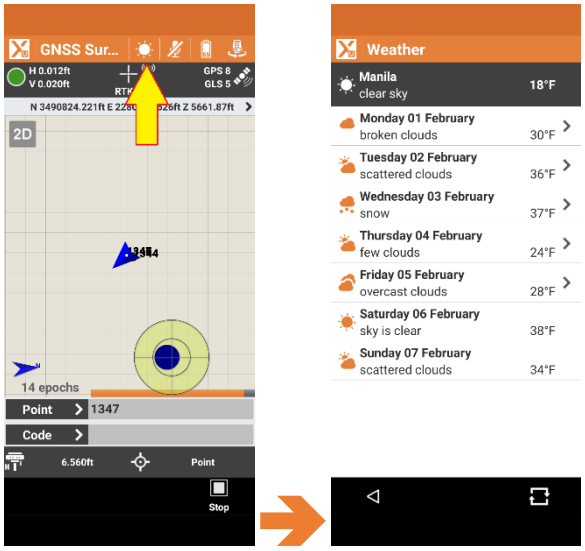
The main SURVEY screen allows you to store measurements, code measurements as points or linework,

X-PAD Info

Clicking the X-PAD Ultimate icon in the upper left corner displays information about X-PAD, the current License activation, release notes and detailed information about the current device.

Weather

Clicking the weather icon displays the current and forecasted weather for your current location.



X-PAD Voice Commands

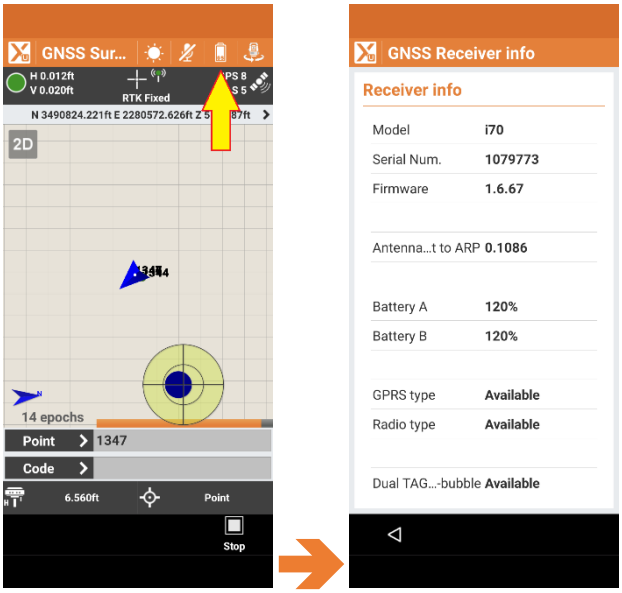
Enables X-PAD voice commands recognition.

Say 'OK X-PAD' to give verbal commands to X-PAD:

SURVEY: Store, Measure, Line, Arc, Stop, Code, XPole
STAKEOUT: Next
TPS/RTS: Prism, NoPrism (reflectorless), Tape, Lock, UnLock, Switch Target, Bubble, Target Height
GNSS/GPS: GNSS Status, Pole Height

You can have multiple words for one command. See Settings: Voice commands to configure and see a full list of voice actions.

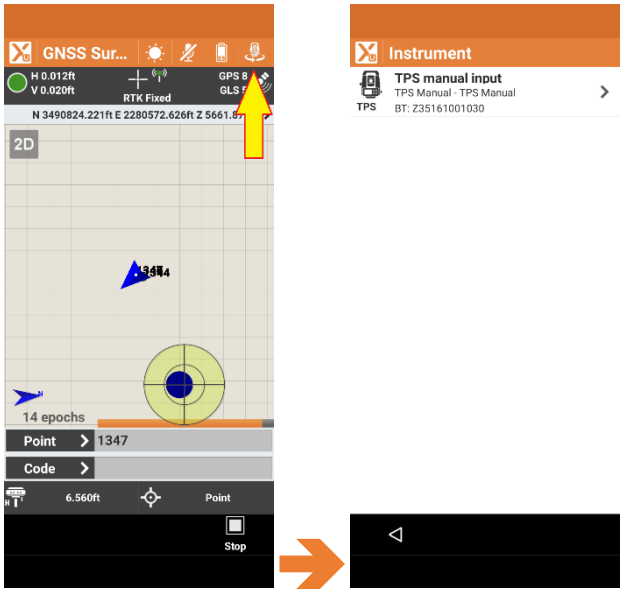
Receiver Battery and Instrument Status



Click to display detailed information about the current instrument including: Model, SN, Firmware, Battery status, Tilt & E-Bubble availability.

Click the < Back arrow to return to the SURVEY screen

Instrument Selection

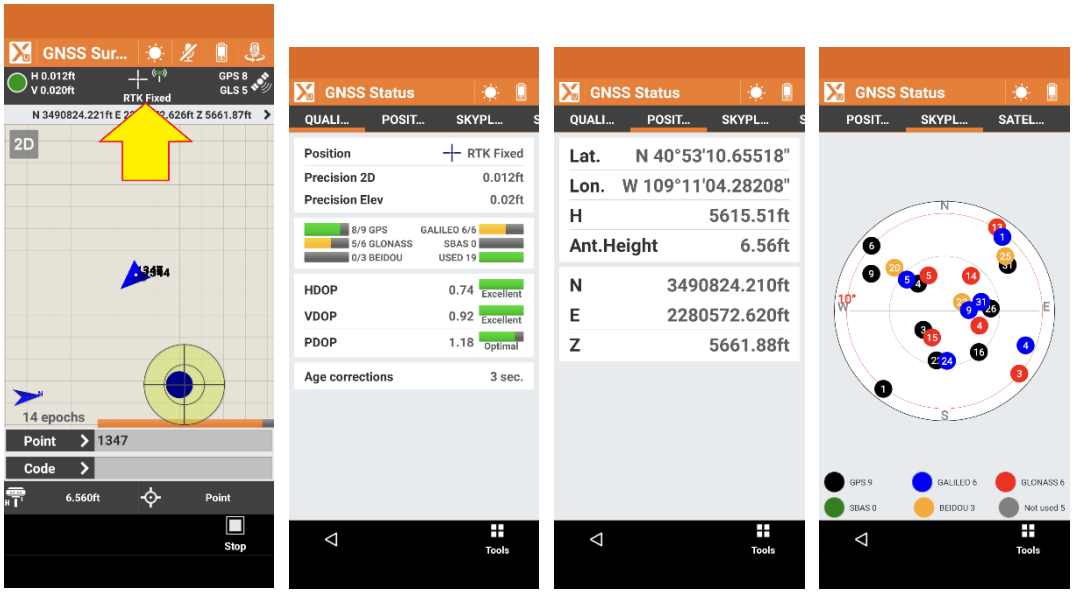


Allows you to quickly switch between instruments, from GNSS to Total Station.

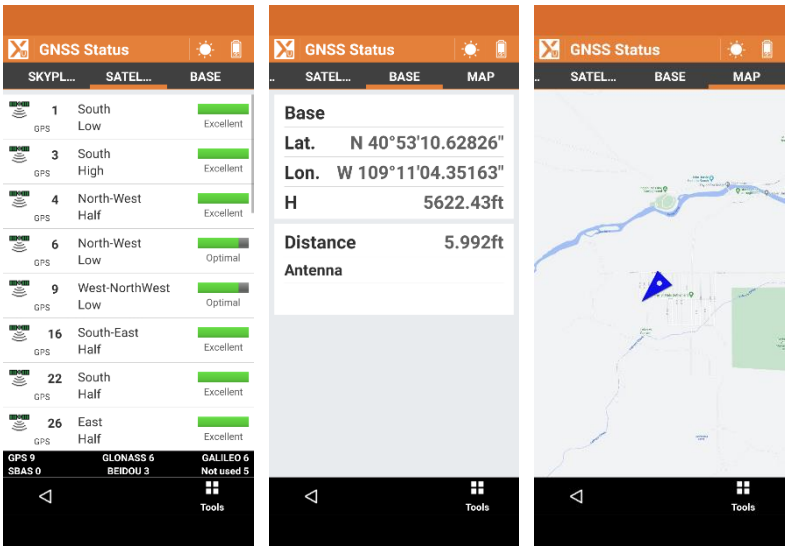
Click the < Back arrow to return to the SURVEY screen

Receiver Status

The receiver status panel shows: current measurement tolerance result (Green Dot); the estimated Horizontal and Vertical error; the current FIX, FLOAT, DGPS status; RTK Correction icon and the number and type of currently used satellites.



Click anywhere on the instrument status panel to move to the GNSS Status screens where you can move between the: QUALITY, POITION, SKYPLOT...



SATELLITE, BASE and general area MAP display screens.

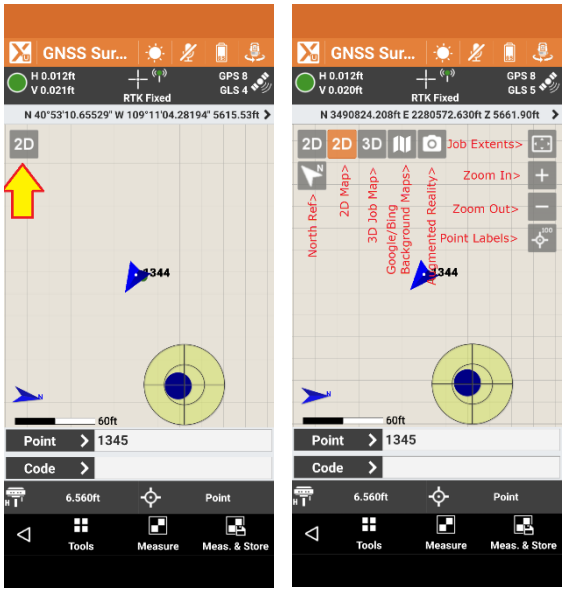
Click the < Back arrow to return to the SURVEY screen

Current Position Display

This line shows the current projected position:

If you click on the coordinate, it will toggle to showing the geographic coordinates:

Map Display Screen

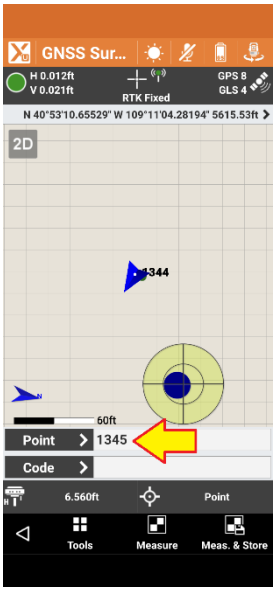


You can pinch in and out on the map display to Zoom in and out. One finger will drag the map over the screen.

- Clicking the Map button (2D above) displays the map controls:
- Show a 2D representation
- Show a 3D representation
- Change background maps between Google, Bing, Custom, other custom Servers
- Switch to Augmented Reality mode: Superimpose your points and lines on the camera image:

- Zoom to job extents
- Zoom In, Out
- Enable / Disable point information display

Next Point Name



Enter the Point name for the next stored measurement.

Clicking on the grey Point button:  to display the point and measurement list.

Clicking in the entry box:  to activate the onscreen point name editor.

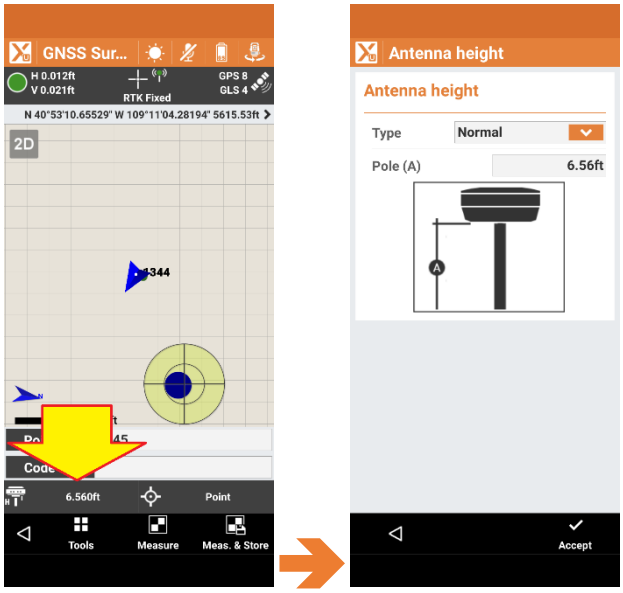
Next Point Code

Enter the Code for the next stored measurement.

Click on the grey Code button to pick the code from the library or add new codes. Coded points can also contain GIS Feature data, control drawing layers, symbols, colors. Click in the white area to directly enter a non-library code.

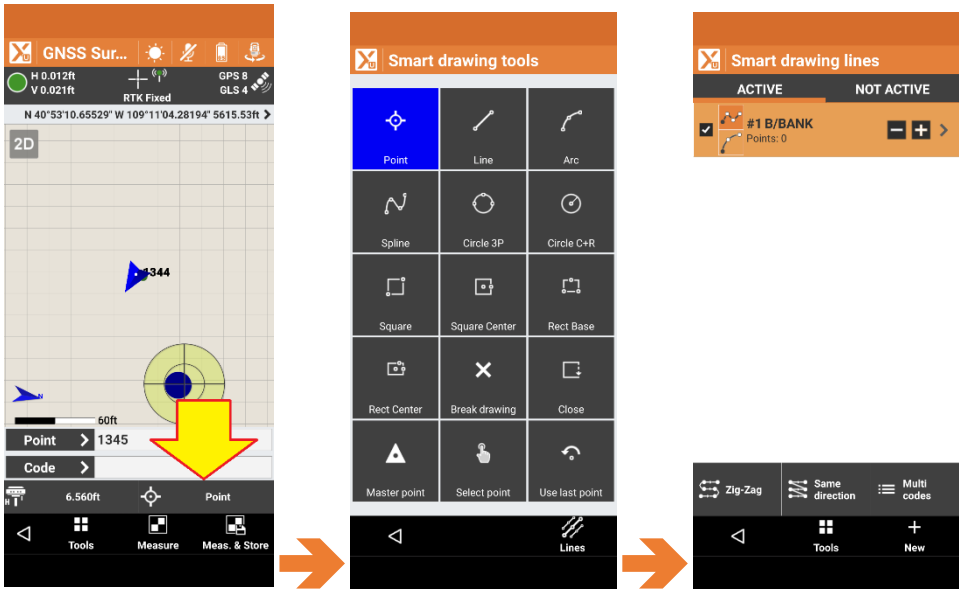
The X-PAD Ultimate User Manual has details about code operations.

Antenna Height



Click on the Antenna height button to edit the Instrument Height. This is the vertical distance from the bottom of the receiver to the tip of the point.

Smart Drawing Tools



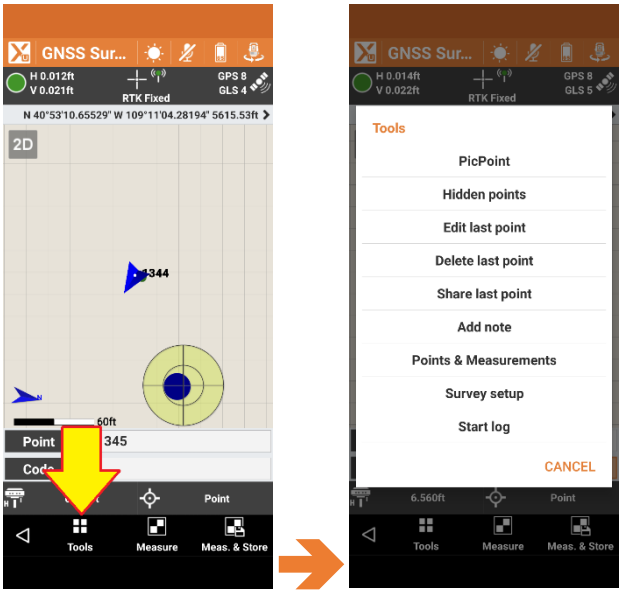
Smart drawing tools choose the measurement type and control line drawing in the field as measurements are taken. You can connect shots with straight Lines; Arcs; Splines; build Circles from 3-points on the circumference or the Center; set Squares and Rectangles. These field collections actions allow features to be collected on drawing layers, linework to be completed in the field and nearly complete drawings to be built as collected.

The /// Lines button launches the Smart drawing lines list that helps acquire multiple lines as you Zig-Zag or Z-Cross alignments. Detailed information on Smart drawing tools is presented in the X-PAD User Manual.

Point is used for Topo or quick side-shots, Master point uses a longer average.

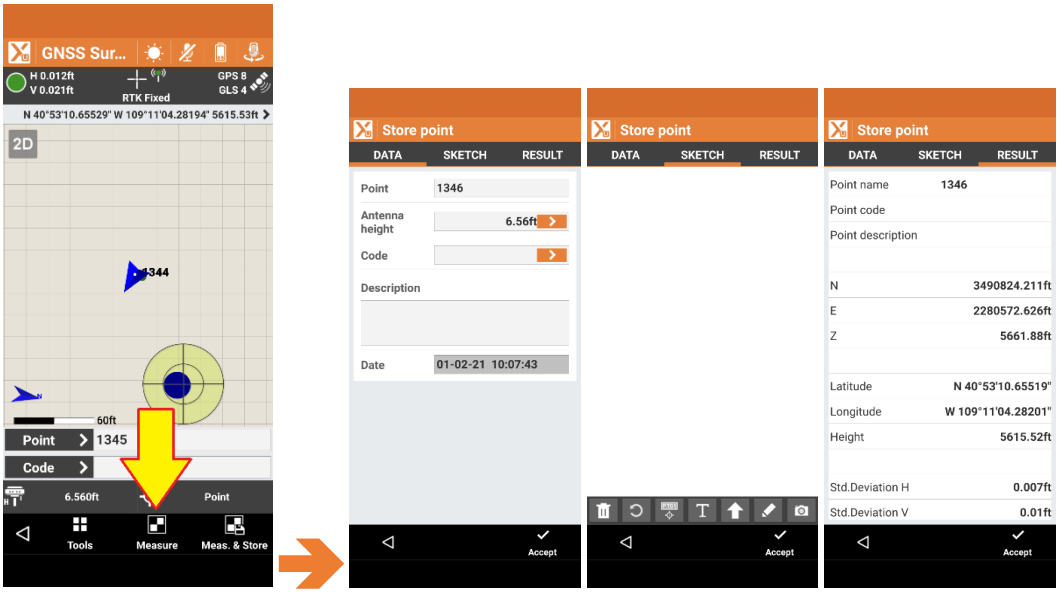
Continuous polygon and arc figures can be Closed to form shapes.

Store Points Tools



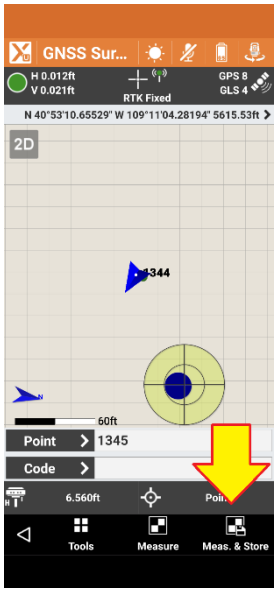
The Tools button allows quick access to PicPoint (pick a point from the map and add a point), Edit last point, Delete last point, Share last point, Add note to the survey with text and sketches, Points & Measurements brings up the point list and Survey setup allows you to edit the survey configuration for TPS, SURVEY, STAKEOUT and POINTS.

Measure



The Measure button acquires a point as configured by the Smart Drawing Tool and Survey settings; after the point is collected you will have an opportunity to enter attributes for the stored point. You can change the point Name, edit the Antenna height, edit the Code, enter a detailed Description; you can also make a detailed SKETCH and include pictures; finally, all of the measurement data can be viewed on the RESULT tab.

Measure & Store



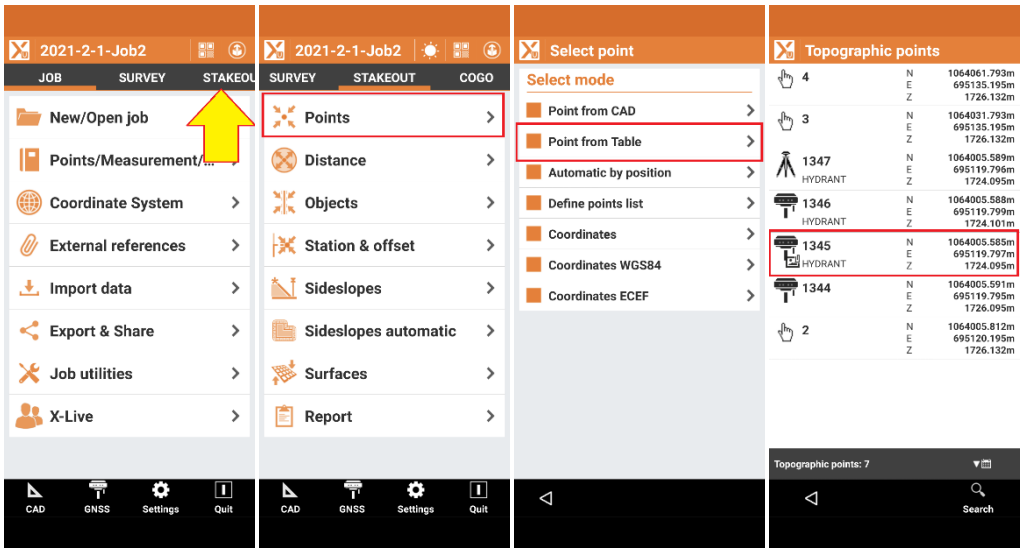
The Measure & Store button acquires a point as configured by the Smart Drawing Tool and Survey settings; after the point is collected it is immediately stored and X-PAD is ready to store another point.

If you decide you want to edit a point stored with Measure & Store, click on Tools and then Edit last point.

SURVEYING WITH X-PAD: STAKE POINTS

Staking points is the process of navigating to a point or an offset from a point.

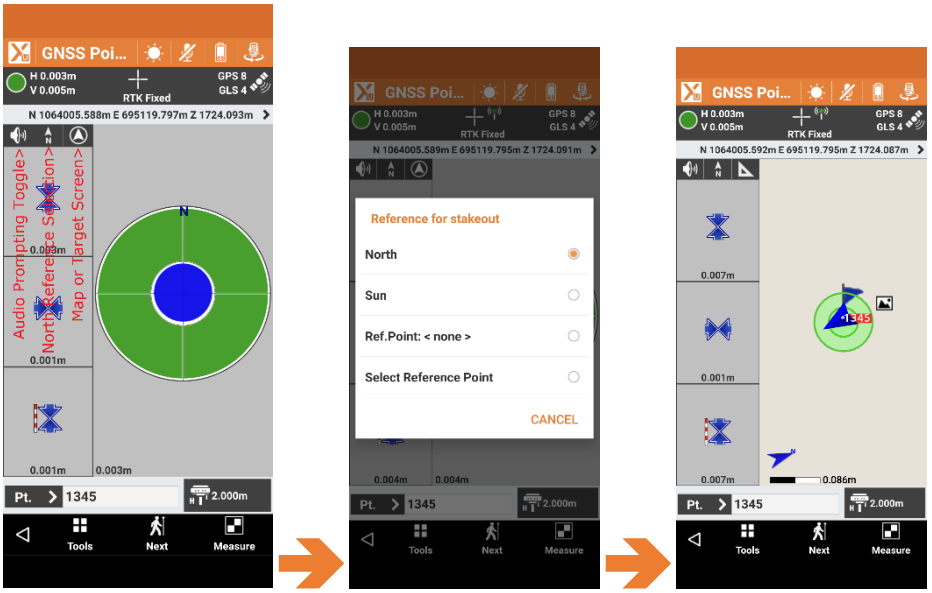
From the X-PAD main menu:



Click on the STAKEOUT tab, then POINTS, then Point from Table, finally choose a point to STAKEOUT.

Choosing Select point, Select mode Define points list allows you to define a point list to stake, X-PAD will remember and display the points already staked and help you choose the nearest, un-staked point.

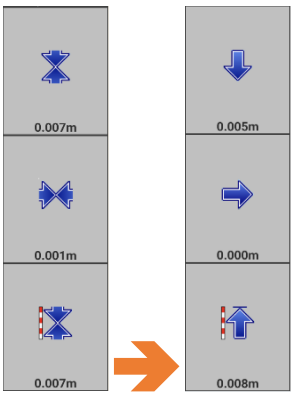
The Stakeout Screen



If audio is enabled, X-PAD will prompt you with navigation instructions to lead you to the point.

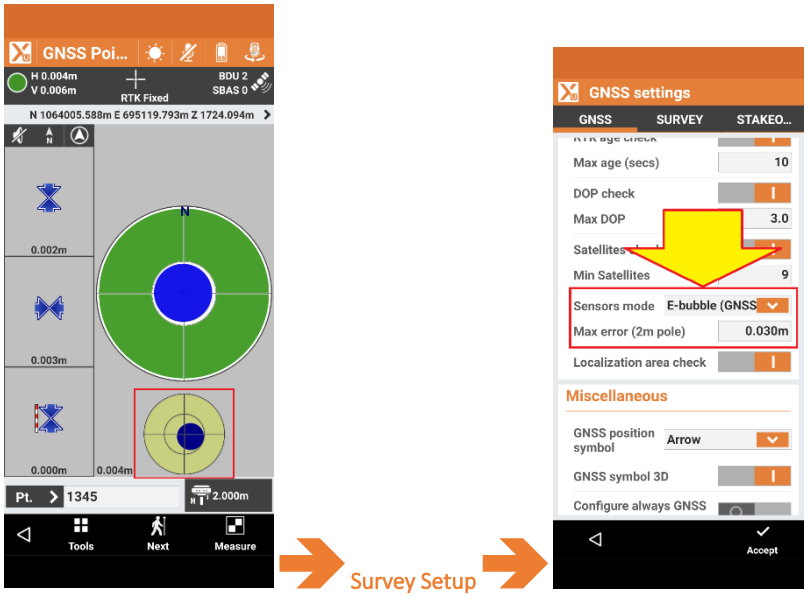
North Reference can be North Up, Sun Up or Reference Point up.

toggles to Map display; toggles to Target display.



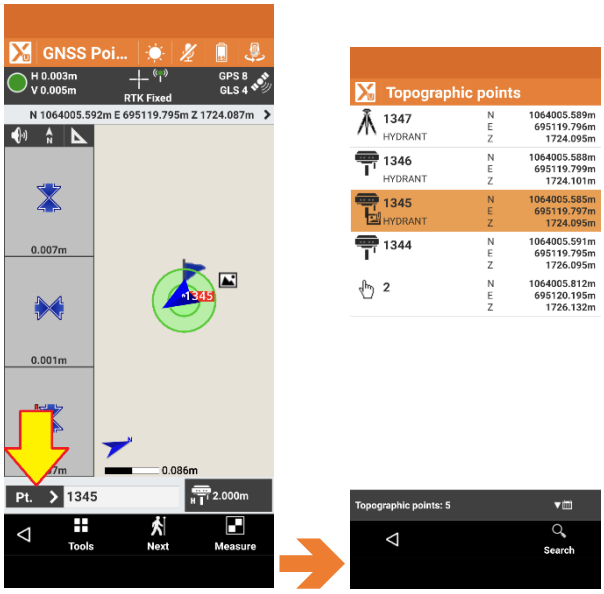
Click on the side panel to toggle between visualization modes.

E-Bubble or IMU Tilt Compensation

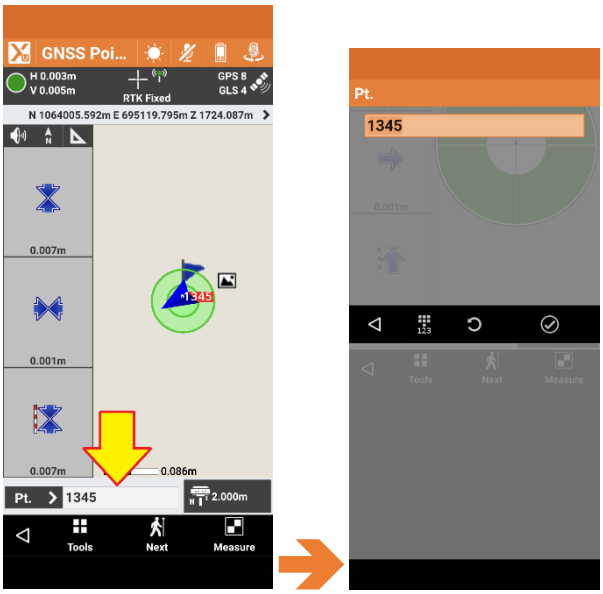


If your receiver has an E-Bubble or IMU Tilt Compensation you can enable the E-Bubble display or compensation by clicking on Next then Survey setup, selecting E-Bubble (GNSS receiver) or Tilted Pole (GNSS receiver).

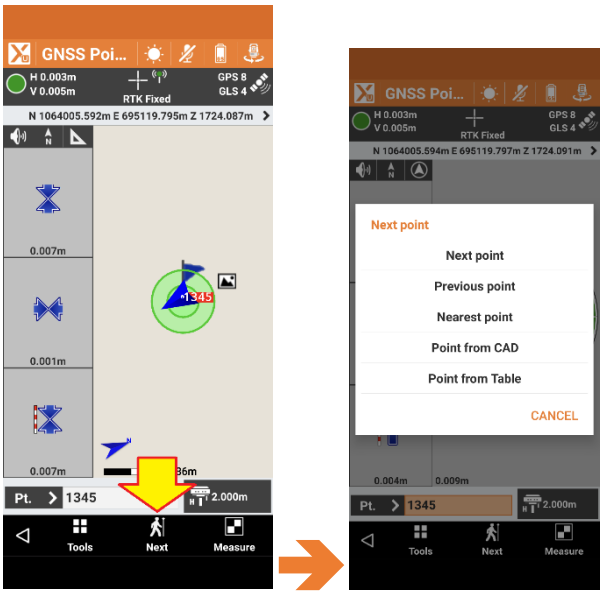
Point Selection



Click on the Pt. > button to choose a new stake point from the current list.



Click on the current point Name to directly enter a new Name to stake.



Click on the Next button to choose the Next, Previous, Nearest points or choose from CAD or the complete Table list.

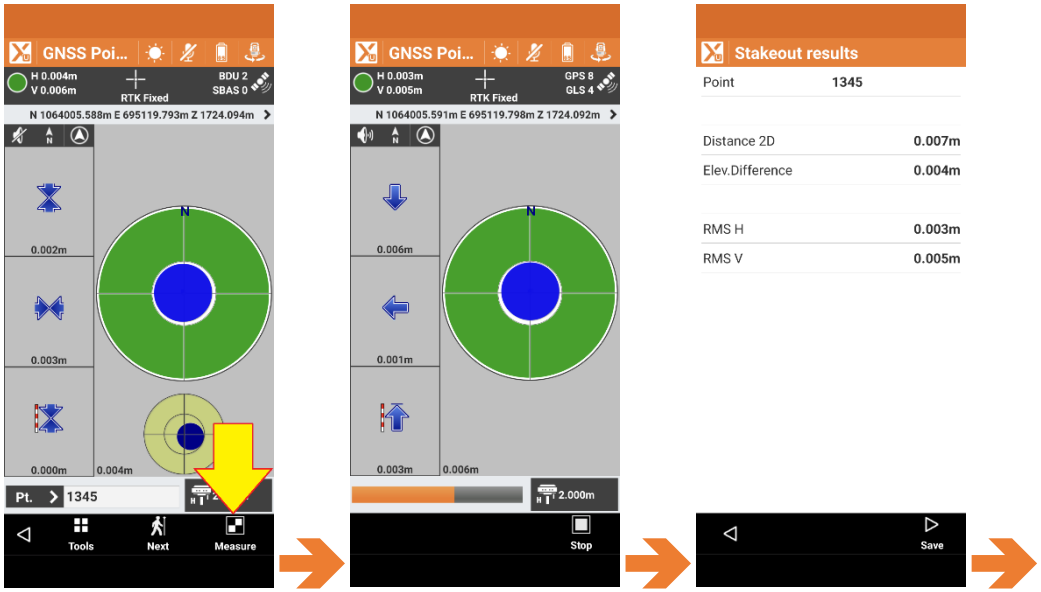
Stakeout Tools

Click on Tools to:

- add a note to the survey record
- display the Points & Measurements list
- go to the Survey setup
- add a Reference surface

If you add a reference surface X-PAD will continuously display the elevation difference between the rod point and the design surface.

Measure



Clicking Measure begins measuring the staked point, then Stakeout results are shown with the option to Save the result.

Clicking on Save advances to the Store point dialog set: