

C12 User Manual

GNSS Network Connected Base / Rover



This manual is for use with C12 GNSS receivers sold by iGage Mapping Corporation. Receivers purchased from other sources that appear to be similar will not match devices provisioned by iGage.

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C12_UserGuide_BD990_R004.docx

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Copyright, Control and Safety

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GNSS Safety Warning

The iG8 GNSS receiver tracks and utilizes signals from many space based satellite navigation systems:

The Global Positioning System (GPS) is operated by the US Government which is solely responsible for the accuracy and maintenance of the GPS network. Accuracy can also be affected by bad satellite geometry and obstructions including buildings and tree canopy.

The GLONASS (GLObal Navigation Satellite System), is a satellite navigation system operated by the Russian Aerospace Defense Forces.

The Galileo System is the global navigation satellite system (GNSS) that is operated by the European Union (EU) and European Space Agency (ESA)

BeiDou Navigation Satellite System (BDS) (also known as COMPASS or BeiDou-2) is operated by CNSA (China National Space Administration.)

SBAS (Satellite Based Augmentation Services) including WAAS (USA), MSAS (Japan), EGNOS (Europe), QZSS (Asia), and GAGAN (India) may also be utilized by the iG8 for carrier-phase corrections, in addition to differential corrections.

iGage Mapping Corporation is not responsible for, nor warrants the viability of the space segment portion of the GNSS system. The user is cautioned that they alone are responsible for determining the application of the iG8 to their task at hand.

Any of the GNSS system components can fail at any time. Be prepared for down time and failures. Do not use the C12 receiver for any critical navigation purpose.

Export Controlled Device

The iG8 device should be considered to be an export controlled device.

Because of the complex federal sanctions regulations governing controlled countries, as well as the severe civil and criminal penalties for sanctions violations, you should not attempt to interpret export licensing requirements or license exclusions for travel to or transactions with comprehensively embargoed countries. Before shipping, providing or hand carrying iG8 devices out of the United States, consult counsel who specializes in ITAR/DOD matters.

The following country list is not exhaustive:

Afghanistan, Balkans, Belarus, Burundi, Central African Republic, Cote d'Ivoire, **Crimea Region of Ukraine, Cuba**, Cyprus, Democratic Republic of the Congo, Eritrea, Fiji, Haiti, **Iran**, Lebanon, Liberia, Libya, Myanmar (formerly Burma), **North Korea**, Republic of the Sudan (Northern Sudan), Rwanda, Somalia, South Sudan, Sri Lanka, **Sudan, Syria**, Ukraine, Venezuela, Vietnam, Yemen, Zimbabwe

The countries in bold face type are comprehensively embargoed. Do not transport an iG8 receiver to one of these countries.

FCC Compliance

FCC Notice: C12 receivers comply with the limits for a Class B digital device, pursuant to the Part 15 of the FCC rules when it is used in the Portable Mode.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference
- (2) This device must accept any interference received, including interference that may cause undesired operation

Thank you!

Thank you very much for choosing to purchase and use a C12 GNSS receiver from iGage Mapping Corporation!

With a ground-breaking price, outstanding performance, field ready case and easy-to-use features, we know that the C12 receiver will be a valuable tool that will quickly pay for itself.

This guide is designed to help you familiarize yourself with your new equipment and successfully use it in the field.

If you have questions or suggestions, don't hesitate to contact us:



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Your input is extremely valuable and we will listen to your suggestions!

Overview

The C12 Network GNSS Receiver uses a Trimble BD990 OEM GNSS board. It can be used in a variety of applications and is compatible with various platforms as a Base or Rover.

The C12 outer casing is heavy duty aluminum alloy and serves to protect and cool the receiver without a fan. High-quality self-locking connectors are employed. Serial, Ethernet and Power connections are included in the standard kit.

Product Features

- Multiple connections provide compatibility with network or serial connected terminals and radios.
- Flexible configuration for use as a Rover, Base or Network Base.
- Field ready case provides resistance to shock, water and dust.
- Supports standard data formats for input and output corrections and NMEA outputs.
- External antenna connector provides isolation from noise.
- Built-in RJ45 network connection, provides GNSS server functions (DIP and NTRIP).

The C12 has the same features and specifications as the BD990 board. I

Specifications

Maxwell 7 + Everest

336 satellite channels:

Supports	GPS, BD, GLONASS, Galileo, IRNSS, SBAS, QZSS, MSS L-BAND;
GPS:	L1 C/A, L2E, L2C, L5
BDS:	B1, B2, B3
GLONASS:	L1 and L2 C/A, L3 CDMA
Galileo:	E1, E5A, E5B, E5AltBOC, E6
IRNSS:	L5
QZSS:	L1 C/A, L1 SAIF, L2C, L5, LEX
SBAS:	L1 C/A, L5
MSS L-Band:	OmniSTAR, Trimble RTX (with L-Band antenna)
Cold start:	< 45S
Warm start:	< 30S

Communication

One Ethernet port supporting network connections:

- HTTP (web interface)
- NTP Server



- NMEA, GSOE, CMR over TCP/IP or UDP
- NTripCaster, NTripServer, NTripClient
- mDNS/uPnP Service discovery
- Dynamic DNS
- eMail alerts
- Network link to Google Earth
- Support for external modems through PPP
- RDNIS support

One USB / Serial host port

One Serial Port supporting baud rates to 560,800 baud

Accuracy

Mode	Precision
Single Baseline RTK (<30 km)	0.008m+ 1ppm horizontal 0.015m+ 1ppm vertical
DGPS	0.25m+1ppm horizontal 0.5m+1ppm vertical
SBAS	0.5m horizontal 0.85m vertical
Autonomous	1.00 m horizontal 1.5 m vertical

Physical Characteristics

Size: 210mm*160mm*58mm (8.27" x 6.30" x 2.28")

Weight: 1.50 Kg (3 lb 5 oz)

Case Material: aluminum alloy

Working temperature: -40 to +75°C (-40 to 167 °F)



Storage temperature: -55 to +85 °C (-16 to 185 °F)




Electrical Data

Operating Voltage: 12V /1A

Device and Part List

The following items are included with the C12P9 receiver package:

C12 Rover / Base Station	
Power Adaptor (Input 110-220V AC; output 12V DC)	

4-pin Fisher to DC charging cable (Connects to the Power Adaptor)	
7-pin Fisher to DB9 data cable	
5-pin adapter cable to RJ45 network port	

Provisioning the C12P9

GNSS Antenna: Connect a suitable GNSS antenna to the TNC connector. The GNSS connector will supply 100 mA at 5 V, suitable for most GNSS antenna.

You must install a suitable external lightning arrester for permanent installations:



You can purchase these from Amazon, see link # 31 at <http://alltopo.com/amazon.htm>

Locate the arrester near the point where the antenna feed wire enters the building. The arrester should be directly connected to building ground.

The C12P9 warranty does not cover damage caused by lightning strikes or stray welding currents.

WARNING: You must disconnect the antenna cable from the C12 prior to welding on or near the GNSS antenna or mounting structure.

Network Connection: The Ethernet connection should also have a suitable lightning arrester:



You can purchase these from Amazon, see link # 32 at <http://alltopo.com/amazon.htm>

External Power: Connect the C12P9 to the power supply using the supplied power connector, the power indicator will light (Green) when the C12 is on. There is no ON/OFF switch.

Locate the arrester near the point where the antenna feed wire enters the building. The arrester should be directly connected to building ground.

The C12 warranty does not cover damage caused by lightning strikes or stray welding currents.

WARNING: You must disconnect the antenna cable from the C12 prior to welding on or near the GNSS antenna or mounting structure. Stray welding current that travels down the antenna wire will destroy the receiver.

This is a COMMON issue on Ag and radio towers. It is NOT covered by warranty!

Device Support Tools and Documents

From the Trimble website:

<https://www.trimble.com/Precision-GNSS/BD990-Board.aspx>

you may obtain the following Support Tools and Documents:

BD9XX_User Guide.pdf

BD9xx_WinFlash (latest version).exe

The Trimble User Guide includes detailed configuration instructions.

Connection using C12 Serial Port

The supplied serial cable will directly connect to a Windows PC type serial port. If your computer does not have a serial port, use a USB to Serial convertor to connect to the C12 serial port.

Configuration of the C12 using the Ethernet Port

The 'User Manual' contains detailed configuration information for setting the C12 as a base or a rover. See section 6 for the 'Quick Setup Guides' to get started.

Typically you will need to set the C12 Ethernet settings to match your network. Use Trimble the WinFlash utility to set the device Ethernet parameters.

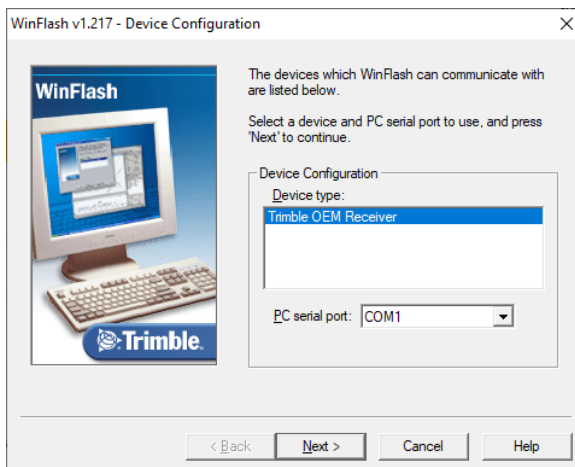
See the section 'Configuring Ethernet settings' in the 'User Guide' for step-by-step instructions on using WinFlash to configure the station.

See the section 'Web Interface' for information on logging in.

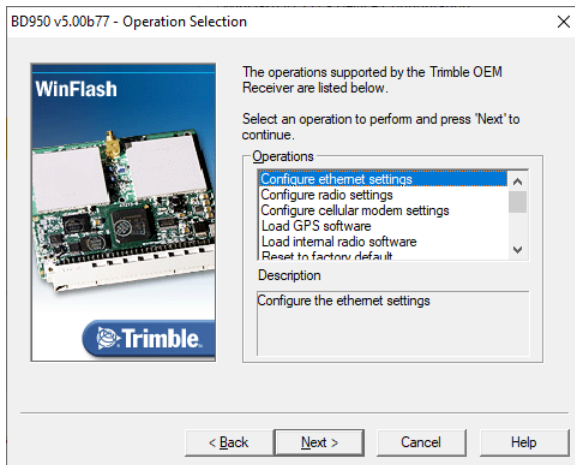
Configure the Ethernet Settings

Also see the section 'Configuring Ethernet settings' in the 'User Guide' on page 184 for step-by-step instructions on using WinFlash to configure the Ethernet settings.

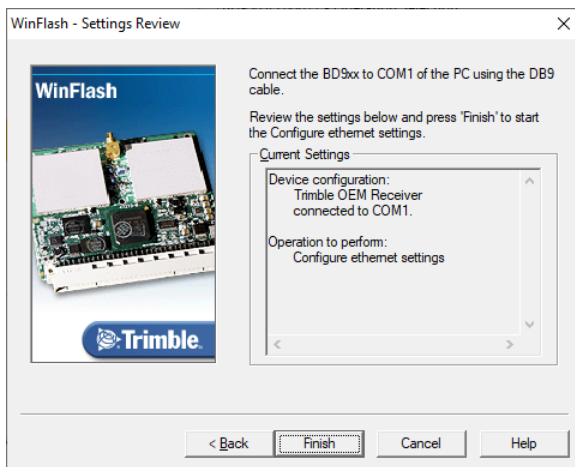
Connect the receiver by the serial port to your Windows Computer and run the WinFlash utility (after installing WinFlash from the web distribution):



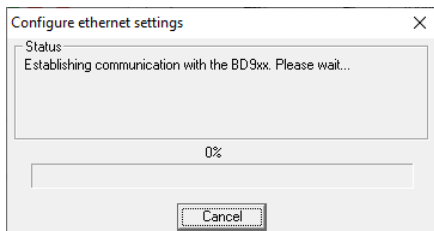
Set the correct COM port and click Next.



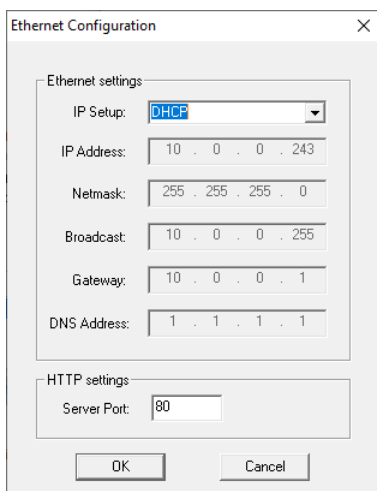
Select 'Configure Ethernet settings' then click Next.



Click Finish.

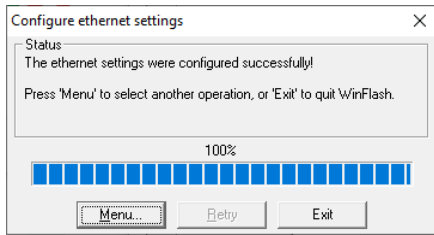


Wait a few seconds...



Change the IP Setup from DHCP to Static and configure the Ethernet settings honoring the wishes of your network administrator. Remember the IP Address. Don't initially change the Server Port from 80.

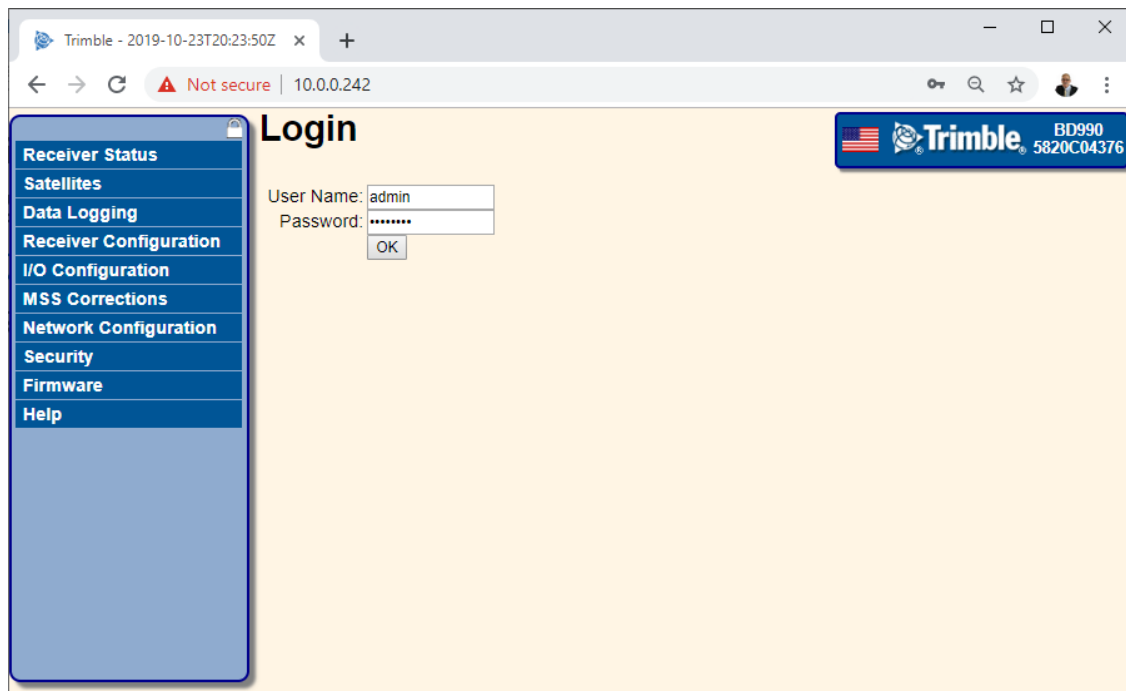
Click OK.



Click on Exit.

Configure the Receiver as a Network CORS Base

Using the Ethernet address configured above, while on the same network subnet, enter the address in your browser of choice:



The default User Name is 'admin' the default password is 'password'.

Once you enter the device you can change the default login credentials under 'Security':

Security Summary

Security: Enabled
Current User: igage
[Log Out](#)

User Name	Receiver Config	File Download	File Delete	Edit Users	NTripCaster
admin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
igage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
MarkS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ftp	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Check the user manual for instructions.

It is recommended to make a backup, full rights user (just in case it gets locked up).

Set the Tracking

Click on "Satellites, Enable/Disable". Enable all GPS, GLONASS, GALILEO, BeiDou, QZSS SV's. Under SBAS use the following configuration:

Satellite Enable/Disable

GPS	GLONASS	Galileo	BeiDou	QZSS	IRNSS	SBAS	
SV	Satellite	Setting	Use Obs.	SV	Satellite	Setting	Use Obs.
120	EGNOS - AOR-E	Auto Enable	<input type="checkbox"/>	140	SDCM - LUCH-5A	Off	<input type="checkbox"/>
121		Off	<input type="checkbox"/>	141	SDCM - LUCH-5V	Off	<input type="checkbox"/>
122	AUS/NZ - INMARSAT 4-F1	Auto Enable	<input type="checkbox"/>	142		Off	<input type="checkbox"/>
123	EGNOS - ASTRA-5B	Auto Enable	<input type="checkbox"/>	143		Off	<input type="checkbox"/>
124		Off	<input type="checkbox"/>	144		Off	<input type="checkbox"/>
125	SDCM - LUCH-5B	Off	<input type="checkbox"/>	145		Off	<input type="checkbox"/>
126	EGNOS - EMEA	Off	<input type="checkbox"/>	146		Off	<input type="checkbox"/>
127	GAGAN - GSAT 8	Auto Enable	<input type="checkbox"/>	147		Off	<input type="checkbox"/>
128	GAGAN - GSAT 10	Auto Enable	<input type="checkbox"/>	148		Off	<input type="checkbox"/>
129	MSAS-1	Auto Enable	<input type="checkbox"/>	149		Off	<input type="checkbox"/>
130		Off	<input type="checkbox"/>	150		Off	<input type="checkbox"/>
131	WAAS - EUTELSAT 117WB	Auto Enable	<input checked="" type="checkbox"/>	151		Off	<input type="checkbox"/>
132		Off	<input type="checkbox"/>	152		Off	<input type="checkbox"/>
133	WAAS - SES-15	Auto Enable	<input checked="" type="checkbox"/>	153		Off	<input type="checkbox"/>
134		Off	<input type="checkbox"/>	154		Off	<input type="checkbox"/>
135	WAAS - GALAXY XV	Auto Enable	<input checked="" type="checkbox"/>	155		Off	<input type="checkbox"/>
136	EGNOS - SES-5	Off	<input type="checkbox"/>	156		Off	<input type="checkbox"/>
137	MSAS-2	Auto Enable	<input type="checkbox"/>	157		Off	<input type="checkbox"/>
138	WAAS - ANIK F1R	Auto Enable	<input checked="" type="checkbox"/>	158		Off	<input type="checkbox"/>
139	GAGAN - GSAT 15	Off	<input type="checkbox"/>				

Enable All | Disable All
OK | Cancel

Under 'Receiver Configuration, Tracking' configure as shown below:

Tracking

Elevation Mask
 Everest™
 Clock Steering

Type	Signal	Enable	Options
GPS	L1 - C/A	<input checked="" type="checkbox"/>	
GPS	L2E	<input checked="" type="checkbox"/>	L2C and L2E
GPS	L2C	<input checked="" type="checkbox"/>	CM + CL
GPS	L5	<input checked="" type="checkbox"/>	I + Q
SBAS	L1 - C/A	<input checked="" type="checkbox"/>	
SBAS	L5	<input checked="" type="checkbox"/>	
GLONASS	L1 - C/A	<input checked="" type="checkbox"/>	
GLONASS	L1P	<input checked="" type="checkbox"/>	
GLONASS	L2P	<input checked="" type="checkbox"/>	L2 - C/A(M) and P
GLONASS	L2 - C/A	<input checked="" type="checkbox"/>	
GLONASS	L3	<input checked="" type="checkbox"/>	Data + Pilot
Galileo	E1	<input checked="" type="checkbox"/>	
Galileo	E5 - A	<input checked="" type="checkbox"/>	
Galileo	E5 - B	<input checked="" type="checkbox"/>	
Galileo	E5 - AltBOC	<input checked="" type="checkbox"/>	
Galileo	E6	<input checked="" type="checkbox"/>	
BeiDou	B1	<input checked="" type="checkbox"/>	
BeiDou	B2	<input checked="" type="checkbox"/>	
BeiDou	B2A	<input checked="" type="checkbox"/>	
BeiDou	B3	<input checked="" type="checkbox"/>	
QZSS	L1 - C/A	<input checked="" type="checkbox"/>	
QZSS	L1S	<input checked="" type="checkbox"/>	
QZSS	L2C	<input checked="" type="checkbox"/>	
QZSS	L5	<input checked="" type="checkbox"/>	
QZSS	LEX	<input checked="" type="checkbox"/>	Pilot
IRNSS	L5 - C/A	<input checked="" type="checkbox"/>	

OK Cancel

Click OK

Under 'Receiver Configuration, Position', configure as shown:

Position

PDOP Mask
 RTK Mode
 RTCM 2 Type Input Datum
 Autonomous/Differential Engine
 Signal Tracking Bandwidth
 Receiver Motion(Dynamic model)
 RTK Propagation Limit [Sec.]

DGNSS Age of Correction:

GPS [Sec.]
 GLONASS [Sec.]
 Galileo [Sec.]
 BeiDou [Sec.]

ITRF Realization (2014):
 Epoch Fixed Current

OK Cancel

Chose 'SBAS+' for the differential engine.

On the 'Receiver Configuration, General' page:



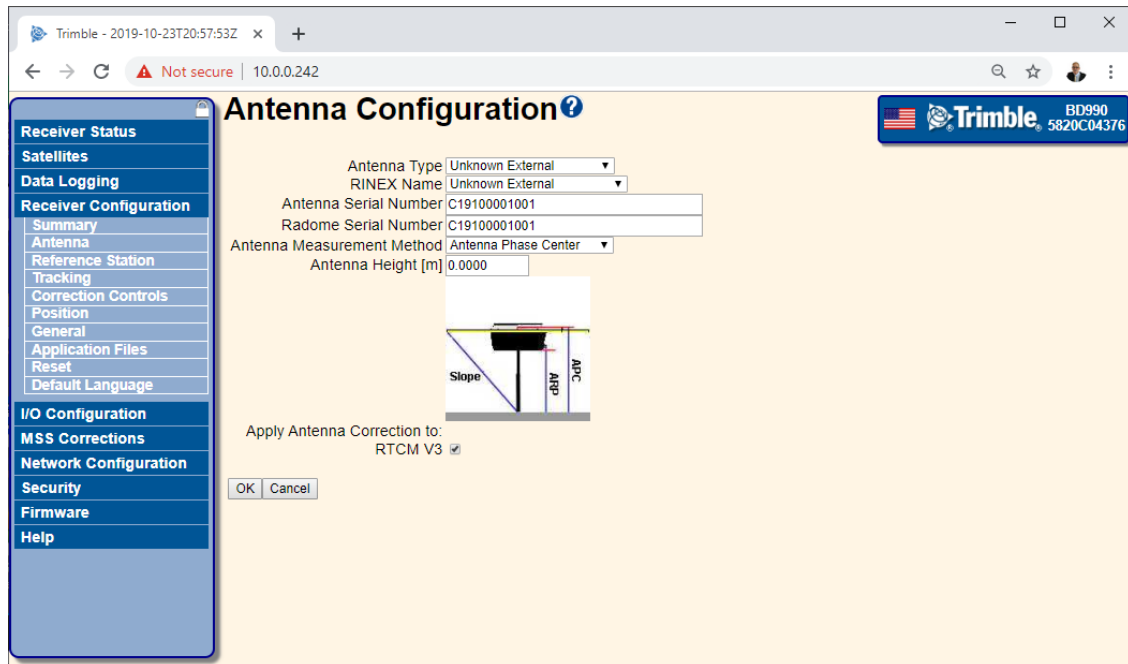
Set the 'Operation Mode' to 'Base'.

Antenna Configuration

The CR220GR2 antenna has a full Absolute Type Mean Robotic Calibration and is listed in both the IGS and NGS tables. It is approved and suitable for use in NGS CORS applications. Note that there are two revisions of this antenna, revision 2 has a North arrow while revision 1 does not have a North arrow. If you purchased the antenna after 2017 it is most likely a R2 (Revision 2).

The L1 Offset for this antenna is 121.44 mm.

When configuring the base station, manually add the L1 offset to the ARP and broadcast the PC (Phase Center) Location. On the 'Receiver Configuration, Antenna' page:



Set the type to Unknown. Set the RINEX NAME to Unknown.

Enter the antenna serial number for the Antenna and Radome (they are connected and are the same).

Set the method to 'Antenna Phase Center', set the height to 0.000 (m).

Check the 'Apply Antenna Correction to: RTCM V3' checkbox. This will broadcast an ADVNUL antenna type.

Click on OK to save these changes.

Reference Station Configuration

Collect static data for the station. (Ask for help from iGage.)

Submit the static data to OPUS using the CORRECT antenna model (CHCC220GR2 CHCD) and a 0.000 M antenna height. The returned OPUS solution will be for the ARP (the bottom of the antenna.) Add the L1 offset (121.44 mm) to the solution and enter that as the reference position. (Which is programmed as the PC, Phase Center.)

Assuming you have this OPUS solution for the receiver ARP:

LAT:	40	44	10.39837	0.002 (m)	40	44	10.41367	0.002 (m)
W LON:	111	51	33.55852	0.008 (m)	111	51	33.61558	0.008 (m)
EL HGT:			1310.241 (m)	0.010 (m)			1309.530 (m)	0.010 (m)

Compute the PC above the ARP: $1310.241 + 0.12144 = 1310.362$:

Reference Station

CMR ID: 19
RTCM 2.x ID: 19
RTCM 3.x ID: 19
Station Name: IG19
Station Code: IG19

Cartesian Geographical

Reference Latitude: 40 44 10.39837 " N S
Reference Longitude: 111 51 33.55852 " E W
Reference Height: 1310.362 [m]

Set the Latitude, Longitude to match the NAD83 coordinate in the OPUS report. (Or the average value if you are using multiple days of data, or the adjusted value if you are using the results of an OPUS Project.)

Set the Reference Height to the ARP + L1Offset.

Set the ID's to the station ID number you want to broadcast. The station ID is included in the correction broadcast and is useful to verify the actual station connection.

Set the Station name to a unique 4-character ID. (Try to pick a station name that does not already exist in the NGS array in case you decide to add your station to the NGS array.)

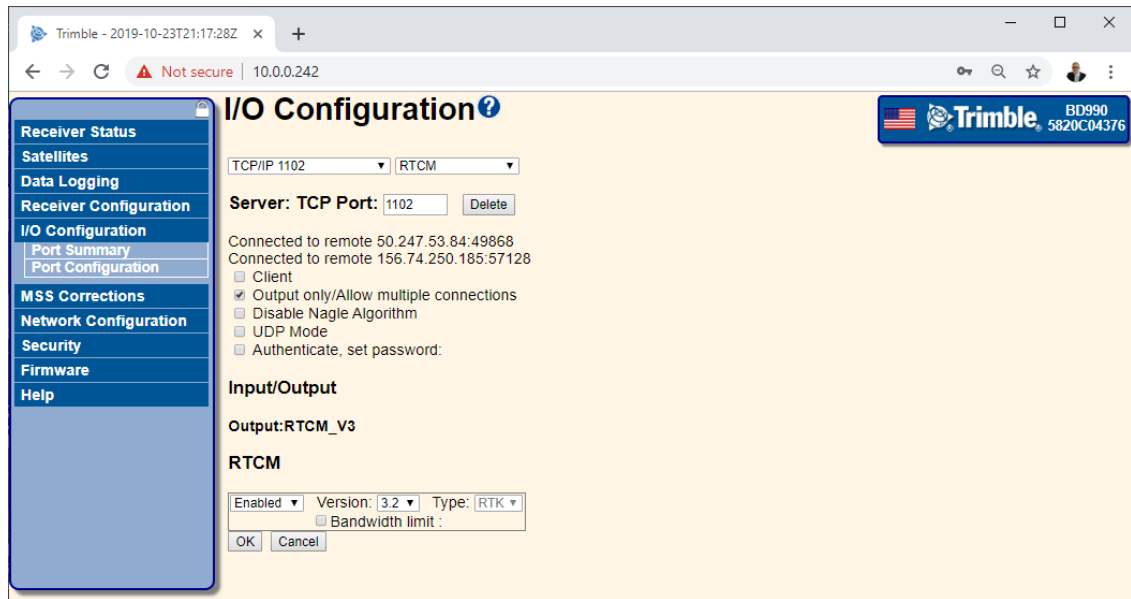
Setup IO Outputs

Typically you will access your station via the internet. At a minimum you should setup DIP outputs for 'RTCM3.2', 'RTCM3.X', 'CMR+'. If you are using iGage supplied receivers you may want to include a 'SCMRX' stream also.

You may also want to setup a NTRIP server which distributes corrections via password protected user accounts.

NOTE: SCMRX is 'Scrambled CMRX' and is purposely NOT compatible with Trimble Receivers 'CMRX' protocol. For Trimble Receivers use 'RTCM3.2 (MSM)' protocol.

Here is a sample IO screen for 'RTCM3.2' on port 1102:



ALWAYS check the 'Output only/Allow multiple connections' checkbox. **ALWAYS!**

RT27 Stream push to APIS1.US (iGage Stream Server)

If you would like iGage to accumulate static data, you will need to either allow direct access to a port configured to RT27 or to arrange for a port on the APIS1.US server to push a stream to.

This example shows the configuration for a push connection to the iGage APIS1.US server. This method will work behind closed firewalls.

The screenshot shows the 'I/O Configuration' page in a web browser. The browser's address bar shows '10.0.0.13'. The page title is 'I/O Configuration?'. On the left is a sidebar with a tree view containing: Receiver Status, Satellites, Receiver Configuration, I/O Configuration (selected), Port Summary, Port Configuration, MSS Corrections, Network Configuration, Security, Firmware, and Help. The main content area has a header with the Trimble logo and 'BD990 5812C02081'. Below the header, there are dropdown menus for 'TCP/IP apis1.us: 2121' and 'RT17/RT27'. A 'Client: TCP' label is followed by a 'Delete' button. The status indicates 'Connected to remote apis1.us:2121'. There are several checkboxes: 'Client' (checked), 'Output only' (checked), 'Disable Nagle Algorithm' (unchecked), and 'UDP Mode' (unchecked). The 'Remote IP' is 'apis1.us' and the port is '2121'. Below this, it says 'IP Resolves to: 50.247.53.84'. The 'Input/Output' section shows 'Output: RT27 (1 Hz)'. Under 'RT27:', there is a dialog box with 'Epoch Interval' set to '1 Hz' and 'Measurements' and 'Positions' checked. The 'Options' section includes: 'Concise' (checked), 'R-T Flag' (checked), 'Send Raw GPS Data' (checked), 'Send Raw SBAS Data' (checked), 'Include FLL Measurements' (unchecked), 'Multi-System Support' (checked), 'Smooth Pseudorange' (checked), 'Smooth Phase' (checked), and 'Include Doppler' (checked). Below these are dropdown menus for 'GPS Ephemeris', 'GLONASS Ephemeris', 'Galileo Ephemeris', 'QZSS Ephemeris', 'BeiDou Ephemeris', 'IRNSS Ephemeris', and 'SBAS Ephemeris', all set to 'When new one is available'. The 'Almanac' dropdown is set to '1800 Sec.'. 'OK' and 'Cancel' buttons are at the bottom of the dialog.

DO NOT check the 'Include FLL Measurement' checkbox, as TEQC is used to decode streams and FLL won't work. When configured to a matching port at the iGage stream server, hourly and daily files will be collected and archived.