DELTA

GNSS Receiver

Operator's Manual

Version 2.3

Last Revised June 18, 2013

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PREFACE

Thank you for purchasing this product. The materials available in this Manual (the “Manual”) have been prepared by JAVAD GNSS, Inc. (“JAVAD GNSS”) for owners of JAVAD GNSS products. It is designed to assist owners with the use of the DELTA receiver and its use is subject to these terms and conditions (the “Terms and Conditions”).

Note: Please read these Terms and Conditions carefully.

Terms and Conditions

USE – JAVAD GNSS receivers are designed to be used by a professional. The user is expected to have a good knowledge and understanding of the user and safety instructions before operating, inspecting or adjusting. Always wear the required protectors (safety shoes, helmet, etc.) when operating the receiver.

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SAFETY – Improper use of the DELTA receiver can lead to injury to persons or property and/or malfunction of the product. The DELTA receiver should only be repaired by authorized JAVAD GNSS warranty service centers. Users should review and heed the safety warnings in Appendix B on page 49.

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WEEE Directive

The following information is for EU-member states only:

The use of the symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this

product. For more detailed information about the take-back and recycling of this product, please contact your supplier where you purchased the product or consult.

Declaration of Conformity

Cesky [Czech]	JAVAD GNSS tímto prohlašuje, že tento DELTA Receiver je ve shodì se základními požadavky a dalšími pøíslušnými ustanoveními smìrnice1999/5/ES.
Dansk [Danish]	Undertegnede JAVAD GNSS erklærer herved, at følgende udstyr DELTA Receiver overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
Deutsch German]	Hiermit erklärt JAVAD GNSS, dass sich das Gerät DELTA Receiver in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 1999/5/EG befindet.
Eesti [Estonian]	Käesolevaga kinnitab JAVAD GNSS seadme DELTA Receiver vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
English	Hereby, JAVAD GNSS, declares that this DELTA Receiver is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Español [Spanish]	Por medio de la presente JAVAD GNSS declara que el DELTA Receiver cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
Francais [French]	Par la présente JAVAD GNSS déclare que l'appareil DELTA Receiver est conforme auxexigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.
Italiano [Italian]	Con la presente JAVAD GNSS dichiara che questo DELTA Receiver è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Latviski [Latvian]	Ar šo JAVAD GNSS deklare, ka DELTA Receiver atbilst Direktivas 1999/5/EK butiskajam prasibam un citiem ar to saistitajiem noteikumiem.
Lietuviu [Lithuanian]	ŠiuoJAVAD GNSS deklaruoja, kad šis DELTA Receiver atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.
Nederlands [Dutch]	Hierbij verklaart JAVAD GNSS dat het toestel DELTA Receiver in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.
Malti [Maltese]	Hawnhekk, JAVAD GNSS, jiddikjara li dan DELTA Receiver jikkonforma mal-.ti.ijiet essenzjali u ma provvedimenti o.rajn relevanti li hemm fid-Dirrettiva 1999/5/EC.
Magyar [Hungarian]	Alulírott, JAVAD GNSS nyilatkozom, hogy a DELTA Receiver megfelel a vonatkozó alapvetõ követelményeknek és az 1999/5/EC irányelv egyéb elõírásainak.
Polski [Polish]	Niniejszym JAVAD GNSS o?wiadcza, ?e DELTA Receiver jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 1999/5/EC.

Portugues [Portuguese]	JAVAD GNSS declara que este DELTA Receiver está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.
Slovensko [Slovenian]	JAVAD GNSS izjavlja, da je ta DELTA Receiver v skladu z bistvenimi zahtevami in ostalimi relevantnimi doloèili direktive 1999/5/ES.
Slovensky [Slovak]	JAVAD GNSS týmto vyhlasuje, že DELTA Receiver spåòa základné požiadavky a všetky príslušné ustanovenia Smernice 1999/5/ES.
Suomi [Finnish]	JAVAD GNSS vakuuttaa täten että DELTA Receiver tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Svenska [Swedish]	Härmed intygar JAVAD GNSS att denna DELTA Receiver står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.
Íslenska [Icelandic]	Hér með lýsir JAVAD GNSS yfir því að DELTA Receiver er í samræmi við grunnkröfur og aðrar kröfur, sem gerðar eru í tilskipun 1999/5/EC.
Norsk [Norwegian]	JAVAD GNSS erklærer herved at utstyret DELTA Receiver er i samsvar med de grunnleggende krav og øvrige relevante krav i direktiv 1999/5/EF.

Manual Conventions

This manual uses the following conventions:

Example	Description
File ▸ *Exit*	Click the *File* menu and click *Exit*
TriPad	This format represents titles of dialog windows/boxes, names of menu options, identifies program interface objects, such as checkboxes, edit boxes, radio buttons, etc.
`Temp`	This format is used to enter various string information (e.g., file and directory names) as well as operator commands.

Note: Supplementary information that can have an affect on system operation, system performance, measurements, or personal safety.

Caution: *Notification that an action has the potential to adversely affect system operation, system performance, data integrity, or personal health.*

Warning: *Notification that an action will result in system damage, loss of data, loss of warranty, or personal injury.*

Danger: Under no circumstances should this action be performed.

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 QUESTIONS system at the JAVAD GNSS World Wide Web site: www.javad.com

Return Material Authorization

Initially, the customer contacts support to report a problem. Please refer to support: Question section on www.javad.com. If support determines the problem cannot be resolved over e-mail/internet, it will authorize the return of the unit for repair or replacement, depending on the nature of the problem.

Description and Operation

1.1. Principles of Operation

Delta receivers' family is based on our TRIUMPH Technology implemented in our TRIUMPH Chip and is designed to meet all the needs of today's high precision GNSS satellite receiver market.

For the first time in the GNSS history we offer up to 100 Hz RTK. 216 channels of single or dual frequency GPS, Galileo and GLONASS in a small attractive, sturdy, and watertight box. Delta contains either TRE-G2T, TRE-G3T, or TRE-G3TAJT, With the ability to process GPS, Galileo and GLONASS, QZSS, Compass signals as well as SBAS, the Delta receivers work with optimum signal available creating the most reliable results, saving your time and money.

DeltaD contains Duo-G2, Duo-G2D,or Duo-G3D, and DeltaQ contains Quattro-G3D board. DeltaD is a powerful and reliable receiver for high-precision navigation systems to be used in various applications, such as machine and traffic control, precision agriculture, etc. The dual-frequency code and carrier phase data from two antennas are processed to determine the heading angle and the RTK positions of the two antennas up to 50 times per second.

DeltaQ is a powerful GNSS receiver disigned for high accuracy applications with requirements of the three-dimentional position and attitude, linear and angular velocity determination of the four-antenna system using the dual frequency code and carrier data from four antenna

Delta 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.

Figure 1-1. DELTA Receiver

DELTA can receive and processes multiple signal types (including GPS C/A, P1, L2C (L+M), P2, L5 (I+Q), Galileo E1 (B+C), E5A (I+Q), E5B (I+Q), AltBOC, GLONASS C/A, L2C, P1, P2, L3 (I+Q), QZSS C/A, L1 (I+Q), SAIF, L2C (L+M), L5 (I+Q), Compass B1, B2, 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 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 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.

1.2. Getting Acquainted

DELTA is a 216-channel GNSS receiver with an interface for controlling and viewing data logging (TriPad). The DELTA receiver can be equipped according users needs and have different ports on the front and back panels.

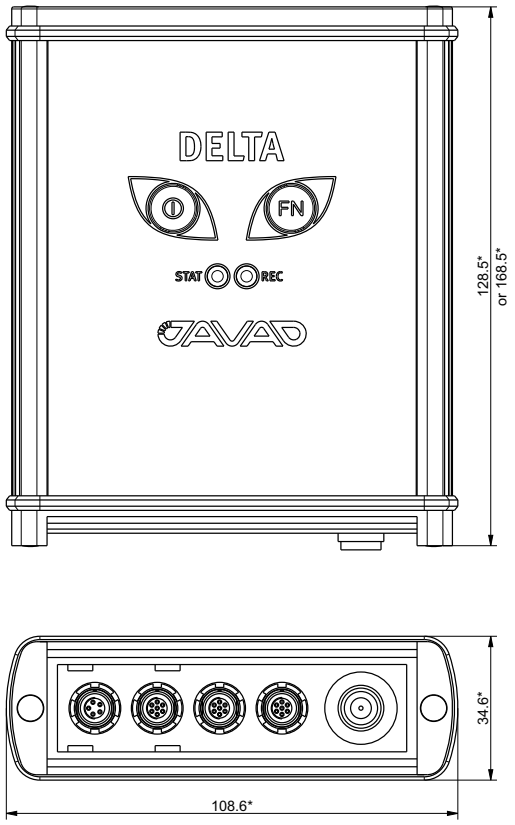


Figure 1-2. DELTA dimensions in mm

1.2.1. TriPad

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

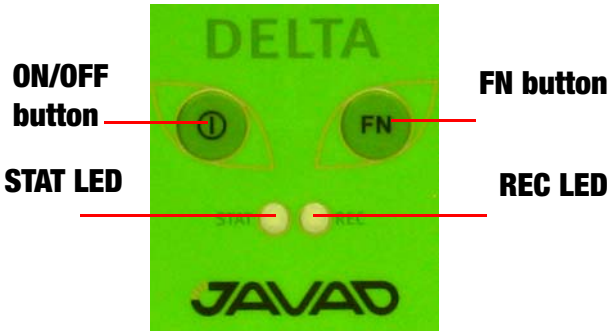


Figure 1-3. DELTA TriPad

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

- When the receiver is on and no satellites are tracked, the STAT LED will blink red.
- When satellites are tracked, the STAT LED will produce one blink for each tracked satellite (green for GPS, orange for GLONASS).

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

Pressing the *FN button* for less than one second switches the receiver between different information modes (normal and extended information), or between static and dynamic post-processing modes, depending on the receiver's configuration.

- During the first second of pressing the FN button, the REC LED is orange.
- Pressing the *FN button* for more than one and less than five seconds will start/stop data recording.
- During data recording the REC LED is green or orange.
- If the *REC LED* is red, the receiver has run out of memory, has a hardware problem, or contains an improper OAF (see "Option Authorization File (OAF)" on page 16 for more information on OAFs).
- The *REC LED* blinks green or orange each time data is written to the internal receiver's memory.
- Each time you turn off or on data recording, either a new file opens or data appends to a particular file. See "Always Append to the File parameter" on page 36 and "Files Creation Mode parameter" on page 36 for information on setting this function.
- Pressing the FN button for more than five and less than eight seconds will turn the baud rate of serial port A to 9600. After about five seconds of pressing the FN button, the REC LED becomes red. Release the FN button while the REC LED is red (during the next three seconds).
- Pressing the FN button for more than eight seconds has no impact.

After loading new firmware or clearing the receiver's NVRAM, the receiver checks its internal file system. During this operation, the REC LED flashes orange, and the file system is not accessible for CDU (control display unit) applications or for data recording. This operation may require from fractions of a second to several minutes, depending on the circumstances and the amount of internal memory.

1.2.2. Data and Power Ports

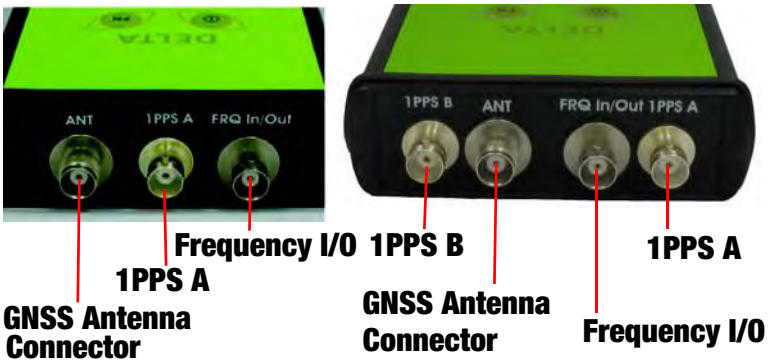
The DELTA receiver can be equipped according users needs and have different ports on the front and back panels.

Below are presented some examples of possible configurations (Figure 1-4):

Figure 1-4. DELTA Ports

- *Power* – used to connect the receiver to an external power source. This port can also be used to charge the batteries.
- *Serial* – used for communication between the receiver and an external device.
- *Ethernet* - used to connect the receiver to local network.
- *USB* –used for high-speed data transfer and communication between the receiver and an external device.

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



- 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)

1.2.3. Cables

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

Receiver-to-computer RS232 serial cable – connects the receiver's serial port and an external device (hand-held controller or computer) p/n 14-578103-01	
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	
SAE-to-SAE cable extension – connects SAE connectors over longer distances p/n 14-578102-01	

1.3. 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 receiver according to particular needs, thus only purchasing those options needed. Typically, all DELTA 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. The OAF enables the following kinds of functions. For a complete list of available options and details, visit the JAVAD GNSS website (http://www.javad.com) or consult your dealer.

Optional Features:

- Galileo E1/E5A (G2T, G3T, G3TAJT)
- Galileo E5B (G3T only)
- GLONASS L3 (G3T only)
- QZSS
- Compass B1
- Compass B2 (G3T only)
- WAAS/EGNOS/MSAS (SBAS)
- Update rate 5Hz, 10Hz, 20Hz, 50Hz & 100Hz
- RTK rate 1 Hz, 5Hz, 10Hz, 20Hz, 50Hz & 100Hz
- Data recording up to 2048MB
- Multi-Base Code Differential Rover
- Code Differential Base

- Advanced Multipath Reduction
- Two event markers
- Two 1 PPS timing strobes
- 1 PPS level converter
- CAN port
- External Reference Frequency Input/Output
- External Reference Output Frequency converter
- IEEE1588 Master Clock (G3TAJT only)
- Up to 3 high-speed RS232 serial ports
- High-speed RS232/RS422 serial port
- USB port
- Ethernet
- WAAS/EGNOS/MSAS (SBAS)

1.4. Operation

1.4.1. Software Installation

Use the NetView software program for configuring and maintaining the receiver. This software is available on the JAVAD GNSS website. NetView™ is a comprehensive Windows® software product designed for controlling GNSS receivers developed by JAVAD GNSS.

Note: Refer to the *NetView Software Manual* for full details on installing and using NetView Software.

1. If downloading the program from the website, extract the program files into a folder on your hard drive.
2. Navigate to the location of the NetView program and double-click the Setup.exe icon.
3. Follow the on-screen installation instructions. Click *Install* to continue. Keep the default installation location or select a new location.
4. If desired, create a shortcut on the computer's desktop for quick access to NetView.

1.4.2. Powering the Receiver

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. 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.

CAUTION: *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.*

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

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.*

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.

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

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

1.4.3. Turning On/Off the Receiver

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 saves the last power status and restore it after voltage loss.

1.4.4. Connecting the Receiver and a Computer

JAVAD GNSS NetView software provides an interface for various configuration, monitoring, and management functions for the receiver.

To configure, manage files, or maintain the receiver, connect the receiver and a computer using one of the following methods and start NetView:

- an RS232 cable and a computer/controller
- a USB cable and a computer/controller with the JAVAD GNSS USB driver installed.

Once you have established a connection between the receiver and the computer/controller, you will be able to configure the receiver and its components, send commands to the receiver, download files from the receiver's memory; as well as, upload new firmware, upload an OAF, and upload configuration files to a receiver, using NetView.

Establishing an RS232 Cable Connection

1. Using the RS232 cable, connect the serial port of your computer (usually COM1) to the receiver's serial port A.
2. Press the power buttons on the receiver and computer to turn them on.
3. Start NetView, select SER as type of connection mode, and specify the port the receiver is connected to.

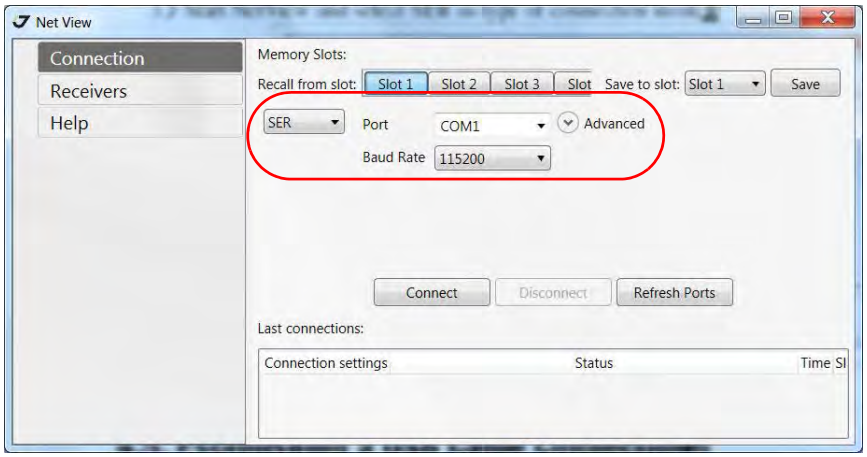


Figure 1-5. NetView - Connection via serial port

1.4.5. Establishing a USB Cable Connection

Make sure the computer has JAVAD GNSS's USB driver installed (available from www.javad.com) before continuing.

1. Using the USB cable, connect the USB port on the receiver to a USB port on the computer.
2. Press the power buttons on the receiver and computer to turn them on.

3. Start NetView and select USB as type of connection mode and select USB port ID from the list.

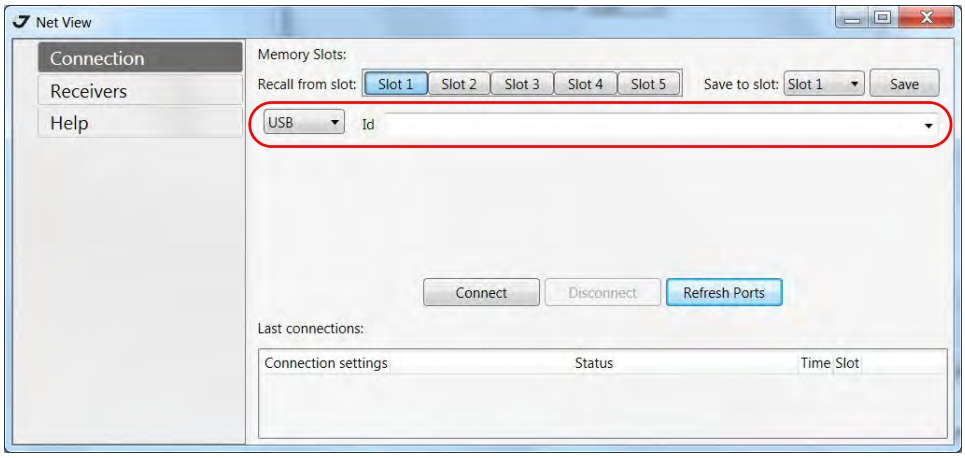


Figure 1-6. NetView - Connection via USB port

1.5. DELTA Configuration

DELTA receiver can be configured according the desired survey type, for RTK or for post-processing:

- A static Base station collects measurement information and saves this data to its internal memory.
- An RTK Base station collects measurement information, determines differential corrections, and transmits them to the RTK Rover(s).
- A static Rover collects observation data from the same satellites during the same time interval as the static Base station.
- An RTK Rover collects measurement information and accepts corrections from the RTK Base station to compute its relative position.
- A Rover acting as a repeater to re-transmit RTK Base station measurements to other rover receivers, extending the range of a GPS system.

Note: Refer to the *NetView Software Manual* for full software description.

1. Connect the receiver and computer as described in “Connecting the Receiver and a Computer” on page 19. Start NetView. Select the connection type and connect the receiver and PC.
2. Click *Receiver* ▸ *Parameters* on the left panel.

Note: Click *Apply* every time after the parameter was changed, otherwise the receiver won’t save the changes. Click *Refresh,* to ensure the changed parameters and new configuration are saved.

3. In the *General* tab set the parameter *Antenna Input* to *External* (Figure 1-7).

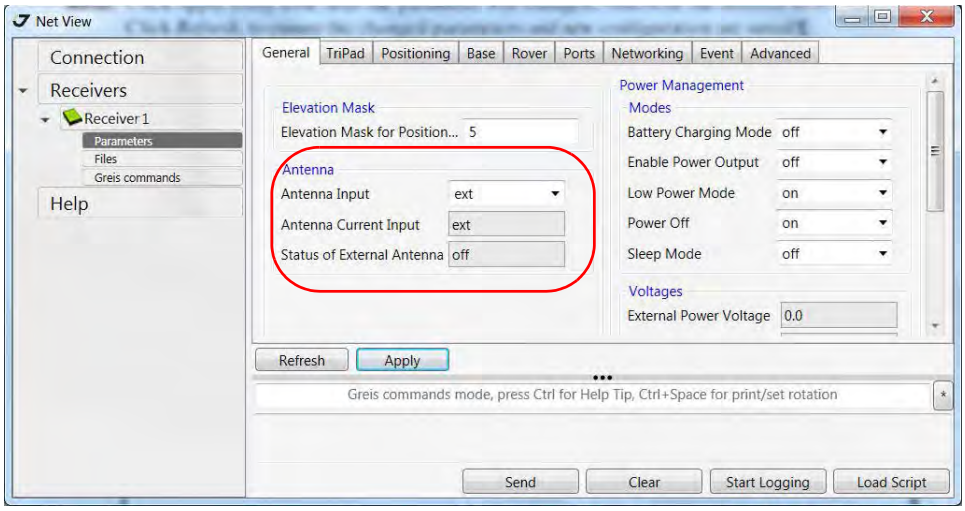


Figure 1-7. General tab

4. Open the *TriPad* tab and set the following parameters (Table 1-1), click *Apply* (Figure 1-8 on page 22).

Table 1-1. TriPad Settings

Parameter	Base	Rover
Implicit Message Output Period	15 seconds	
Elevation mask angle	15 degrees	
File name prefix	Enter a unique ID, such as the last 3 digits of receiver's serial number. By deafault the prefix is `log`	
FN key mode	(starts/stops the data recording when FN button is used)	
	Select *LED blink mode switch* for Static data	Select *Occupation mode switch* (for RTK)
Initial dynamic mode	-	Select *Dynamic* (for trajectory survey)

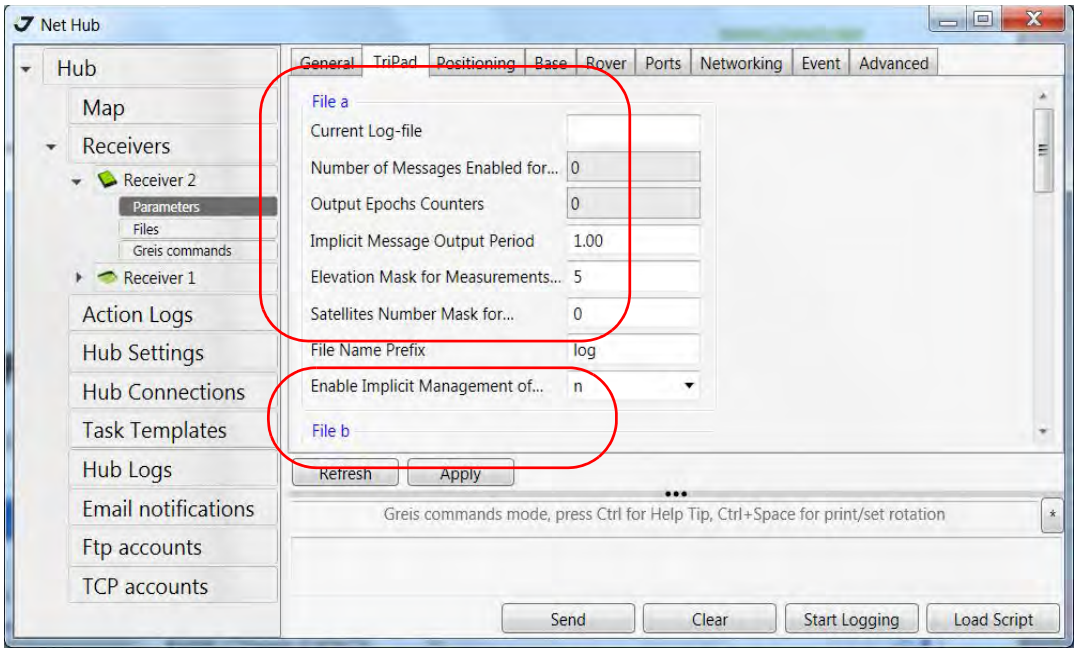


Figure 1-8. TriPad tab settings

5. Open *Positioning* tab and set the Elevation mask to 15 degrees (Figure 1-9).

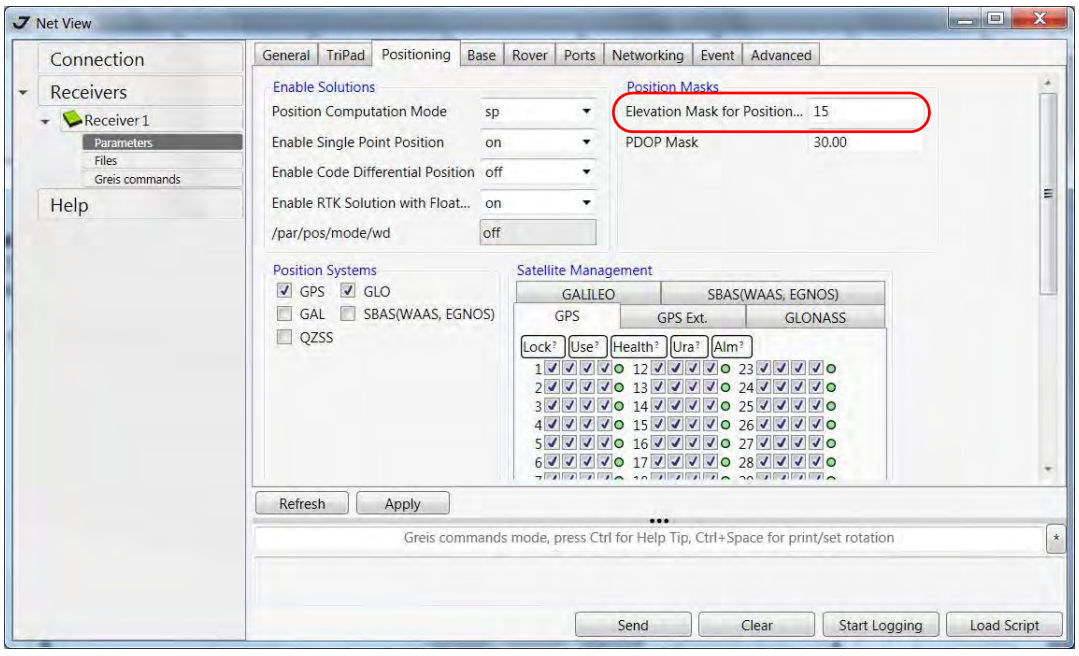


Figure 1-9. Positioning tab - Elevation Mask

6. To set up the base station, open the *Base tab and set the following parameters* (see Figure 1-10 on page 23):

- *Antenna Phase Center Position (APC)* - enter latitude, longitude, and altitude (ellipsoidal height) values of the antenna position. Do one of the following:
- If known, type in the values.
- Click *Get from receiver* to use the current antenna position.

7. Restart your receiver. Open the *Base tab and check coordinates.* Click *Refresh*, to refresh the parameters.

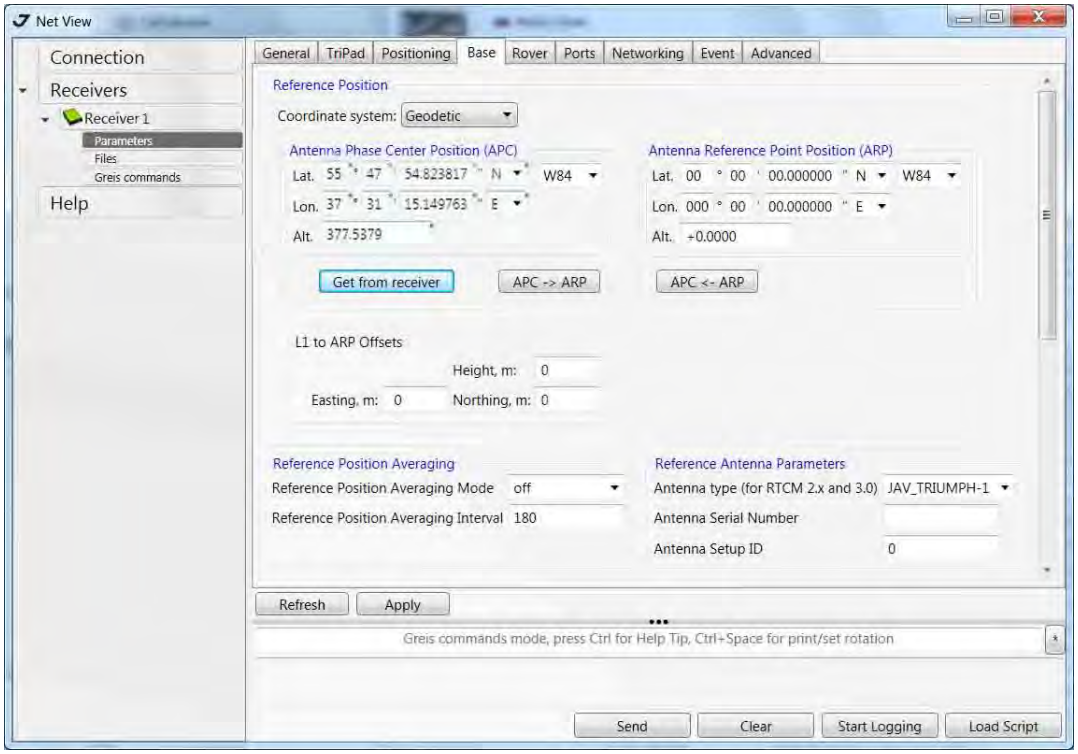


Figure 1-10. Base tab

- To set up the rover, open *Positioning* tab and set the *Position Computation Mode* - this drop-down list box allows selecting the mode of position computation:
    - pd -carrier phase differential (RTK) with fixed ambiguities
    - pf - carrier phase differential (RTK) with float ambiguities
    - cd- code differential (DGPS) mode
    - wd - wide area code differential mode (WDGPS)
    - sp - single point positioning mode1
- *Open the Rover tab and set up the following parameters:*
    - *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..

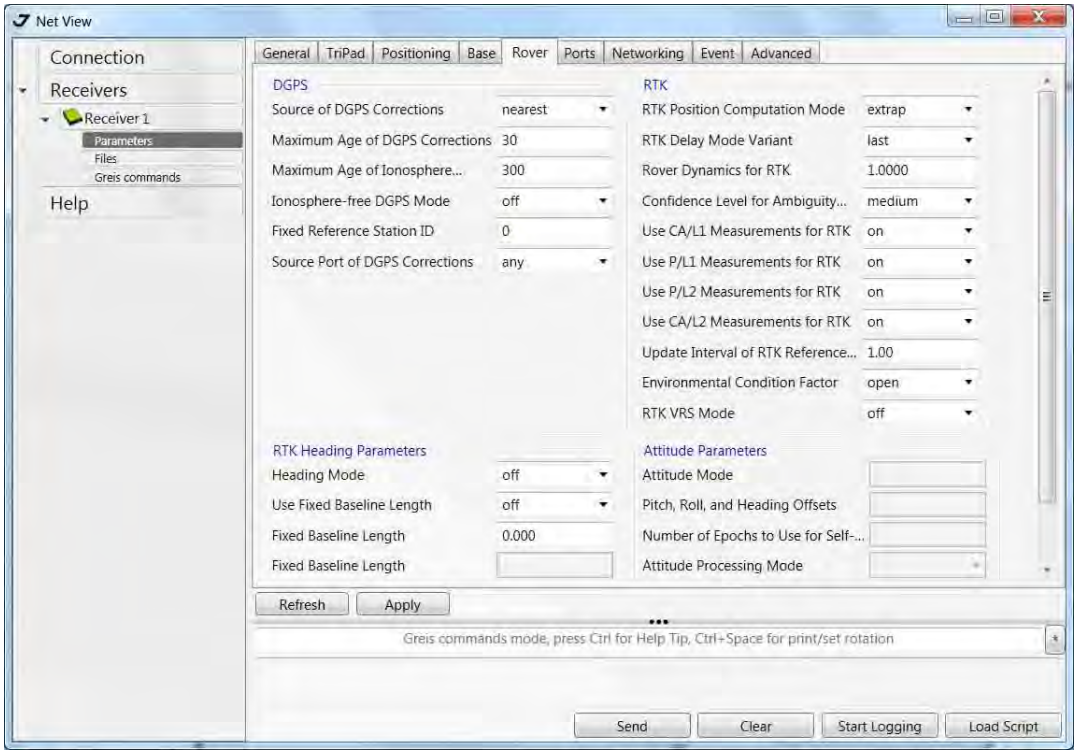


Figure 1-11. Rover tab

8. For RTK survey, open the *Ports* tab and set up the parameters according Table 1-2, then click *Apply* (Figure 1-12 on page 25).

Note: For the survey with the post-processing keep default parameters.

Table 1-2. Settings for Ports tab

Parameter	Base	Rover
Input	-	The same correction type as Base has
Output	Select the correction type.	None
Period (sec)	Set the period of correction output	-
Baud rate	baud rate for the corresponding receiver port	
RTS/CTS	Enable	

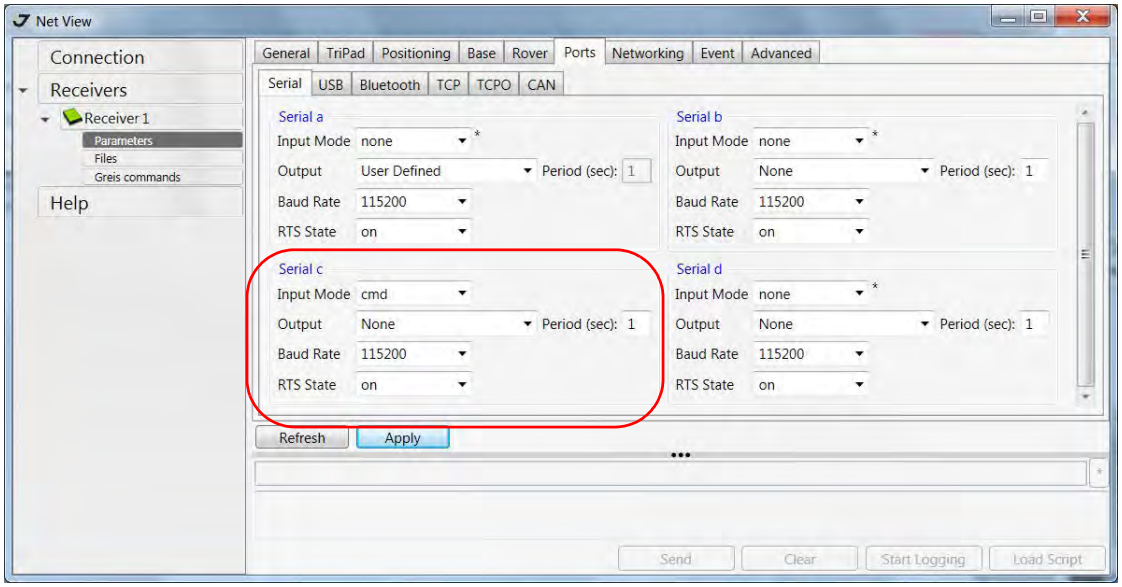


Figure 1-12. Ports tab

9. Open *Advanced tab*, and then *Multipath Reduction* subtab. Activate *Code multipath reduction* (`mpnew`) on base and rover for DGPS mode.
   For RTK mode activate *Carrier multipath reduction* (`mpnew`) as well (Figure 1-13).

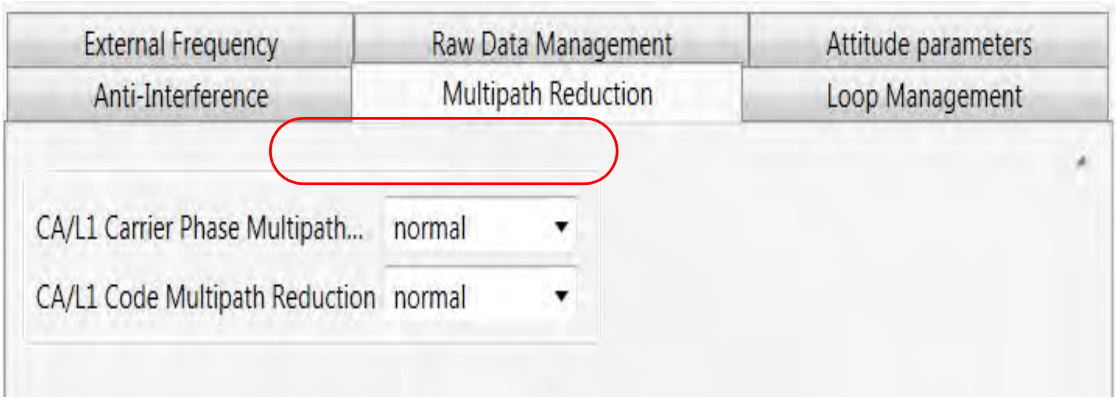


Figure 1-13. Multipath Reduction

10. Click *Apply*, to save the made changes and settings into receiver's memory and close the dialog window. The receiver configuration will be kept in the receiver till you will change them or will clear NVRAM. For detailed description of settings and parameters see *NetView Software Manual*.

1.5.1. TriPad Configuration

The DELTA's simple user interface (TriPad) consists of two buttons (Power and FN) and up to six LEDs that control and display the receiver's operation (Figure 1-14).

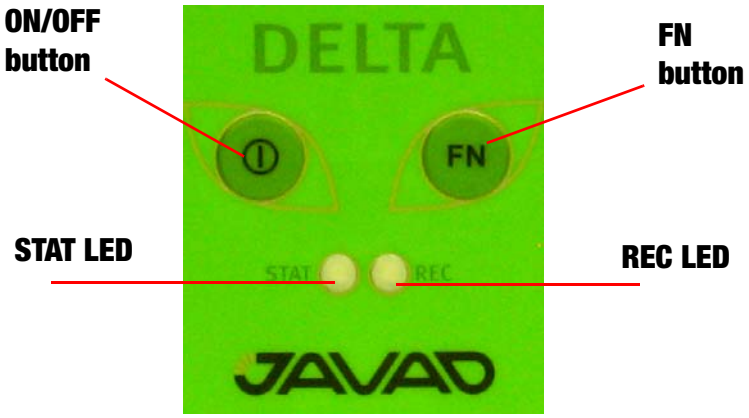


Figure 1-14. TriPad

The TriPad performs numerous functions:

- Turn the receiver on/off.
- Turn data recording on or off (FN button).
- Show the status of satellites being tracked (STAT LED).
- Show data recording status (REC LED).
- Show each time data records to internal memory (REC LED).
- Show the status of post-processing mode (static or dynamic) when performing a Post-Processing Kinematic measuring with the help of FN button (REC LED).

1. Connect the receiver and PC as described in "Connecting the Receiver and a Computer" on page 19. Start NetView. Establish connection with the receiver.
2. Open *TriPad* tab. Set the following parameters and click *Apply*:
    - "File a, File b" on page 26
    - "Function Key" on page 27
    - "Automatic File Rotation Mode (AFRM)" on page 27

File a, File b

In the fields *File a, File b* can be specified current log-file name, message output period, etc.

- *Current log-file* edit box allows the user to specify the prefix of the log file, which will be saved into receiver memory during survey.
- In the *Output Epochs Counter* box the number of outputted epochs is shown.
- In the *Implicit Message Output Period* edit box the output period for the implicit messages can be specified. This parameter specifies the interval of outputting messages into the log-file when data logging is activated with the TriPad or through the AFRM.

- *Elevation Mask for Measurements Output* (the minimum elevation angle for the satellites whose data will be put in the receiver files logged when pressing FN).
- *Satellites Number Mask for Position computation* - Satellites with elevations lower than this mask will be excluded from position computation.
- *File Name Prefix* - this setting specifies what prefix will be added to the names of the receiver files created via MinPad, (i.e., by pressing FN). The prefix can be up to 20 characters long. Default is log.
- Enable *Implicit Management of Specific* - enables/disables the management of *Implicit Message Output Period.*

Function Key

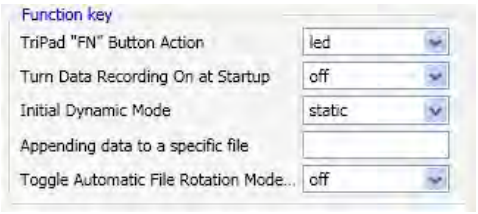


Figure 1-15. Function Key

- *TriPad "FN" Button Action* - This drop-down list box is used to program how the receiver will react to clicking FN (i.e., keeping the button depressed for less than one (1) second). In *led* blink mode switch mode, clicking FN will toggle between the TriPad's standard and extended information modes. In *occupation* mode switch you click FN to get the receiver to insert into the corresponding log file a message indicating that the occupation type has been changed from static to kinematic, or vice versa.
- *Turn Data Recording on at Startup - enables/disables data recording on at startup,*
- *Initial Dynamic Mode* - specifies the starting occupation type descriptor that will be inserted at the beginning of each receiver files logged via the TriPad. You select *static* and *kinematic* to specify that the corresponding log file will start with a static and kinematic occupation, respectively.
- *Appending data to a specific file* - If the new receiver data are to be appended to an existing log file, enter the desired filename in the Always append to the file edit box. The setting can be up to twenty characters long.
- *Toggle Automatic Rotation Mode* - enables/disables Automatic File Rotation Mode.

Automatic File Rotation Mode (AFRM)

Period – specifies the time duration of each of the multiple log files created in AFRM mode.

- *Phase* – specifies the *phase* (i.e., constant time shift) of the multiple log files created in AFRM mode.

Enable Oldest Log-file removal – 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.

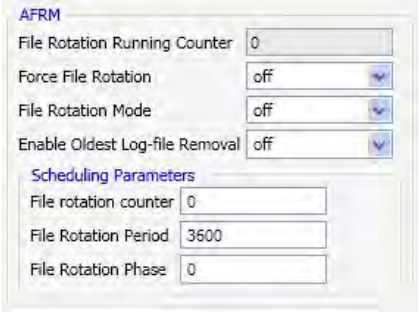


Figure 1-16. AFRM

1.6. Setup and Measuring

1.6.1. External Antenna Setup

The DELTA receiver can be used with an external antenna. Follow the steps below to connect an external antenna to DELTA and measure its offset.

1. Attach the antenna to a tripod or bipod and center it over the point at which data will be collected.
2. Measure the antenna height as described below.
3. Record the antenna height, point name, and start time in the field notes.
4. Attach the flexible RF cable from the external antenna to the antenna connector on the bottom panel of the receiver.

Measure Antenna Height

The location of the antenna relative to the point being measured is very important for both measurings in which the elevation of the points is important and in measurings for horizontal location only. Horizontal measurings 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 measuring 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.

1. Measure the antenna height above the control point or marker, either the slant height or the vertical height.
2. Record the antenna height, point name, and start time in the field notes.

1.6.2. TriPad Operation

The TriPad is the receiver’s minimum interface used to display and control data input and output. See the description of the TriPad on page 26.

To turn on/off the receiver, press the On/Off button (Figure).

- When turning on, press the On/Off button until the TriPad’s LEDs briefly flash.
- When turning off, press the On/Off button until the LEDs go out, then release.

To start/stop logging data, press the FN button for 1–5 seconds (Figure).

- During data recording, the REC LED is green. Use NetView to set the recording time interval.
- The REC LED blinks green each time data is written to the memory.
- If the REC LED is red, the receiver has run out of memory, has a hardware problem, or contains an improper OAF.

Use NetView to enable the desired FN button mode in the receiver, either “LED blink mode switch” for static measurings or “Occupation mode switch” for kinematic measurings.

Each time you turn off or on data recording, either a new file opens or data appends to a particular file.

To toggle between post-processing modes, press the FN button for less than 1 second when “Occupation mode switch” has been enabled using NetView.

To change the information mode of the receiver, press the FN button for less than 1 second when “LED blink mode switch” has been enabled using NetView.

To change the baud rate of the receiver’s serial port, press the FN button for 5–8 seconds. This is useful if the data collector does not support the rate that the receiver port is set to. After about five seconds, the REC LED becomes red. Release the FN button during the next three seconds.

1.6.3. Static Measuring for Base Stations

Static measuring is the classic measuring method, well suited for all kinds of baselines (short, medium, long). At least two receiver antennas, plumbed over measuring 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 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

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

1.6.4. Kinematic (Stop & Go) Measuring for Rover Stations

In a kinematic, stop and go measuring, the stationary receiver (Base station) is set up at a known point such as a measuring 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 measuring 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.

1.6.5. Real Time Kinematic Measuring

With RTK measuring, as with kinematic measuring 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 measurings, RTK measurings 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).er transmits this information via radio 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 measuring 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).

1.7. 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.

1.7.1. 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 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. NetView provides a File Manager to download files to your computer and delete files from the receiver DELTA.

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 19 for this procedure. Start NetView. Establish connection between NetView and receiver.
2. Click *File* on the left panel. On the right panel appears the list of files, saved in receiver’s memory. Select the file(s) to download (Figure 1-17).

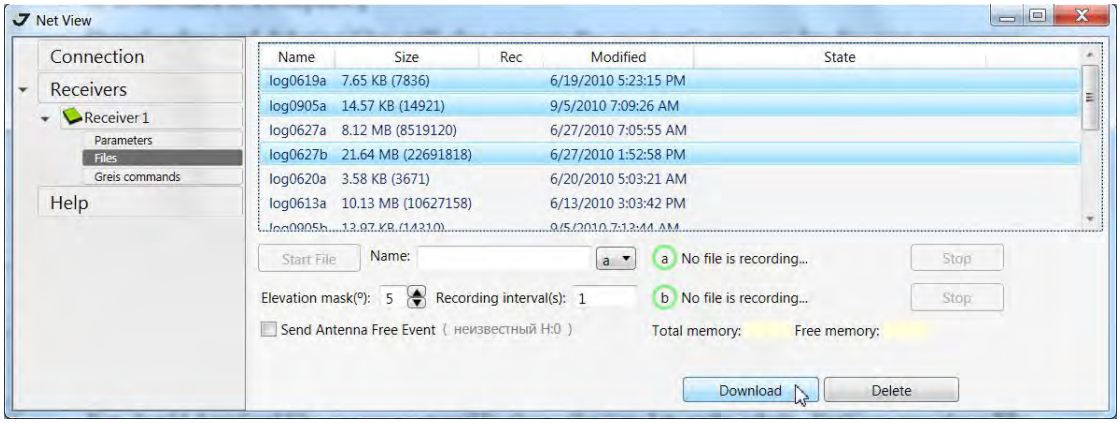


Figure 1-17. Download Files

Note: To select multiple files, hold down the shift key and click on nonsequential files to select several files at once; or hold down the Ctrl key and click on individual files.

3. Click the *Download* button. During the download, status indicators display each file.

1.7.2. Deleting Files

Use the following steps to delete files from your receiver.

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 19 for this procedure. Start NetView. Establish connection between NetView and receiver.
2. Click *File* on the left panel. On the right panel appears the list of files, saved in receiver’s memory. Select the file(s) to delete

Note: To select multiple files, hold down the shift key and click on nonsequential files to select several files at once; or hold down the Ctrl key and click on individual files.

3. Click *Delete*. Click *Yes* at the delete files confirmation dialog box. NetView deletes the selected files.

1.7.3. Managing Receiver Options

Checking an OAF

Note: 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 NetView.

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 19 for this procedure. Start NetView. Establish connection between NetView and receiver.
2. Click on the receiver name on the left panel. On the right open *Options* tab.
   - *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. Please have your receiver ID number available.

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 19 for this procedure. Start NetView. Establish connection between NetView and receiver.
2. Click on the receiver name on the left panel. On the right open *Options* tab.
3. To upload a new options file, click on *Upload* button, and select the options file. *Refresh* – updates the window.
4. Navigate to the location of the new Option Authorization File. OAFs have .jpo extension and are unique to each receiver.

1.7.4. 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 DELTA 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’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

It is possible to clear NVRAM using only TriPad. To do that:

1. Turn the receiver OFF.
2. Press and hold FN button.
3. Press and release PWR button to turn the receiver ON.
4. Wait until both LEDs will light green.
5. Wait around five seconds, until both LEDs will blink orange.
6. Release FN button.

Note that LEDs will blink orange only during next five seconds, and to clear NVRAM it is essential to release FN button when they blink yellow.

Using NetView to Clear NVRAM

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 19 for this procedure. Start NetView. Establish connection between NetView and receiver.
2. Click on the receiver name on the left panel. On the right click on *Actions* ▸ *Clear NVRAM*.
3. Confirm NVRAM clearing.

1.7.5. Checking Firmware Version

Use NetView to check the firmware version of your receiver.

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 19 for this procedure. Start NetView. Establish connection between NetView and receiver.
2. Click on the receiver name on the left panel. On the right appears the information about receiver including receiver model, ID, firmware version.
3. To save this information to the .txt file, click *Reports* ▸ *Receiver info* on the right panel.

1.7.6. 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.

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 19 for this procedure. Start NetView. Establish connection between NetView and receiver.
2. Click on the receiver name on the left panel. On the right appears the information about receiver.
3. Click *Action* ▸ *Update firmware*.
4. Select the file with the mew firmware and click *Open*.

Chapter 2

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.*

2.1. 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 using NetView: *Receiver name (on the left panel)* ▸ *Actions* ▸ *Reset.*
- Restore default settings using NetView *Receiver name (on the left panel)* ▸ *Actions* ▸ *Initial parameters.*
- Clear the NVRAM (see “Clearing the NVRAM” on page 33).

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

2.2. 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 (see “Connecting the Receiver and a Computer” on page 19) and start NetView.
    - 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” on page 33 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 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” on page 26 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 (see “Connecting the Receiver and a Computer” on page 19) and start NetView.
    - 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 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” on page 33 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 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” on page 26 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:

    - Connect your receiver and a computer and start NetView. See “Connecting the Receiver and a Computer” on page 19.
    - Click and the *Ports* tab. Use the same input/output format for both receivers.
- 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” on page 33.
- The receiver’s memory has no free space.
    - Download and/or delete data files to free up space for new files (see “Connecting the Receiver and a Computer” on page 19 and “Deleting Files” on page 32).
    - Use the AFRM feature. See“TriPad Configuration” on page 26.

2.3. 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!" on page 35 for some solutions that may fix the issue.

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

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

SPECIFICATIONS

This JAVAD GNSS product is a 216-channel GNSS receiver with a rugged magnesium housing complete with TriPad and cable connectors.

Note: Performance specifications assume a minimum of 6 GPS satellites above 15 degrees in elevation and adherence to the procedures recommended in this manual.

Note: In areas of high multipath, during periods of large PDOP, and during periods of increased ionospheric activity, performance may degrade.

Note: Use robust checking procedures in areas of extreme multipath or under dense foliage.

A.1. Receiver Specifications

The following sections provide specifications for the receiver and its internal components.

A.1.1. General Details

Table below lists the receiver's general specifications.

Table A-1. Receiver General Specifications

Physical	
Enclosure	Aluminum extrusion, waterproof IP66
Color	JAVAD GNSS Green and Gray
Dimensions, mm	109 x 35 x 141/max 160 with connectors
Weight, g DELTA-G2T DELTA-G3T, G3TAJT DELTAD DELTAQ	 394 401 518 595
GNSS Antenna	External
Buttons	Two buttons: Power – On/Off Function (FN) – start/stop data logging.
LEDs	Two LEDs: STAT – satellite and receiver status REC – record and data status
Environment	
Operating temperature	-40° C to +80° C

Storage temperature	-45° C to +85° C
Humidity	95% non-condensing
External power	
External power input	1 port
Input voltage DELTA-G2T, G3T, G3TAJT, DELTAD-G2, G2D DELTAD-G3D, DELTAQ	 +4.5 to +35 V DC +6.0 to +35 V DC
I/O	
Communication Ports	- 3x serial RS232 up to 460.8 kbps - serial RS422/RS232 up to 460.8 kbps - High speed USB 2.0 device port (480 Mbps) - Full-duplex 10BASE-T/100BASE-TX Ethernet port
Connectors	- External GNSS Antenna - External power (PWR) - CAN (optional) - up to two 1PPS output (optional) - up to two Event Marker input (optional) - IEEE1588 Master Clock (Delta-G3TAJT)
TriPad	- Two LEDs (STAT, REC) - Two function buttons (ON/OFF, FN)
Data Features	
Up to 100 Hz update rate for real time position and raw data (code and carrier)[1] 10 cm code phase and 1 mm carrier phase precision Hardware Viterbi decoder RTCM SC104 versions 2.x and 3.x Input/Output NMEA 0183 versions 2.x and 3.0 Output Multi-Base Code Differential Rover Code Differential Base Geoid and Magnetic Variation models RAIM Different DATUMs support Output of grid coordinates	
Technology	
Low signal tracking Advanced Multipath mitigation KFK WAAS/EGNOS (SBAS) Adjustable PLL and DLL parameters In-Band Interference Rejection[2] (IBIR) (DELTAS-G3TAJ only)	
NMEA	
NMEA version	Ver. 2.1, 2.2, 2.3, 3.0
Messages	GGA, GLL, GNS, GRS, GSA, GST, GSV, HDT, RMC, VTG, ZDA, ROT, GMP
Output interval	1, 5, 10, 20, 50, 100 Hz optional
DGPS	
Correction format	RTCM SC104 Ver 2.1, 2.2, 2.3, and 3.0
RTCM 2.x message type	1, 3, 9, 31, 32, 34; user selectable
RTCM 3.0 message type	1003, 1004, 1005, 1006, 1007, 1008, 1011, 1012, 1019, 1020; user selectable
Process interval	1, 5, 10, 20, 50, 100 Hz optional

Output interval for RTCM correction data	1, 5, 10, 20, 50, 100 Hz optional
Elevation mask	0 to 90 deg (independent of data logging)
Multi-base DGPS	Differential correction select mode: Nearest, Mix, Best (optional)
RTK	
Correction format	RTCM SC104 Ver 2.2, 2.3, or 3.0
RTCM 2.x message type	3, 18, 19, 20, 21, 22; user selectable
RTCM 3.0 message type	1003, 1004, 1005, 1006, 1007, 1008, 1019, 1011, 1012, 1020; user selectable
Ambiguity initialize	OTF (L1, L1/L2)
Baseline Length	Up to 50 km in the morning and evening. Up to 32 km at noon.
Initialize time	5 seconds to 10 min depending on the base line length and multipath conditions
Output interval for CMR/RTCM	1, 5, 10, 20, 50, 100 Hz optional
Elevation	0 to 90 degrees (independent of data logging)
Solution mode	Delay (synchronization); Extrapolation (not synchronized)
Process interval	1, 5, 10, 20, 50, 100 Hz optional
Latency	Delay mode – 20 msec to 20 sec (depends on latency which receives corrections data from base receiver); Extrapolation – 20 to 30 msec
Raw Data logging	The receiver can record raw data at another interval during RTK operation
Status	Fix, Float, DOP, Data Link Status, Receiver Latency, Common satellites, Percentage of fixing
Results	RTK coordinates, HRMS, VRMS, Covariance Matrix
Ambiguity fixing level	Selectable thresholds Low: 95%; Medium: 99.5%; High: 99.9%
Measuring Modes	
Base or Rover	Static, Fast Static Kinematic (Stop and Go) RTK (Real-time Kinematic) DGPS (Differential GPS) SBAS DGPS
Measuring Accuracy	
Autonomous	< 2m
Static, Fast Static	Horizontal: 0.3 cm + 0.5 ppm * base_line_length^3 Vertical: 0.5 cm + 0.5 ppm * base_line_length
Kinematic, RTK	Horizontal: 1 cm + 1 ppm * base_line_length Vertical: 1.5 cm + 1.5 ppm * base_line_length
RTK (OTF)	Horizontal: 1 cm + 1 ppm * base_line_length Vertical: 1.5 cm + 1.5 ppm * base_line_length

DGPS	< 0.25 m Post Processing, < 0.5 m Real Time
Real time heading accuracy (for DELTAD and DELTAQ only)	~ 0.004/L [rad] RMS, where L is the antenna separation in [m]
Roll/Pitch (for DELTAQ only)	~ 0.008/L [rad] RMS, where L is the antenna separation in [m]
Cold Start Warm Start Reacquisition	< 35 sec < 5 sec < 1 sec

1. RTK update rate means the position update rate of the rover working in the “extrapolation” mode. In the extrapolation mode you may use the base with measurements update rate = 1 Hz and run the rover at 100 Hz RTK update rate.
2. In-Band interference usually is caused by harmonics of external transmitters (like TV stations) located close to GPS receiver. Interference decreases SNR and may stop receiver operation completely. Our In-Band Interference Rejection technique suppresses interference and recovers SNR. Multipath signal propagation worsens code/phase measurements. Advanced Multipath Reduction technique reduces this harmful effect.
3. The accuracy estimate is applicable to base lines up to several hundreds of km. But normally RTK works predictable on base lines up to 50 km.

A.1.2. GNSS Board Details

Table A-2 lists the GNSS board's general specifications.

Table A-2. GNSS Board Specifications

Signals tracked	
DELTA-G2T	GPS C/A, P1, P2, L2C (L+M), L5 (I+Q) Gallileo E1 (B+C), E5A (I+Q) QZSS C/A, L1C (I+Q), L2C (L+M), L5 (I+Q), SAIF Compass B1 SBAS L1, L5
DELTA-G3T	GPS C/A, P1, P2, L2C (L+M), L5 (I+Q) Gallileo E1 (B+C), E5A (I+Q), E5B (I+Q), AltBoc GLONASS C/A, L2C, P1, P2, L3 (I+Q) QZSS C/A, L1C(I+Q), L2C (L+M), L5 (I+Q), SAIF Compass B1, B2 SBAS L1, L5
DELTA-G3TAJT	GPS C/A, P1, P2, L2C (L+M), L5 (I+Q) Gallileo E1 (B+C), E5A (I+Q) GLONASS C/A, L2C, P1, P2 QZSS C/A, L1C(I+Q), L2C (L+M), L5 (I+Q), SAIF Compass B1 SBAS L1, L5
DELTAD	GPS C/A, P1 GPS L2C (L+M), P2 (G2D, G3D only) Galileo E1 (B+C) GLONASS C/A, L2C, P1, P2 (G3D only) QZSS C/A, L1 (I+Q), SAIF QZSS L2C (L+M) (G2D, G3D only) Compass B1 SBAS L1
DELTAQ[1]	GPS C/A, P1, P2, L2C (L+M) Galileo E1 (B+C) GLONASS C/A, L2C, P1, P2 (main antenna only) QZSS C/A, L1C (I+Q), L2C (L+M), SAIF Compass B1 SBAS L1
Tracking Specifications	
Standard channels	Total 216 channels: all-in-view (GPS L1/L2/L2C/L5, Galileo E1, GLONASS L1/L2, SBAS)
Tracked signals	L1/L2 C/A and P Code & Carrier
Tracking Functions	
Multipath reduction	Code and Carrier
PLL/DLL settings	Bandwidth, order, adjustable Smoothing interval Code and Carrier
WAAS/EGNOS	WAAS optional; EGNOS optional
Memory	
Internal Memory	Up to 2048MB of on board non-removable memory for data storage
Raw Data Recording	Up to 100 times per second (100Hz)

Data Type	Code and Carrier from GPS L1, L2, Galileo E1/E5A, GLONASS L1/L2 (G3T only)
1PPS Output (optional)	
Number of PPS ports	1
Edge	Rise, Fall
Period	10 to 1000000000 ms
Offset	-500000000 to 500000000 msec
Reference time	GPS, GLONASS, UTC (USNO), UTC (SU)
Event Marker (optional)	
Number of event Marker ports	1
Edge	Rise, Fall
Reference time	GPS, GLONASS, UTC (USNO), UTC (SU)

1. The simultaneous signals tracking is limited by the number of the available channels. By the attitude determination GPS L1/L2/L2C and GLONASS L1/L2 tracking should be active only.

A.2. Connector Specifications

Power Connector

The power connector (Figure A-1) is a sealed receptacle, 5 pin, ODU p/n G80F1C-T05QF00-0000.

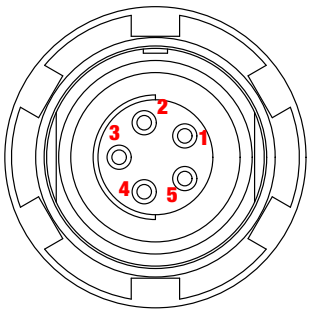


Figure A-1. Power Connector

Table A-3 gives power connector specifications.

Table A-3. Power Connector Specifications

Number	Signal Name	Dir	Details
1	Power_INP	P	10 to 30 volts DC input
2	Power_INP	P	10 to 30 volts DC input
3	Power_GND	P	Ground, power return
4	Power_GND	P	Ground, power return
5			Not used

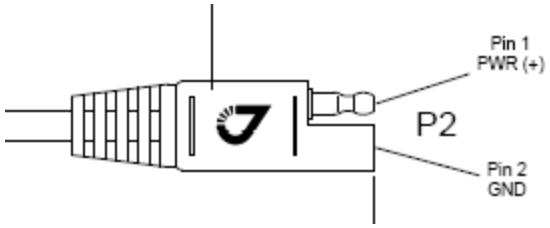


Figure A-2. Polarity of SAE for power cable P/N 14-578101-01

Serial RS-232C Connector

The RS232 connectors (Figure A-3) are sealed receptacle, 7 pin, ODU p/n G80F1C-T07QC00-0000.

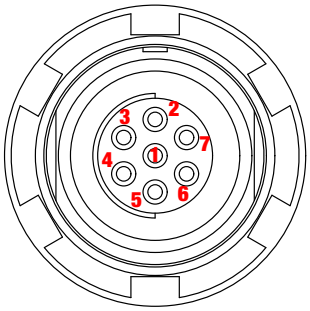


Figure A-3. RS-232C Connector

Table A-4 gives the RS-232C cable connector specifications.

Table A-4. 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

USB connector is a sealed receptacle, 5 pin, ODU p/n G80F2C-P05QF00-0000 (Figure A-4).

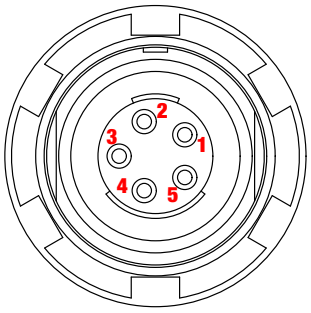


Figure A-4. USB Connector

Table A-5 gives the USB connector specifications.

Table A-5. USB Connector Specifications

Number	Signal Name	Dir	Details
1			
2	USB_PWR	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 (Figure A-5).

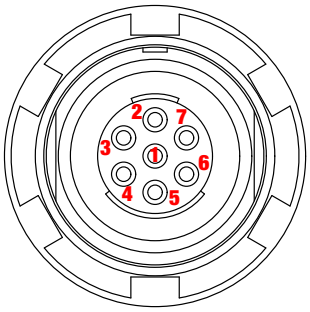


Figure A-5. Ethernet Connector

Table A-6. Ethernet Connector Specifications

Number	Signal Name	Dir	Details
1			Not used
2	Power_GND		Signal ground

Number	Signal Name	Dir	Details
3	TXD+	O	Transmit data plus
4	TXD-	O	Transmit data minus
5	RXD+	I	Receive data plus
6	RXD-	I	Receive data minus
7	LAN LED		External LAN LED anode

RS422/RS232/CAN Connector

The RS422/RS232/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 (Figure A-6)

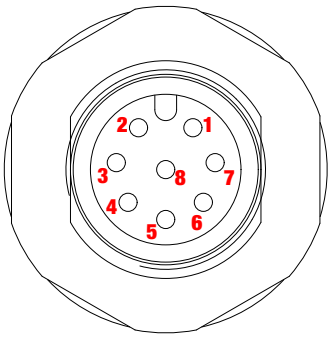


Figure A-6. RS422/RS232/CAN Connector

Table A-7 gives the RS422/RS232/CAN connector specification.

Table A-7. RS422/CAN Specification

Number	Signal Name	Dir	Details
1	PWR OUT	P	Bus power, +12 V DC, 250 mA max
2	GND	-	Ground
3	422_TX+/RTS	O	Port TX+ line/RTS
4	422_TX-/TX	O	Port TX- line/TX
5	422_RX+/CTS	I	Port RX+ line/CTS
6	422_RX-/RX	I	Port RX- line/RX
7	CAN_H	I/O	CAN_H bus line (dominant high)
8	CAN_L	I/O	CAN_H bus line (dominant low)

GNSS External Antenna RF 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 1PPS Connectors (Optional)

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

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.

B.1. Storage Precautions

1. Always clean the instrument after use. Wipe off dust with a cleaning brush, then wipe off dirt with a soft cloth.
2. Store in a location with a temperature of from -40° to +85°C, and no exposure to direct sunlight.
3. 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.
4. Always make sure the instrument is completely dry before storing. Dry the receiver with a soft, clean cloth.

B.2. 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.

DANGER: THE DELTA RECEIVER SHOULD NEVER BE USED IN DANGEROUS ENVIRONMENTS. USE IN RAIN OR SNOW FOR A LIMITED PERIOD IS PERMITTED.

B.3. Power Supply

A single external power supply with 5 pin ODU connector or SAE connector is necessary to operate DELTA. 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.

CAUTION: *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.*

CAUTION: *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.*

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

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.*

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.

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

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.*

Note: JAVAD GNSS recommends certified Phihong power supply PSAA60W-120 (JAVAD GNSS p/n 22-570101-01) for indoor use.

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

B.4. Usage Warnings

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

Note: 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.

Appendix C

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[1].

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.

1. The warranty against defects in JAVAD GNSS battery, charger, or cable is 90 days.

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