DELTA-3S

GNSS RECEIVER

User Manual

VERSION 1.0
LAST REVISED NOVEMBER 23, 2021

Contents

Preface

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Screen Captures

This manual includes sample screen captures. Your actual screen can look slightly different from the sample screen due to the receiver you have connected, operating system used and settings you have specified. This is normal and not a cause for concern.

Technical Assistance

If you have a problem and cannot find the information you need in the product documentation, contact your local dealer. Alternatively, request technical support using the JAVAD GNSS World Wide Web site at: www.javad.com

To contact JAVAD GNSS Customer Support use the QUESTIONS button available on the www.javad.com

Introduction

DELTA-3S is a powerful and reliable receiver for high-precision navigation systems, including high dynamics systems, for machine and traffic control, as well as for high-precision surveying and geodynamics and aerogeophysics applications.

874 GNSS channels of this receiver allow tracking all current and future satellite signals. DELTA-3S is the receiver that can track and decode the QZSS LEX signal messages.

DELTA-3S can operate as a receiver for post-processing, as a Continuously Operating Reference Station (CORS) or portable base station for Real-time Kinematic (RTK) applications, and as a scientific station collecting information for special studies, such as ionosphere monitoring and the like (Fig. 1).

DELTA-3S

DELTA-3S can receive and processes multiple signal types (including GPS C/A, P1, P2, L2C (L+M), L5 (I+Q); Gallileo E1 (B+C), E5A (I+Q), E5B (I+Q), AltBoc, E6; GLONASS C/A, L2C, P1, P2, L3 (I+Q); QZSS C/A, L1C(I+Q), L2C (L+M), L5 (I+Q), SAIF, LEX; BeiDou B1, B2, B3; SBAS L1, L5 signals) improving the accuracy and reliability of your measuring points and positions, especially under difficult jobsite conditions.

The GNSS component of DELTA-3S receivers means you can access the GPS (Global Positioning System) satellites of the United States, the Galileo (an upcoming global positioning system maintained and operated by Galileo Industries), the GLONASS (Global Navigation Satellite System) satellites of the Russian Federation, the QZSS (is a proposed three-satellite regional time transfer system and Satellite Based Augmentation System for the Global Positioning System, that would be receivable within Japan), and the Beidou Compass (Chinese Global Navigation Satellite System), increasing the number of satellites your receiver can detect, thus improving the accuracy of your measuring points, increasing productivity, and reducing cost.

Several other features provide under-canopy and low signal strength reception. The DELTA-3S receiver provides the functionality, accuracy, availability, and integrity needed for fast and easy data collection.

Measuring with the right GNSS receiver can provide users accurate and precise positioning, a requirement for any measuring project. This section gives an overview of existing and proposed Global Navigation Satellite Systems (GNSS) and receiver functions to help you understand and apply basic operating principles, allowing you to get the most out of your receiver.

Unpacking and checking contents

DELTA-3S in the transporting case

1. 20-587200-02 Transport case (for one receiver)
2. DELTA-3S receiver
3.14-578102-01 Extension Cable SAE/SAE (1.8m)
4. 14-578101-01 Power Cable, ODU-5/SAE (0.3m)
5. 14-578104-01 USB Cable to ODU-5 (1.8m)

Specifications

Tracking Features

- GPS C/A, L1C(P+D) including TMBOC(6,1,4/33) , P1, P2, L2C(L+M), L5(I+Q)
- GLONASS C/A, P1, P2, L2C, L3(I+Q)
- Galileo E1(B+C) including CBOC(6,1,1/11), E5A(I+Q), E5B(I+Q), AltBoc, E6(B+C)
- QZSS C/A, L1C(P+D) including TMBOC(6,1,4/33) , L2C(L+M), L5(I+Q), L6(L61/L62), L1S, L1Sb, L5S
- BeiDou B1, B1C(P+D) including TMBOC(6,1,4/33) , B2B(I+Q), B2, B2A(I+Q), AltBoc, B3
- IRNSS L5, S
- L-band 1525-1560 MHz
- SBAS[1] L1, L5(P+D)
- In-Band Interference Rejection
- Spoofing detection
- Advanced Multipath Reduction
- Fast acquisition channels
- High accuracy velocity measurement

Performance Specifications

- Autonomous: < 2 m
- Static, Fast Static Accuracy:
  Horizontal: 0.3 cm + 0.1 ppm * base_line_length[2]
  Vertical: 0.35 cm + 0.4 ppm * base_line_length
- Kinematic Accuracy:
  Horizontal: 1 cm + 1 ppm * base_line_length
  Vertical: 1.5 cm + 1 ppm * base_line_length
- RTK (OTF) Accuracy:
  Horizontal: 1 cm + 1 ppm * base_line_length
  Vertical: 1.5 cm + 1 ppm * base_line_length
- DGPS Accuracy:
  < 0.25 m post processing;
  < 0.5 m real-time
- Real-time heading accuracy:
  0.004/L [rad] RMS, where L is the antenna separation in [m]
- Cold/Warm Start/ Reacquisition:
  < 35 seconds / < 5 seconds / < 1 second

Data Storage

- Up to 64 GB of onboard non-removable memory for data storage

Input/Output

- High-speed RS232 serial ports (up to 460.8 Kbps) 7 pins ODU
- High speed configurable RS232/RS422 serial port (up to 460.8 Kbps), 7 pin ODU
- High-speed configurable RS232/RS422 serial port (up to 460.8 Kbps) and CAN 2.0 M12, 8 pins
- High speed USB 2.0 dual-role port (device or host), 5 pin ODU
- Full-duplex 10BASE-T/100BASE-TX Ethernet port
- CAN 2.0 port
- IRIG timecode output A134, A137, B124, B137, BNC
- 1 PPS output, BNC
  Synchronized to UTC or any selected satellite system time.
  Voltage level: Voh>1,8V at 50 Ohm load
  Output Impedance: 25 to 30 Ohm (typ)
- Event Marker input, BNC
- External Reference Frequency Input/Output, BNC
- The central pin of the RF antenna connector outputs +5 VDC to power LNA. The sourced current is 0.12A max.
- Serial port (M12) bus power, +12 V DC, 250 mA max
- Two LEDs, two function keys (TriPad)

Power Specification

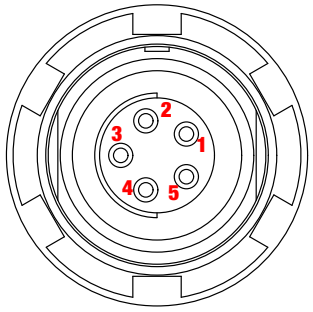
- External power input, 5 pins ODU
- Power consumption: 4.5 Watt (typ.)
- Input voltage: +4.5 to +35 Volts

Physical & Environmental

- Temperature:
  Operating: -40 °F to 176 °F (-40°C to +80°C)
  Storage: -40 °F to 185 °F (-40°C to +85°C)
- Humidity: 95%
- High shock and vibration resistance
- Dimensions:
  4.3x1.4x5.6/max 6.3 inches (109x35x141/ max 160 mm) with connectors
- Weight: 0.92 lbs (0.42 kg)Connectors specifications

Power connector

The power connector is a sealed receptacle, 5 pin, ODU p/n G80F1C-T05QF00-0000.



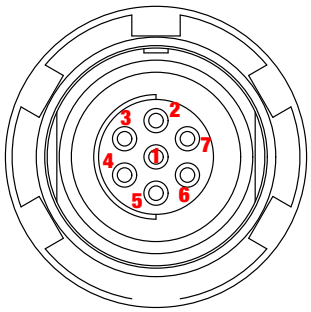
Power connector

The table below shows the power connector specification:

Number	Signal name	Dir	Details
1	Power_INP	P	+4.5 to+40 V DC input
2	Power_INP	P	+4.5 to+40 V DC input
3	Power_GND	P	Ground, power return
4	Power_GND	P	Ground, power return
5			Not used

Serial RS-232C Connector

The RS232 connectors are sealed receptacle, 7 pin, ODU p/n G80F1C-T07QC00-0000.



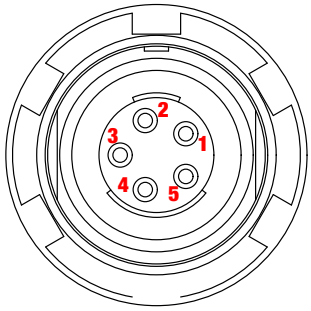
RS-232C Connector

The table below gives the RS-232C cable connector specifications.

Number	Signal name	Dir	Details
1	-	-	-
2	GND	-	Signal ground
3	CTS	I	Clear to send
4	RTS	O	Request to send
5	RXD	I	Receive data
6	TXD	O	Transmit data
7			Not used

USB Connector

The USB connector is a sealed receptacle, 5 pin, ODU p/n G80F2C-P05QF00-0000.



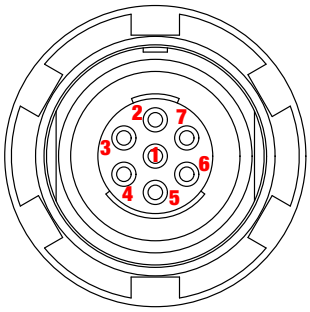
USB Connector

The table below gives the USB connector specifications.

Number	Signal name	Dir	Details
1	-	-	-
2	USB Power	P	Bus power
3	GND	-	Ground
4	USB D+	I/O	Data plus
5	USB D-	I/O	Data minus

Ethernet Connector

The Ethernet connector is a sealed receptacle, 7 pin, ODU p/n G80F2C-P07QC00-0000.



Ethernet Connector

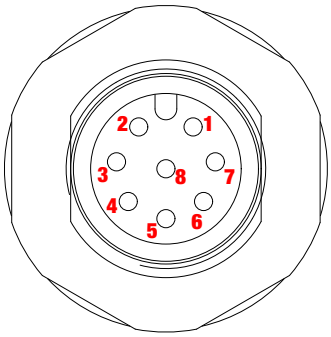
The table below gives the Ethernet connector specifications.

Number	Signal name	Dir	Details
1			Not used
2	Power_GND		Signal ground
3	TXD+	O	Transmit data plus
4	TXD-	O	Transmit data minus
5	RXD+	I	Receive data plus
6	RXD-	I	Receive data minus

Number	Signal name	Dir	Details
7	LAN LED		External LAN LED anode

RS422 and CAN Connectors

The RS422/CAN connector is a sealed receptacle, M12, 8 pin Male receptacle, FM, M16x1.5, flying lead connector Binder-USA p/n 09-3481-700-08.



RS422 and CAN Connector

The table below gives the RS422/CAN connector specification.

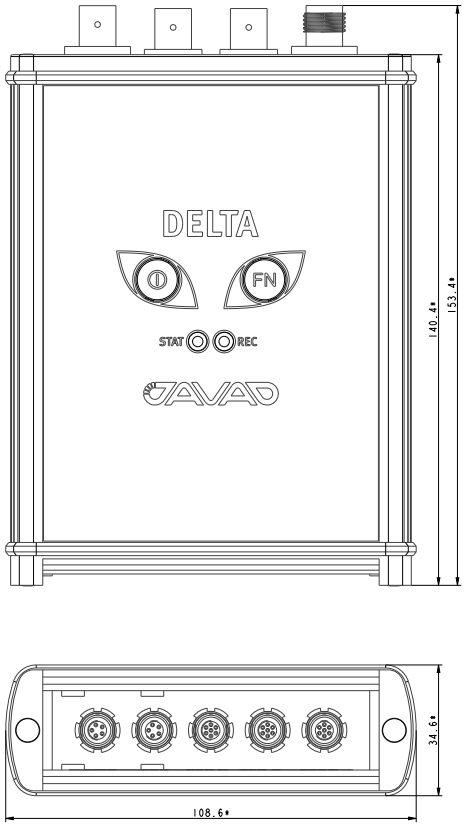
Number	Signal name	Dir	Details
1	PWR IN	-	
2	GND	-	Signal ground
3	422_TX+	O	Port TX+ line
4	422_TX-	O	Port TX- line
5	422_RX+	I	Port RX+ line
6	422_RX-	I	Port RX- line
7	CAN_H	I/O	CAN_H bus line (dominant high)
8	CAN_L	I/O	CAN_L bus line (dominant low)

GNSS External Connector

The external antenna connector type is a TNC RF connector with an Applied Engineering Product p/n 6001-7051-003. RF input from LNA, 100 mA at 5.0 volts DC output.

EVENT and 1 PPS Connectors

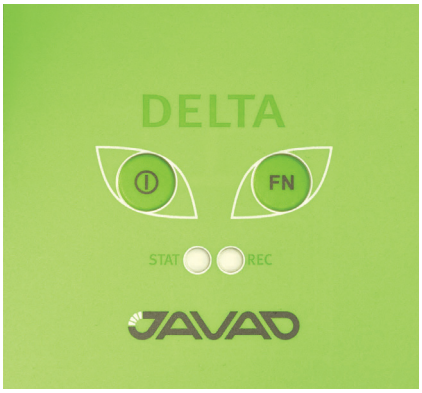
The EVENT and 1PPS connectors are coaxial female receptacles of BNC series, Kings Electronics part number KC-79-108.



Dimensions in mm

TriPad

The TriPad is the receiver's minimum interface used to display and control data input and output.



DELTA-3S TriPad

The STAT (status) LED displays the number of tracked satellites.

- Green – eight and more satellites.
- Yellow – five to seven satellites.
- Red – less than five satellites.
- No light – no satellites.

Effective number of satellites are total number of satellites tracked minus the number of non-GPS systems tracked. E.g. if 8 GPS and 5 GLONASS are tracked the effective number of satellites is 12.

The REC (record) LED displays the data recording status and blinks on each recording.

- Green – recording data.
- Yellow – less than 10 min memory left.
- Red – memory is full.
- No light - not active.

The On/Off (power) button turns the receiver on and off.

The FN button starts/stops data recording.

Data and power ports

The DELTA-3S receiver can be equipped according users needs and have different ports on the front and back panels.

Below are presented some examples of possible configurations:

Ports

- For all modifications, the front panel interfaces:
  PWR
  USB
  Serial Port A
  Serial Port C
  Ethernet

Option A - Reference station

- Back panel: GNSS Antenna

Option B - General Purpose

- Back panel:
  GNSS Antenna
  Event
  1PPS
  Ext. Frequency I/O

Option C - General Mobile Applications

- Back panel:
  GNSS Antenna
  Event
  1PPS
  Serial Port D / CAN

Connectors

The DELTA-3S receiver can be equipped according users need and have different connectors on the back panel. Below are presented some examples of possible configurations:

Connectors

- The external GNSS antenna connects to the TNC external antenna connector (optional).
- The 1PPS and Event marker BNC connectors (up to two) (optional).
- External Frequency Input/Output BNC connector (optional).

Cables

The DELTA-3S receiver package includes standard communication and power cables for configuring the receiver and providing a power source to the receiver.

- Extension Cable SAE/SAE (1.8m)
  p/n 14-578102-01
- Receiver-to-SAE power cable – connects the receiver's power port and the power supply's SAE connector or the extension cable's SAE connector
  p/n 14-578101-01
- USB Cable to ODU-5 (1.8m)
  p/n 14-578104-01

Literature

DELTA-3S literature, including manuals and other product information are available on the JAVAD GNSS website (http://www.javad.com):

- DELTA-3S Operator's Manual
- Functional specifications

Powering the receiver

Turning On/Off

To turn ON the receiver, press and hold the power button until the LEDs briefly flash. To turn OFF the receiver, press and hold the power button for more than one and less than four seconds (until both the SAT and the REC LEDs are off). This delay (about 1 second) will prevent the receiver from being turned off by mistake.

DELTA-3S saves the last power status and restore it after voltage loss.

Power supply requirements

The socket-outlet shall be installed near the equipment and shall be easily accessible.

A single external power supply with 5 pin ODU connector or SAE connector is necessary to operate DELTA-3S. If external power supply has only SAE connector, Receiver-to-SAE power cable shall be used. The external power supply needs to be Listed for US and Certified for EU countries, it needs also to be a Limited Power Source and have an output rated for 14.5 - 35 V DC, 2A. This may not be the same range as other JAVAD GNSS products with which you are familiar. To avoid the introduction of hazards when operating and installing, before connecting of the equipment to the supply, make sure that the supply meets local and national safety ordinances and matches the equipment's voltage and current requirements.

Warning: Never attempt any maintenance or cleaning of the supply while plugged in. Always remove supply from AC power before attempting service or cleaning.

If the voltage supplied is below the minimum specification, the receiver will suspend operation. If the voltage supplied is above the maximum specification, the receiver may be permanently damaged, voiding your warranty.

Make sure cords are located so that will not be stepped on, tripped over, or otherwise subjected to damage or stress. Do not operate equipment with a damaged cord or plug – replace immediately. To reduce the risk of damage to the equipment, pull by the plug body rather than the output cord when disconnecting the equipment.

Warning: Do not operate the supply if it has received a sharp blow, been dropped, or otherwise damaged. Do not disassemble the supply.

Before connecting the external power source and the receiver, make sure that the power source matches the receiver's voltage and current requirements.

Option Authorization File (OAF)

JAVAD GNSS issues an Option Authorization File (OAF) to enable the specific options that customers purchase. An Option Authorization File allows customers to customize and configure the DELTA-3S receiver according to particular needs, thus only purchasing those options needed.

Typically, all DELTA-3S receivers ship with a temporary OAF that allows the receiver to be used for a predetermined period of time. When the receiver is purchased, a new OAF activates desired, purchased options permanently. Receiver options remain intact when clearing the NVRAM or resetting the receiver.

Managing and Operating Receiver

Sofware

To manage and operate the receiver use the NetBrowser. NetBrowser is a web application for JAVAD GNSS Receivers, which runs on any platforms, including desktop, tablet or mobile ones.

Please use the latest version of your favorite web browser.

As soon as NetBrowser is downloaded, it is saved in the cache and you can use it at any time even when offline. Just save the link as a bookmark or add it onto your home screen.

Features:

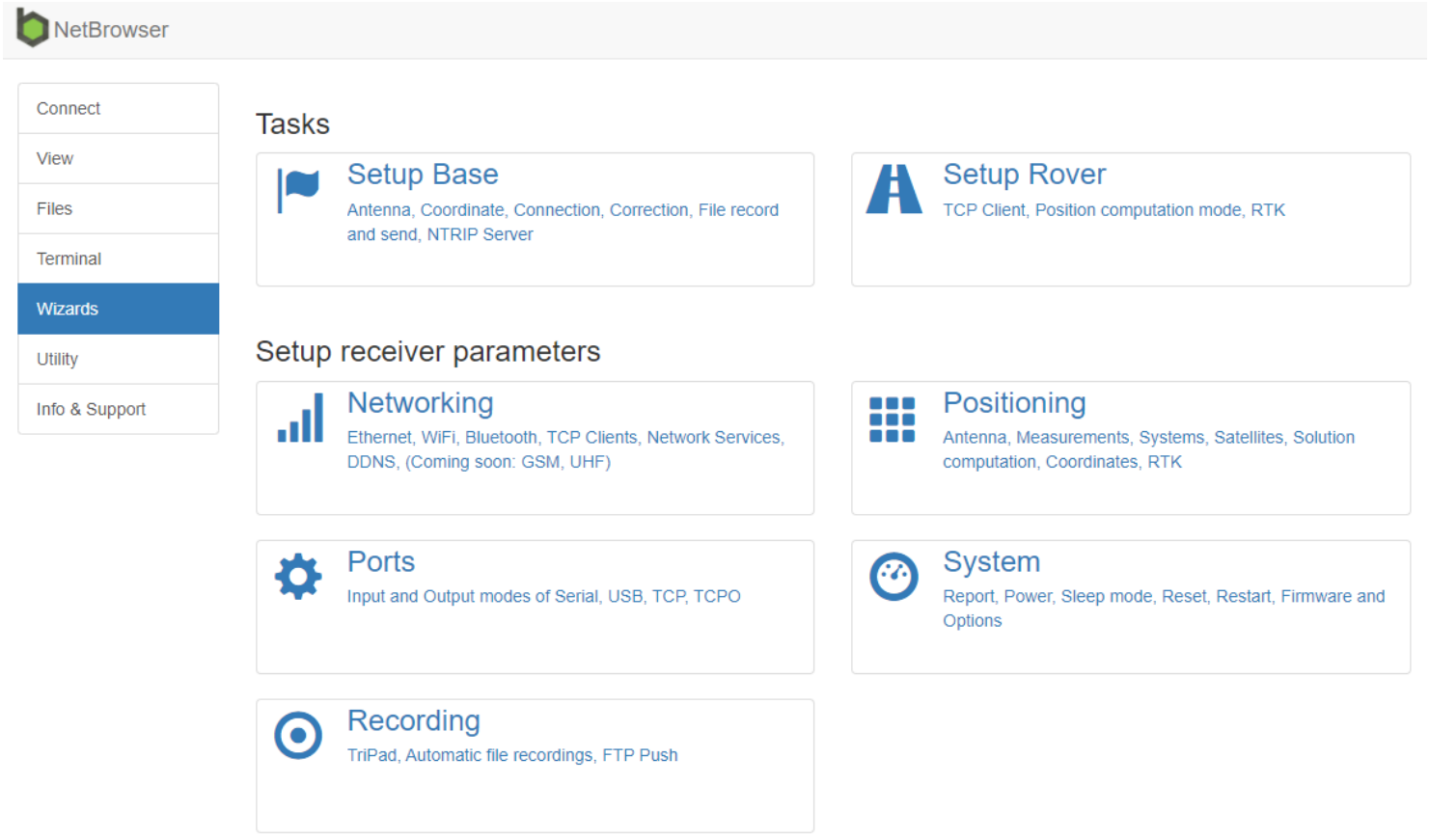
- Connect to the receiver directly over HTTP and save connection settings for future use
- View Receiver status data: satellites table, coordinates, skyplot, options
- Configure your Receiver: setup and initialize parameters, clear NVRAM, setup sleep mode with timeout period up to 7 days, update options from file and from website, update firmware
- Get a comprehensive technical report of Receiver operation and save it as a file
- Manage your raw files: start, stop and delete point survey recordings
- Instantly send your files to Dropbox
- Send commands with terminal (command line)
- Collect spectrum data

Access NetBrowser at: http://javadgnss.net/jwi/

Note: You can also type IP address of your Receiver into your browser's address bar and you will be forwarded to the same page.

To access your Receiver over HTTP, you need to connect it to your local network via Ethernet or Wi-Fi.

Note: You can also access you Receiver directly over Wi-Fi.



NetBrowser Wizards

This panel allows the access to the Base and rover configuration (Setup Base and Setup Rover), setup different receiver parameters (Networks, Ports, Recording, Positioning, and System).

Configuring Receiver

Both Base and Rover receivers must be configured according to the desired survey method.

In applications where real-time positioning results are required, the Base receiver provides the correction information needed to properly calculate the location of the Rover receiver. A Base station is normally set up over a known point and collects GNSS data from satellites. As the receiver picks up satellite data, it measures the carrier and code phases to accurately compute and verify its location. Then, the receiver transmits this information via radio (UHF or GSM) to the Rover receiver.

The Rover receiver applies correction information from the Base station to its current location to accurately calculate one or more points. Rovers are mobile GNSS receivers on a survey pole or bipod that compares the information from the Base station to the data it logs from satellites and applies correction algorithms to accurately calculate a new point.

In applications intended for post-processing, the receivers typically log code phase and/or carrier phase measurements separately from common satellites and during the same time interval. This data is then processed using post-processing software (for example, Justin).

When configuring receivers for RTK surveying, use the following list to ensure the receivers are properly set up:

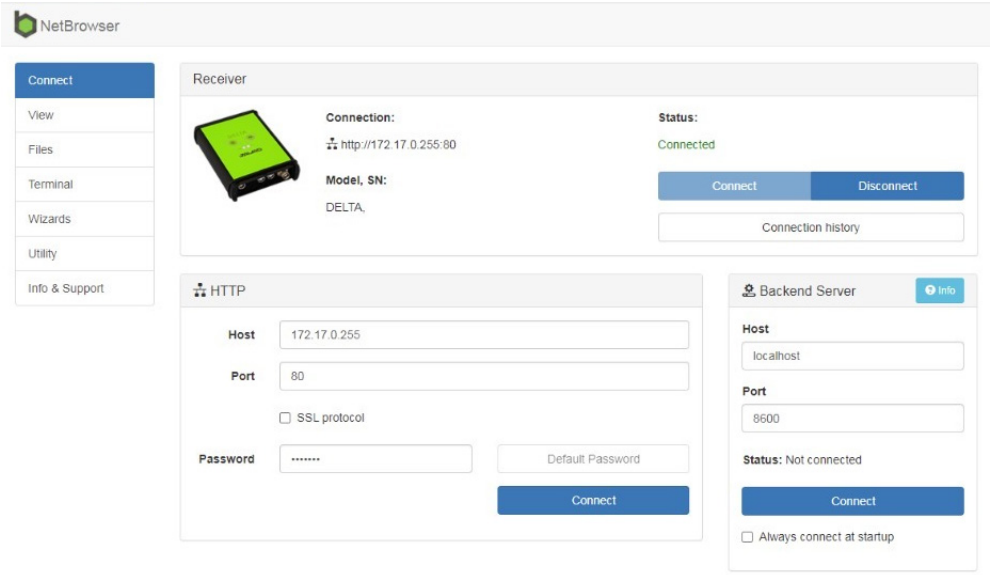
- Configure one receiver as an RTK Base station and the other receiver as an RTK Rover.
- Configure the communication data link for transmitting and receiving corrections.
- Set up the Base receiver over a known point to begin collecting static observation data and transmitting corrections. Set up the Rover receiver to begin collecting RTK data.

When configuring receivers for post-processing surveying, use the following list to ensure the receivers are properly set up:

- Configure one receiver as a Base station and the other receiver as a Rover.
- Set up the Base receiver over a known point to begin collecting static observation data. Set up the Rover receiver to begin collecting static or kinematic observation data.

1. Connect the receiver to the NetBrowser
2. Click Wizards.

To disconnect the receiver click Disconnect.



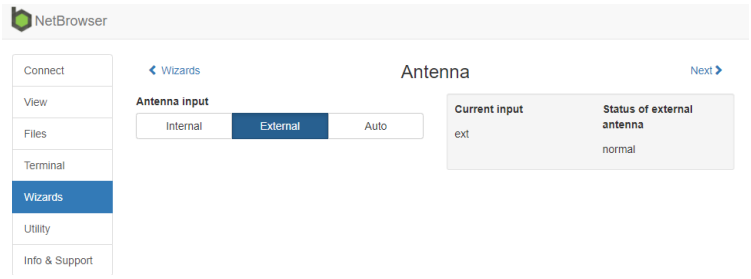
NetBrowser. Connect page

Base setup

Click Wizards > Setup Base to set the parameters for the receiver which will operate like a base.

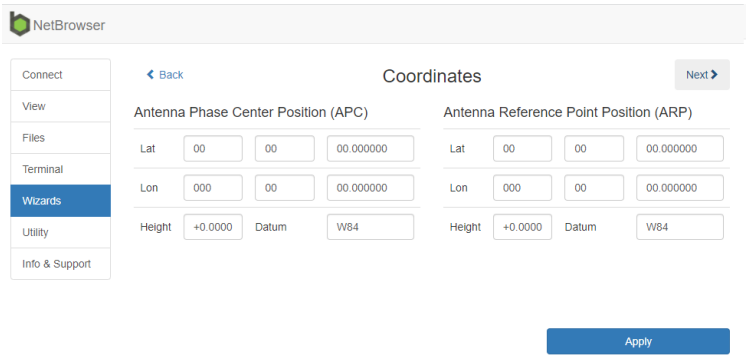
Note: Click Apply every time after the parameter was changed, otherwise the receiver won't save the changes.

- Select the antenna type: External
- Always click Next> to switch to the next step.



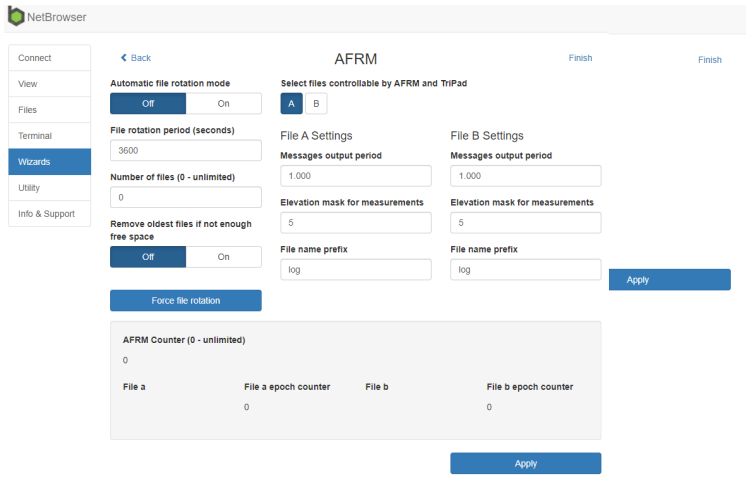
Antenna parameters

- Enter the coordinates of Antenna Phase Center Position (APC). enter latitude, longitude, and altitude (ellipsoidal height) values of the antenna position. If known, type in the values.
- Enter Antenna Reference Point Position (ARP)



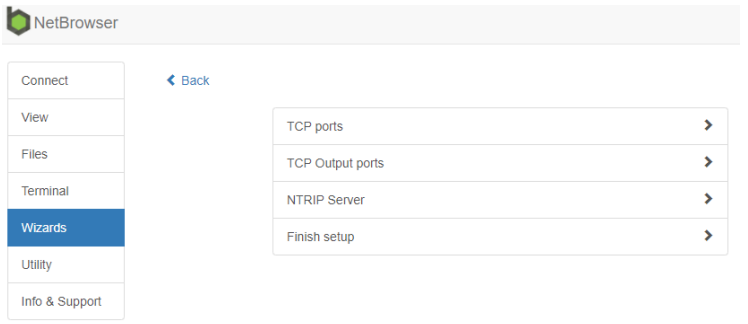
Coordinates

- Activate the Automatic file rotation mode by clicking to the appropriate buttons and controls.
  - File rotation period (seconds)– specifies the time duration of each of the multiple log files created in AFRM mode.
  - Remove oldest files if not enough free space – if active, the receiver will remove the least recent files if no free space is available in the receiver memory to record the current file.
  - Select files controllable by AFRM and TriPad - select file a or b.
  - Set the Messages output period, Elevation mask for measurements, and specify the File name prefix for the File A and File B



AFRM

- Set the Ports and output messages by clicking to the appropriate port names



Ports parameters

Click Finish setup when ready.

Rover setup

Click Wizards > Setup Rover to set the parameters for the receiver which will operate like a base.

Note: Click Apply every time after the parameter was changed, otherwise the receiver won't save the changes.

For the rover should be the following parameters set if needed, or skip this step by clicking Skip.

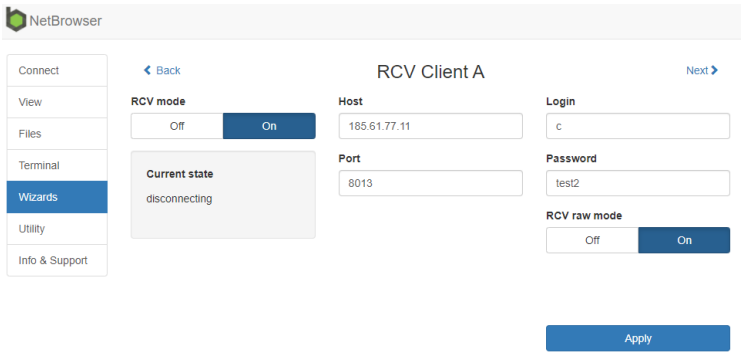
RCV

Configure the RCV client A:

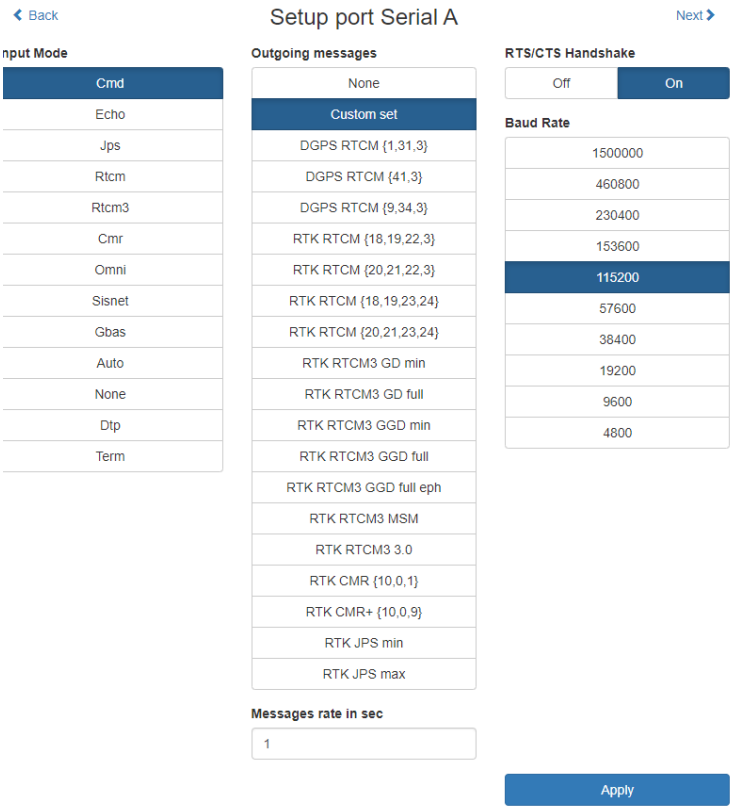
- Enable the RCV mode by switching the RCV mode buttons;
- Enter the host parameters, port number, login and password;
- Activate the RCV raw mode

In the next step Setup the serial port A:

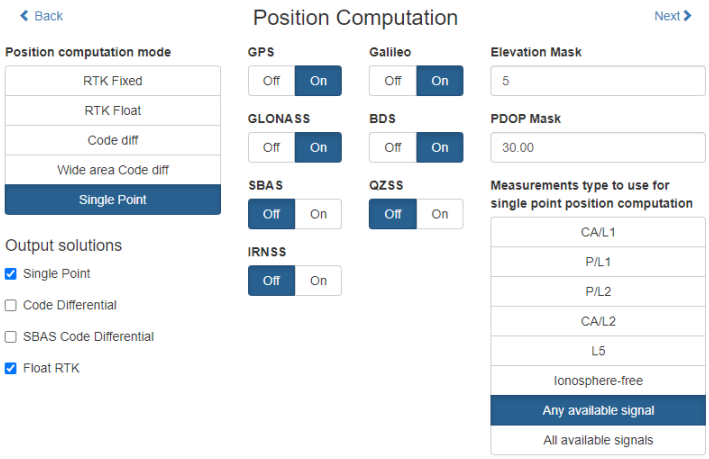
- Select the Input mode from the list
- Outgoing messages
- Activate the RTS/CTS handshake
- And set the baud rate to 115200
- In the Messages rate in sec field set the time

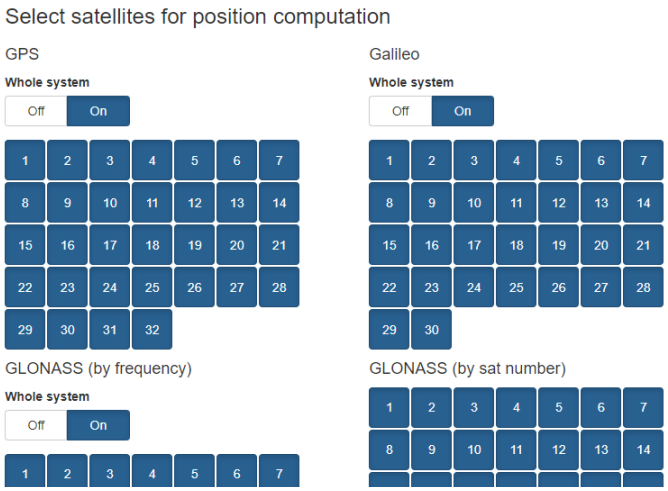


RCV Client A



Setup Port Serial A





- In the Position computation screen set the mode of position computation, and select the constellations, which will the receiver use to compute the positioning.
- Set the elevation mask (5), PDOP mask (30.00), and select from the list the Measurements type to use for single point position computation.
- Set the Output solutions:
  - Code differential (DGPS) mode
  - SBAS Code differential mode (WDGPS)
  - Single point positioning mode
  - Float RTK

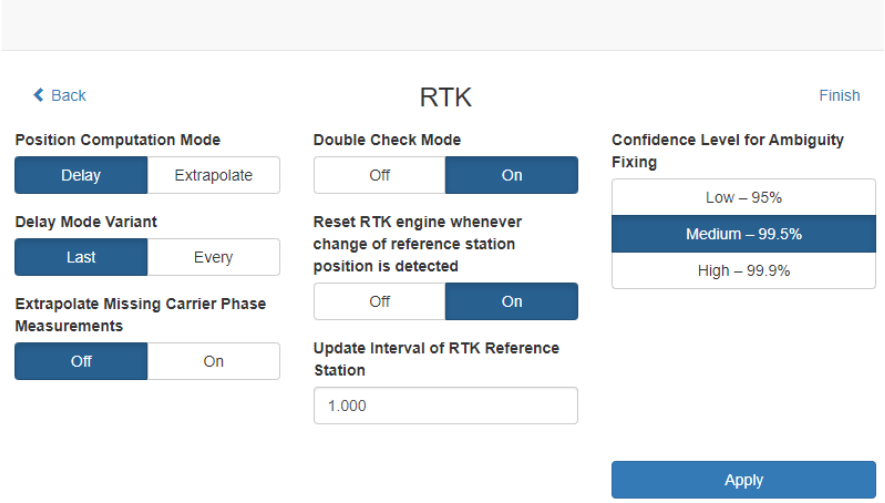
RTK

- RTK Position Computation Mode – select Extrapolation for RTK float (kinematic), or Delay for RTK fixed (static).

If Extrapolation is selected, the rover will extrapolate the base station's carrier phase measurements when computing the rover's current RTK position. If Delay is selected, the rover will not extrapolate the base station's carrier phase measurements to compute the current rover position. Instead, the RTK engine will compute either a delayed RTK position (for the epoch to which the newly received RTCM/CMR message corresponds) or the current stand-alone position (while waiting for new RTCM/CMR messages coming from the base).

- Confidence Level for Ambiguity – list box governs the process of the RTK engine fixing integer ambiguities.

The RTK engine uses the ambiguity fix indicator when making a decision whether to fix ambiguities or not. Low, Medium and High correspond to the indicator's 95%, 99.5% and 99.9% states, respectively. The higher the specified confidence level, the longer the integer ambiguity search time. This is the price one pays for the higher reliability of the ambiguity fixed solution.



RTK

Setup and survey

After configuring the receivers for surveying, each receiver needs to be setup up and the receiver's height measured and the survey can begin. The TriPad provides quick access for logging data, changing receiver modes, and viewing general data logging and satellite information during a survey.

A typical GPS survey system consists of a Base station set up over a known point and a Rover receiver set up to be a mobile data collector. After setting up the Base and Rover receivers, the antenna height must be measured.

Before collecting data, make sure the Base and Rover receivers contain a current almanac and current ephemeris data.

The Base station must be set up, logging data, and transmitting data before setting up the Rover receiver. Receiver setup for either post-process or RTK surveys is the same.

Measure Antenna Height

The location of the antenna relative to the point being measured is very important for both surveys in which the elevation of the points is important and in surveys for horizontal location only. Horizontal surveys are often larger in area than can reliably fit on a flat plane, therefore the antenna adjustment must be done in three dimensions and then projected onto a two dimensional plane.

The receiver calculates the coordinates of the antenna's phase center. To determine the coordinates of the station marker, the user must specify the following:

- Measured height of the antenna above the station marker
- Method of measuring the antenna height
- Model of the antenna used

Antennas have two types of measurements:

- Vertical – measured from the marker to the antenna reference point (ARP) located on the bottom of the receiver at the base of the mounting threads.
- Slant – measured from the marker to the lower edge of the antenna slant height measure mark (SHMM) located on both end panels of the receiver.

The point to which surveying with GNSS measures is called the Phase Center of the antenna. This is analogous to the point at which a distance meter measures in a prism. A user must enter the prism offset to compensate for this point not being at a physical surface of the prism. For a GNSS antenna, the offset is entered depending on the type of measurement taken.

For vertical, the offset is simply added to the measured vertical height to produce a "true" vertical height.

For slant height, the vertical height must first be calculated using the radius of the antenna, then the offset can be added.

The offsets are different because of the difference in location between the slant measuring point and the vertical measuring point.

Measure the antenna height above the control point or marker, either the slant height or the vertical height.

Record the antenna height, point name, and start time in the field notes

To start survey DELTA-3S should be set up on a tripod or in a pole.

Collecting data

See the remaining sections in this chapter for more information on collecting data.

- Turn on the receiver.
- Once the receiver has locked on to eight or more satellites the STAT light will green.
- The process of locking on to satellites normally takes less than one minute. In a new area, under heavy tree canopy, or after resetting the receiver, it may take several minutes.
- To begin collecting data, press and hold the FN button (for more than one second and less than five seconds).
- Release the FN button when the REC (recording) LED turns green. This indicates that a file has opened and data collection has started. The REC LED blinks each time data is saved to the internal memory.
- When finished, press and hold the FN button until the REC LED light goes out.

To turn off the receiver, press and hold the power key until all lights go out, then release.

Static Surveying for Base Stations

Static surveying is the classic survey method, well suited for all kinds of baselines (short, medium, long). At least two receiver antennas, plumbed over survey marks, simultaneously collect raw data at each end of

a baseline during a certain period of time. These two receivers track four or more common satellites, have a common data logging rate (5–30 seconds), and the same elevation mask angles. The length of the observation sessions can vary from a few minutes to several hours. The optimal observation session length depends on the surveyor's experience as well as the following factors:

- The length of the baseline measured
- The number of satellites in view
- The satellite geometry (DOP)
- The antenna's location
- The ionospheric activity level
- The types of receivers used
- The accuracy requirements
- The necessity of resolving carrier phase ambiguities

Generally, single-frequency receivers are used for baselines whose lengths do not exceed 15 kilometers (9.32 miles). For baselines of 15 kilometers or greater, use dual-frequency receivers.

Dual-frequency receivers have two major benefits. First, dual frequency receivers can estimate and remove almost all ionospheric effect from the code and carrier phase measurements, providing much greater accuracy than single-frequency receivers over long baselines or during ionospheric storms. Secondly, dual-frequency receivers need far less observation time to reach the desired accuracy requirement.

After the survey completes, data the receivers collect can be downloaded onto a computer and processed using post-processing software (for example, JAVAD GNSS Justin).

Kinematic (Stop & Go) Surveying for Rover Stations

In a kinematic, stop and go survey, the stationary receiver (Base station) is set up at a known point such as a survey monument, or an unknown point. The receiver continually tracks satellites and logs raw data into its memory. The Rover receiver is set up at an unknown point and collects data in static mode for 2 to 10 minutes. When finished, assign the Rover to kinematic status and move to the next survey point. At this point, and each subsequent point, the receiver is changed to static mode to collect data. So, while moving, the Rover is in kinematic mode, and while collecting data, the Rover is in static mode.

- Set up the Rover at an unknown point and press power. Allow the Rover to collect static data for two to ten minutes. The REC LED will be yellow.
- Check the SAT light for satellites tracked.
- When finished, press the FN button for less than 1 second to assign the Rover to kinematic.
- Move the Rover to the next location (survey point), and press the FN button for less than a second to collect the data in static mode for two to ten minutes.
- Repeat steps five and six until all points have been surveyed. The occupation time for the points depends on the same factors as for the static survey method.
- When finished, press the FN button for one to five seconds to stop logging data. Turn off the Rover if needed. This method of GNSS survey allows the operator to reduce the point occupation time, thus permitting field crews to survey many more points compared to the other methods available.

Real Time Kinematic Surveying

With RTK surveying, as with kinematic surveying described above, one receiver serves as the reference station and conducts observations with its antenna affixed to a stationary tripod or some other device. The other receiver functions as a rover and conducts observations (using an antenna) affixed to a mobile pole and moved to observation points.

Unlike post-processed kinematic surveys, RTK surveys utilize a communications link between the Base and Rover. Using a radio modem link, the Base receiver transmits its measurement and location data to the Rover receiver. The Rover, based on the transmitted data and its own observation data, immediately conducts a baseline analysis and outputs the results.

Usually, the receiver will start to output the coordinates of the antenna's phase center along with the solution type within 10–30 seconds. However, UHF radios and GSM phones may take as long as 60 seconds to synchronize. The geodetic coordinates displayed on the Location tab are always computed in WGS84 and have four solution types.

- Standalone – where the receiver computes 3D coordinates in autonomous mode without using differential corrections.
- Code differential – where the Rover receiver computes the current relative coordinate in differential mode using only pseudo ranges.

• RTK float – where the Rover receiver computes the current relative coordinates in differential mode using both pseudo ranges and phases; however, with a float solution, the phase ambiguity is not a fixed integer number and the “float” estimate is used instead.
• RTK fixed – where the Rover receiver computes current relative coordinates, with ambiguity fixing, in differential mode. The LQ field reflects the status of the received differential messages and contains the following information:
  • Data link quality in percentage
  • Time (in seconds) elapsed since the last received message
  • Total number of received correct messages (dependent on the message type received)
  • Total number of received corrupt messages (dependent on the message type received)
  • If the receiver is not (for some reason) receiving differential corrections, or if none of the ports has been configured to receive differential corrections, the LQ field will either be empty or it will look like this: 100%(999,0000,0000).

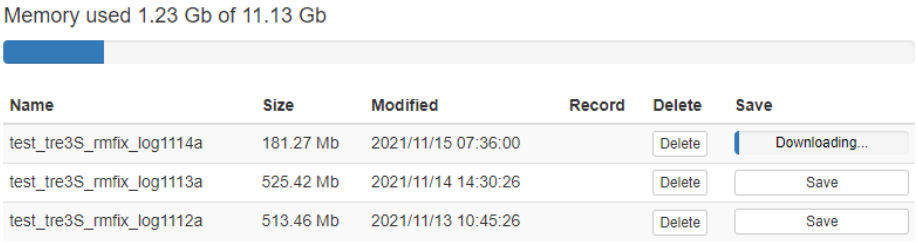
Receiver and File Maintenance

If post-processing the data after completing a measuring, the data in the receiver’s memory will need to be downloaded to a computer. Downloading and deleting files will also prepare the receiver’s memory for the next measuring. Occasionally, the receiver’s NVRAM may need to be cleared to eliminate communication or tracking problems. As project expectations expand, the receiver’s OAF may need to be updated to provide expanded operation and functionality. The receiver requires firmware to properly operate and provide appropriate functionality. As JAVAD GNSS releases firmware updates, loading these updates into the receiver will ensure that the receiver operates at its full potential.

Deleting Files and Downloading Files to a Computer

When your measuring finishes, you can download your measuring files to a computer for storage, post-processing, or backup. Also, the DELTA-3S memory holds a finite amount of files and information, so downloading the files to a computer ensures that no files are lost. You should download files as soon as possible after collecting data at the jobsite.

Click Files on the left panel of NetBrowser. On the right panel appears the list of files, saved in receiver’s memory. Select the file(s) to download:



Downloading files

Click the Save button. During the download, status indicators display each file.

To delete files from your receiver click Delete. Click Yes at the delete files confirmation dialog box. NetVBrowser deletes the selected file.

Managing Receiver Options

Checking an OAF

For a complete list of options and their details, visit the JAVAD GNSS website.

You can check the status of your receiver's options, and load any new OAFs via NetBrowser.

Connect your receiver and computer. Start NetBrowser. Establish connection between NetBrowser and receiver.

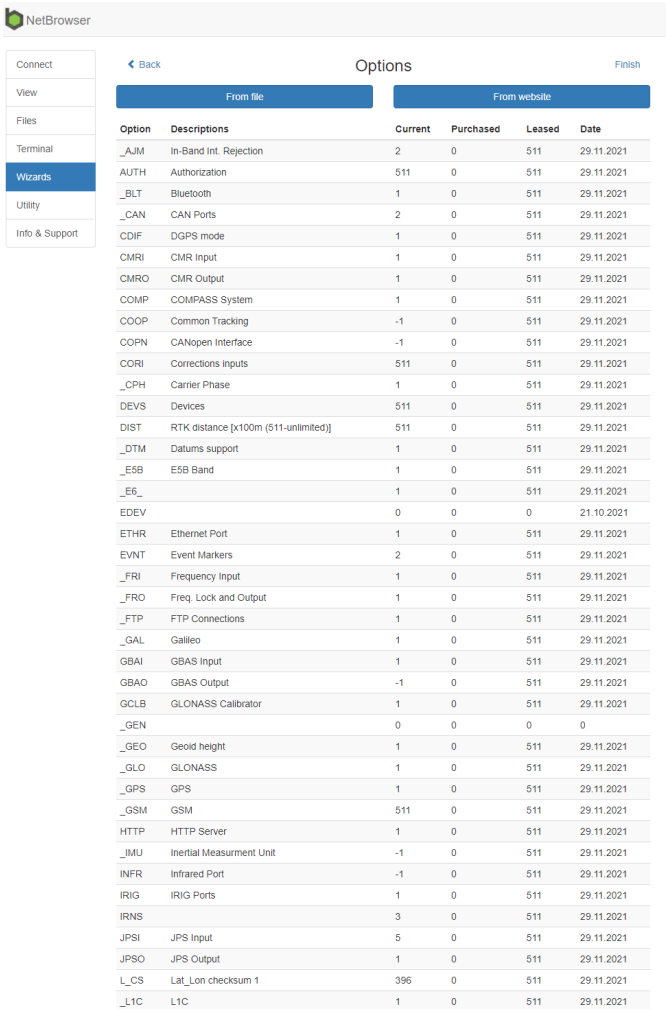
Click on the Wizards on the left panel. On the right open System > Options.

- Option name – a name/description of the option
- Current – shows if the option is in force at the present or not
- Purchased – if the option is purchased or not
- Leased – if the option is leased or not
- Date – the date the leased option will be disabled, if applicable

Loading OAFs

JAVAD GNSS dealers provide customers with OAF files. For any OAF related questions, E-mail at support@javad.com. Please have your receiver ID number available.

To upload a new options file, click on From file or From website, and select the options file. If you select From file, navigate to the location of the new Option Authorization File. OAFs have .jpo extension and are unique to each receiver.



Option	Descriptions	Current	Purchased	Leased	Date
_AJM	In-Band Int. Rejection	2	0	511	29.11.2021
AUTH	Authorization	511	0	511	29.11.2021
_BLT	Bluetooth	1	0	511	29.11.2021
_CAN	CAN Ports	2	0	511	29.11.2021
CDIF	DGPS mode	1	0	511	29.11.2021
CMRI	CMR Input	1	0	511	29.11.2021
CMRO	CMR Output	1	0	511	29.11.2021
COMP	COMPASS System	1	0	511	29.11.2021
COOP	Common Tracking	-1	0	511	29.11.2021
COPN	CANopen Interface	-1	0	511	29.11.2021
CORI	Corrections inputs	511	0	511	29.11.2021
_CPH	Carrier Phase	1	0	511	29.11.2021
DEVS	Devices	511	0	511	29.11.2021
DIST	RTK distance [x100m (511-unlimited)]	511	0	511	29.11.2021
_DTM	Datums support	1	0	511	29.11.2021
_E5B	E5B Band	1	0	511	29.11.2021
_E6_		1	0	511	29.11.2021
EDEV		0	0	0	21.10.2021
ETHR	Ethernet Port	1	0	511	29.11.2021
EVNT	Event Markers	2	0	511	29.11.2021
_FRI	Frequency Input	1	0	511	29.11.2021
_FRO	Freq. Lock and Output	1	0	511	29.11.2021
_FTP	FTP Connections	1	0	511	29.11.2021
_GAL	Galileo	1	0	511	29.11.2021
GBAI	GBAS Input	1	0	511	29.11.2021
GBAO	GBAS Output	-1	0	511	29.11.2021
GCLB	GLONASS Calibrator	1	0	511	29.11.2021
_GEN		0	0	0	0
_GEO	Geoid height	1	0	511	29.11.2021
_GLO	GLONASS	1	0	511	29.11.2021
_GPS	GPS	1	0	511	29.11.2021
_GSM	GSM	511	0	511	29.11.2021
HTTP	HTTP Server	1	0	511	29.11.2021
_IMU	Inertial Measurment Unit	-1	0	511	29.11.2021
INFR	Infrared Port	-1	0	511	29.11.2021
IRIG	IRIG Ports	1	0	511	29.11.2021
IRNS		3	0	511	29.11.2021
JPSI	JPS Input	5	0	511	29.11.2021
JPSO	JPS Output	1	0	511	29.11.2021
L_CS	Lat_Lon checksum 1	396	0	511	29.11.2021
_L1C	L1C	1	0	511	29.11.2021

Options

Clearing the NVRAM

The receiver's Non-Volatile Random Access Memory (NVRAM) holds data required for satellite tracking, such as almanac and ephemeris data, and receiver position. The NVRAM also keeps the current receiver's settings, such as active antenna input, elevation masks and recording interval, and information about the receiver's internal file system.

Even though clearing the NVRAM is not a common (nor normally a recommended) operation, there are times when clearing the NVRAM can eliminate communication or tracking problems. Clearing the NVRAM in your receiver can be interpreted as a "soft boot" in your computer. After clearing the NVRAM, your receiver will require some time to collect new ephemerides and almanacs (around 15 minutes). Clearing the NVRAM of your receiver will not delete any files already recorded in your DELTA-3S's memory. However, it will reset your receiver settings to factory default values.

In addition, the NVRAM keeps information about the receiver file system. Note that after clearing the NVRAM, the receiver's SAT LED will flash yellow for a few seconds indicating that the receiver is scanning and checking the file system.

Using TriPad to Clear NVRAM

- Press the power button to turn off the receiver.
- Press and hold the FN button.
- Press and hold the power button for about 4 to 8 seconds. Release the power button while continuing to hold the FN button.
- Wait until the four LEDs blink yellow.
- Release the FN button.

Checking Firmware Version

Use NetView&Modem to check the firmware version of your receiver.

- Connect your receiver and computer. Start NetView&Modem. Establish connection between NetView&Modem and receiver.
- Click on the receiver name on the left panel. On the right appears the information about receiver including receiver model, ID, firmware version.

To save this information to the .txt file, click Reports-4Receiver info on the right panel.

Loading New Firmware

Base and Rover receivers must be loaded with the same firmware version. Use the latest firmware version, available for download from the JAVAD GNSS website, to ensure your receiver has the most recent updates.

To load new firmware use NetView&Modem.

- Connect your receiver and computer. Start NetView&Modem. Establish connection between NetView&Modem and receiver.
- Click on the receiver name on the left panel. On the right appears the information about receiver.
- Click Action ▸ Update firmware.
- Select the file with the mew firmware and click Open.

Troubleshooting

This chapter will help you diagnose and solve some common problems you may encounter with your receiver.

Warning: Do not attempt to repair equipment yourself. Doing so will void your warranty and may damage the hardware.

Check This First!

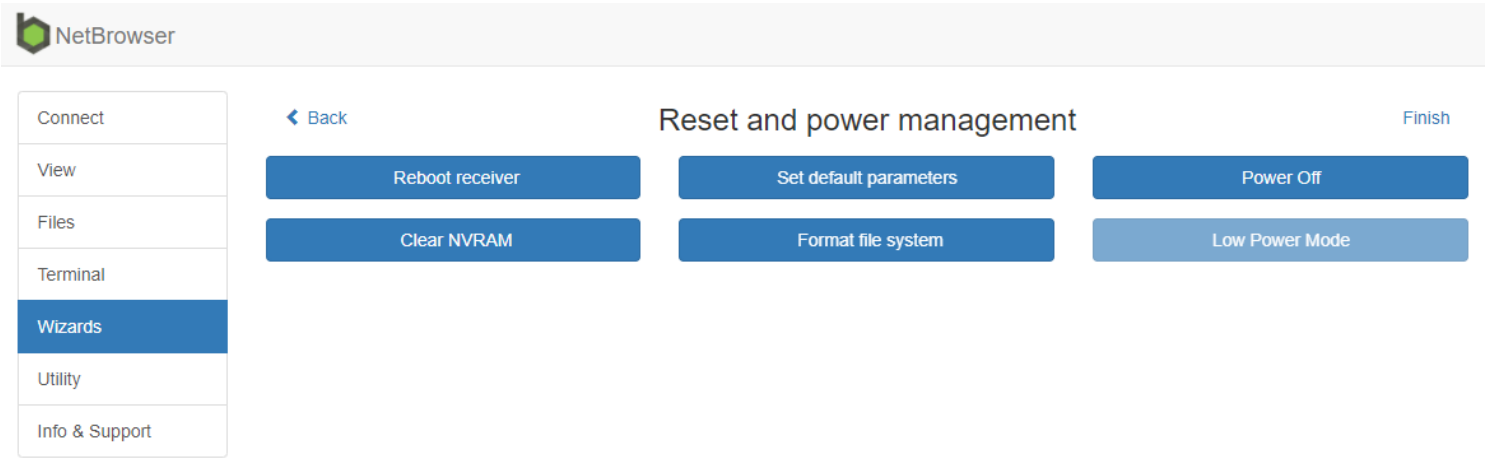
Before contacting JAVAD GNSS support, check the following:

- Check all external receiver connections carefully to ensure correct and secure connections. Double check for worn or defective cables.
- Check all power sources.
- Check that the most current software is downloaded onto the computer and that the most current firmware is loaded into the receiver. Check the JAVAD GNSS website for the latest updates.

Then, try the following:

- Reset the receiver
- Clear the NVRAM.

If the problem persists, see the following sections for other solutions.



Reset and power management

Receiver Problems

The following are some of the most commonly encountered receiver problems.

Cable specific problems

- The cable is not properly plugged in.
- Check that the cable connector is attached to the correct receiver port.
- Unplug the cable, then securely and properly reconnect it to the receiver.
- The cable is damaged.
- Use an undamaged cable. Contact your Dealer to replace the cable.

Generic problems

The receiver port used for connection is not in Command mode.

- Connect your receiver and a computer using a free port and start NetView&Modem.
- Change the Input for the port used for connection to "Command".
- The receiver does not lock on to satellites for a long period of time.
- See "Managing Receiver Options" for details on how to check current options.
- Order a new OAF with the desired options activated to enable or extend validity of the corresponding receiver options. Contact your dealer or visit the JAVAD GNSS website for details.

Note: Refer to the NetView&Modem Software Manual for a detailed description of options.

- The receiver tracks too few satellites
- The elevation mask value is too high (above 15 degrees).
- Lower the elevation mask. See "TriPad Configuration" for information on setting the elevation mask.
- The measuring is conducted near obstructions (tree canopy, tall buildings, etc.).
- Check that the Multipath Reduction boxes have been enabled.
- Connect your receiver and a computer using a free port and start NetView&Modem.
- Click enable Multipath reduction and click Apply.
- Move to an area free of obstructions, if applicable.
- The receiver cannot obtain Code Differential and/or RTK solutions.
- Incorrect Base coordinates entered

Specify the correct coordinates for the Base station using NetView&Modem or another suitable field data collection software.

- The receiver is not configured as a Base or Rover.
- If the receiver should function as a Base, ensure it has the proper configuration.
- If the receiver should function as a Rover, ensure it has the proper configuration.
- The corresponding receiver options may be disabled or expired.
- See "Managing Receiver Options" for details on how to check current options.
- Order a new OAF with the desired options activated to enable or extend validity of the corresponding receiver options. Contact your dealer or visit the JAVAD GNSS website for details.
- Refer to the NetView&Modem Software Manual for a detailed description of options.
- There are not enough common satellites. In order to obtain a fixed solution, the Base and Rover should track at least five common satellites.
- Ensure that both the Rover and Base receivers use the same, and updated, almanac.
- Check the elevation masks of the Rover and Base receivers; they should be the same. See "TriPad Configuration" for information on setting the elevation mask.
- A discrepancy exists between the differential standards used at the Base and Rover receivers. Ensure the Base and Rover receivers use the same corrections input/output format:
- Poor satellite geometry (PDOP/GDOP values are too high).
- Conduct your measuring when PDOP values are low.
- The elevation mask is above 15 degrees.
- Lower the elevation mask.
- The transmitting and/or receiving antenna may be improperly connected.
- Check that the radio modem's antenna is securely and properly connected to the antenna connector.
- Check that the radio modem's antenna is undamaged. If damaged, contact your JAVAD GNSS dealer to replace the antenna.
- The specified baud rate is incompatible with the baud rates the receiver supports.
- The baud rate is the rate at which the receiver transmits differential messages to the receiver and vice versa. Change the baud rate to that which your receiver supports.
- The Base and Rover receivers use different radio link

parameters.
- Configure the Base and Rover radio receivers according to the procedures listed in the applicable section.
- The distance between the Base and Rover is too far.
- Close the distance between the Base and Rover.
- Use repeaters to increase radio coverage.
- There may be a source of radio interference that disrupts radio communications.
- Change the RF channel (if possible).
- Use a spectrum analyzer to detect the radio characteristics of the interfering signal and change your system's configuration accordingly.
- Remove the source of jamming signal or relocate your radio antennas (if possible).
- The receiver does not start data logging
- The memory option is disabled or expired.
- Check that the memory option is enabled. For details, see "Checking an OAF" .
- The receiver's memory has no free space.
- Download and/or delete data files to free up space for new files. Use the AFRM feature.

Technical Support

If the troubleshooting hints and tips in this Operator's Manual fail to remedy the problem, contact JAVAD GNSS Support.

Before contacting JAVAD GNSS Customer support about any problems with the receiver, see "Check This First!" for some solutions that may fix the issue.

To contact JAVAD GNSS Customer Support use the QUESTIONS button available on the www.javad.com.

For quick and effective support, provide a detailed description of the problem.

Safety Warnings

- Read these instructions.
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Clean only with a damp cloth.
- Do not block any of the ventilation openings. Install in accordance with the manufacturer's instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
- Only use attachments/accessories specified by the manufacturer.
- Use only with a pole, cart, stand, or tripod, specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, or has been dropped.
- Apparatus shall not be exposed to dripping or splashing and no objects filled with liquids, shall be placed on the apparatus.

Storage Precautions

Always clean the instrument after use. Wipe off dust with a cleaning brush, then wipe off dirt with a soft cloth.

Store in a location with a temperature of from -40° to +85°C, and no exposure to direct sunlight.

Use a clean cloth, moistened with a neutral detergent or water, to clean the receiver. Never use an abrasive cleaner, ether, thinner benzene, or other solvents.

Always make sure the instrument is completely dry before storing. Dry the receiver with a soft, clean cloth.

General Warnings

JAVAD GNSS receivers are designed for measuring and measuring related uses (that is, measuring coordinates, distances, angles and depths, and recording such measurements). This product should never be used:

- Without the user thoroughly understanding operator's manual.
- After disabling safety systems or altering the product.
- With unauthorized accessories.
- Without proper safeguards at the measuring site.
- Contrary to applicable laws, rules, and regulations.

Warning: The DELTA-3S receiver should never be used in dangerous environments. Use in rain or snow for a limited period is permitted.

A single external power supply with 5 pin ODU connector or SAE connector is necessary to operate DELTA-3S. If external power supply has only SAE connector, Receiver-to-SAE power cable shall be used. The external power supply needs to be Listed for US and Certified for EU countries, it needs also to be a Limited Power Source and have an output rated for 4,5...35 V DC, not less than 2A. This may not be the same range as other JAVAD GNSS products with which you are familiar.

Warning: To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

Warning: To avoid the introduction of hazards when operating and installing, before connecting of the equipment to the supply, make sure that the supply meets local and national safety ordinances and matches the equipment's voltage and current requirements.

Warning: Never attempt any maintenance or cleaning of the supply while plugged in. Always remove supply from AC power before attempting service or cleaning.

Warning:

Warning: If the voltage supplied is below the minimum specification, the receiver will suspend operation. If the voltage supplied is above the maximum specification, the receiver may be permanently damaged, voiding your warranty.

Warning: Make sure cords are located so that will not be stepped on, tripped over, or otherwise subjected to damage or stress. Do not operate equipment with a damaged cord or plug – replace immediately. To reduce the risk of damage to the equipment, pull by the plug body rather than the output cord when disconnecting the equipment.

Warning: Do not operate the supply if it has received a sharp blow, been dropped, or otherwise damaged. Do not disassemble the supply.

Warning: If you have difficulty inserting the plug, turn it over and reinsert it. If the unit will not the used for a long time, disconnect the plug from the outlet.

Warning: Before connecting the external power source and the receiver, make sure that the power source matches the receiver's voltage and current requirements.

JAVAD GNSS recommends certified External power supply (p/n 22-570101-01/02) available to order on JAVAD GNSS accessories page. It is rated for indoor use.

Before plugging the power cord into an AC outlet, make sure that all the connections have been made.

Usage Warnings

If this product has been dropped, altered, transported or shipped without proper packaging, or otherwise treated without care, erroneous measurements may occur.

Do not connect or disconnect equipment with wet hands, you are at risk of electric shock if you do!

The owner should periodically test this product to ensure it provides accurate measurements. Inform JAVAD GNSS immediately if this product does not function properly.

Only allow authorized JAVAD GNSS warranty service centers to service or repair this product.

Warranty Terms

JAVAD GNSS electronic equipment are guaranteed against defective material and workmanship under normal use and application consistent with this Manual. The equipment is guaranteed for the period indicated, on the warranty card accompanying the product, starting from the date that the product is sold to the original purchaser by JAVAD GNSS' Authorized Dealers.

During the warranty period, JAVAD GNSS will, at its option, repair or replace this product at no additional charge. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. This limited warranty does not include service to repair damage to the product resulting from an accident, disaster, misuses, abuse or modification of the product.

Warranty service may be obtained from an authorized JAVAD GNSS warranty service dealer. If this product is delivered by mail, purchaser agrees to insure the product or assume the risk of loss or damage in transit, to prepay shipping charges to the warranty service location and to use the original shipping container or equivalent. A letter should accompany the package furnishing a description of the problem and/or defect.

The purchaser's sole remedy shall be replacement as provided above. In no event shall JAVAD GNSS be liable for any damages or other claim including any claim for lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, the product.

900 Rock Avenue,
San Jose, CA 95131, USA
Phone: +1(408)770-1770
sales@javad.com

www.javad.com