TRIUMPH-1M

GNSS RECEIVER

User Manual

VERSION 1.2
LAST REVISED MAY 26, 2019

www.javad.com

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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 TRIUMPH-1M and its use is subject to these terms and conditions (the "Terms and Conditions").

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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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.

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

REGULATORY INFORMATION

The following sections provide information on this product's compliance with government regulations.

FCC Class A Compliance

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

This device may not cause harmful interference, and

This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Emissions Labeling Requirements

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Réglement sur le matériel brouilleur du Canada.

RF EXPOSURE EVALUATION FOR MULTI-TRANSMITTER PRODUCT PROCEDURES

In mobile exposure conditions, simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated power density, is ≤ 1.0, i.e.

$$\sum_{i=1}^{n} \frac{S_i}{(MPE)_i} \leq 1$$

Where Si is the Power Density on the given distance for i=1, 2, 3. . ...n,

n – number of antennas transmitting simultaneously,

(MPE)i is the Limit of MPE for the given transmitting frequency.

The $\frac{S_i}{(MPE)_i}$ is the MPE ratio of each antenna, determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of power density to MPE limit, at the frequency of interest.

Calculation of Power Density at a given distance

Power Density (S mW/cm^2) is calculated as

$$S = \frac{P_a G}{4\pi d^2}$$

Where

P_a – Average Power input to the antenna (in mW),

$P_a = P \times DC$

DC – Source-based Duty Cycle (numeric)

G – gain of the antenna in the direction of interest relative to an isotropic radiator (numeric),

d – distance to the center of radiation of the antenna (in cm).

Regarding the Javad TRIUMPH-1M device containing multiple transmitters:

- UHF module (FCC ID: WJ4LMR400),
- 4G LTE Mini Card (FCC ID: N7NMC7700),
- Wi-Fi/Bluetooth Module (FCC ID: TFB-TIWI1-01),

the following calculation of RF exposure compliance is performed:

Number of approved single module	FCC ID	Power input to antenna	Source-based Duty Cycle	Maximum antenna gain	Power Density (S_i) at 20 cm	Frequency	Technology	MPE limit	$\frac{S_i}{(MPE)_i}$
1	WJ4LMR400	1000 mW	50% (0.5)	2.5 dBi/1.78	0.18	406 MHz	UHF band	0.27	0.67
2	N7NMC7700	1734 mW	25% (0.25)	1.32 dBi/1.35	0.12	824-848 MHz	Cell band	0.55	0.22
		925 mW	25% (0.25)	3.0 dBi/2.0	0.09	1850-1910	PCS band	1.0	0.09
		277 mW	100% (1.0)	5.5 dBi/3.5	0.19	1712-1752	LTE band 4	1.0	0.19
		256 mW	100% (1.0)	3.0 dBi/2.0	0.10	706-713	LTE band 17	1.0	0.10
3	TFB-TIWI1-01	100 mW	100% (1.0)	6.0 dBi/4.0	0.08	2.4 GHz	WiFi+BT	1.0	0.08
									0.97

Note: N7NMC7700 can transmit only in any one of four modes in time of operation. The worst case is transmitting in Cell band.

$$\sum_{i=1}^{n} \frac{S_i}{(MPE)_i} = 0.97$$

Description and Operation

INTRODUCTION

The new TRIUMPH-1M receiver inherits the best features of our famous TRIUMPH-1. Based on our new 864 channel chip, equipped with the internal 4G/LTE/3G card, easy accessible microSD and microSIM cards, includes “Lift & Tilt” technology. (Fig. 1).

Figure 1. TRIUMPH-1M

TRIUMPH-1 can receive and processes multiple signal types (including the latest GPS C/A, P1, P2, L2C (L+M); GLONASS C/A, L2C, P1, P2; SBAS L1) improving the accuracy and reliability of your survey points and positions, especially under difficult jobsite conditions.

Several other features, including multipath mitigation and common tracking, provide under-canopy and low signal strength reception. The TRIUMPH-1 receiver provides the functionality, accuracy, availability, and integrity needed for fast and easy data collection .

When calculating an absolute position, a stationary or moving receiver determines its three-dimensional position with respect to the origin of an Earth-Center Earth-Fixed coordinate system. To calculate this position, the receiver measures the distance (called pseudoranges) between it and at least four satellites. The measured pseudoranges are corrected for clock differences (receiver and satellites) and signal propagation delays due to atmospheric effects. The positions of the satellites are computed from the ephemeris data transmitted to the receiver in navigation messages. When using a single satellite system, the minimum number of satellites needed to compute a position is four. In a mixed satellite scenario (GPS, GLONASS, Galileo), the receiver must lock onto five or more satellites to account for the different time scales used in these systems and to obtain an absolute position.

Achieving quality position results requires the following elements:

Accuracy – The accuracy of a position primarily depends upon the satellite geometry (Geometric Dilution of Precision, or GDOP) and the measurement (ranging) errors.

– Differential positioning (DGPS and RTK) strongly mitigates atmospheric and orbital errors, and counteracts Selective Availability (SA) signals the US Department of Defense transmits with GPS signals.

– The more satellites in view, the stronger the signal, the lower the DOP number, the higher positioning accuracy.

Availability – The availability of satellites affects the calculation of valid positions. The more visible satellites available, the more valid and accurate the position. Natural and man-made objects can block, interrupt, and distort signals, lowering the number of available satellites and adversely affecting signal reception.

Integrity – Fault tolerance allows a position to have greater integrity, increasing accuracy. Several factors combine to provide fault tolerance, including:

– Receiver Autonomous Integrity Monitoring (RAIM) detects faulty GNSS satellites and removes them from the position calculation.

– Five or more visible satellites for only GPS or only GLONASS; six or more satellites for mixed scenarios.

– Satellite Based Augmentation Systems (WAAS, EGNOS, etc.) creates and transmit, along with DGPS corrections, data integrity information (for example, satellite health warnings).

– Current ephemerides and almanacs.

SPECIFICATIONS

Tracking Specifications	
Signals tracked	GPS C/A, P1, P2, L2C (L+M), 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, L1C(I+Q), L2C (L+M), L5 (I+Q), SAIF; Beidou B1, B2; SBAS L1, L5
Cold / Warm start/ Reacquisition	<35 seconds/ <5 seconds/<1 second
Power Specifications	
Battery	Two internal Li-Ion batteries (7.4 V, 5.8 Ah each) with internal charger
Operation Time	Up to 18 hours
Input Voltage	+10 to +30 volts
GNSS Antenna Specifications	
GNSS Antenna Type	Integrated Microstrip (Zero Centered)
Ground Plane	Antenna on a flat ground plane
I/O	
Communication Ports	2x serial (RS232) up to 460.8 kbps; High speed USB 2.0 device port (480 Mbps); Full-duplex 10BASE-T/100BASE-TX Ethernet port; Wi-Fi (IEEE 802.11b/g); Bluetooth V2.0+EDR Class 2 supporting SPP Slave Profile
External Power port	1 port
Radio Specifications	
4G LTE Mini Card	LTE, HSPA+, HSDPA, HSUPA, WCDMA, GSM, GPRS, EDGE (up to 100 Mbps) LTE, EV-DO, 1xRTT CDMA (up to 100 Mbps)
MicroSIM card slot	User accessible, fully sealed
Radio Modem	Internal 406-470MHz UHF radio Internal 902-928/ 868-870 MHz ISM radio (optional)
Base Power Output	1 Watt
Memory and Recording	
Internal Memory	Up to 16 GB of on-board non-removable memory for data storage
SD card slot	High Capacity microSD Card (microSDHC) up to 32GB Class 10; user accessible,fully sealed
Raw Data Recording	Up to 100 times per second (100Hz)
Real Time Data	
Input/Output	JPS, RTCM SC104 v. 2.x and 3.x, CMR
Output	NMEA 0183 v. 2.x and 3.0, BINEX
Status Indicator	Six LEDs, two function keys (MinPad)
Environmental	
Enclosure	Molded magnesium alloy and plastic, waterproof IP67
Operating /Storage Temperature	-30° C to +55° / -20° C to +45° C
Humidity	100% condensing
Shock	Survives a 2 m drop onto hard surface
Dimensions	7 x 3.78 x 7 in (178 x 96 x 178 mm)
Weight	3.75 lbs (1.7 kg)/4.02 lbs (1.82 kg) with modem antenna

GETTING ACQUAINTED

The TRIUMPH-1M receiver's advanced design reduces the number of cable required for operation, allowing you to survey more reliably and efficiently. The casing allocates space for two rechargeable batteries, SIM card and SD card slots, a Bluetooth® wireless technology module, a multi-system receiver board, and a radio modem.

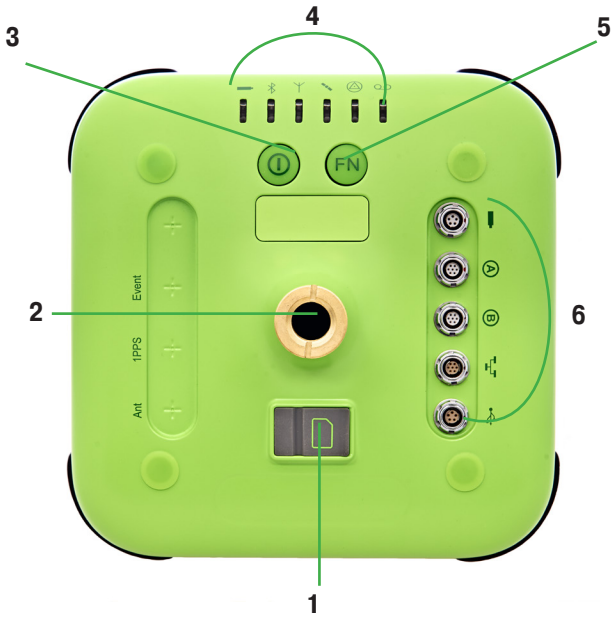


Figure 2. TRIUMPH-1M

1. SIM-card slot
2. Mounting
3. On/Off button
4. LEDs
5. FN button
6. Connectors

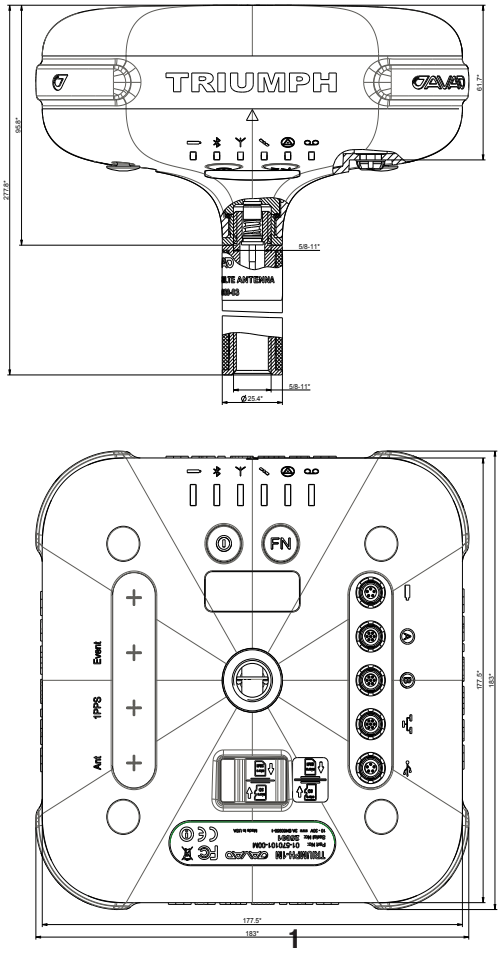


Figure 3. Dimensions in mm

MINPAD

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

Figure 4. TRIUMPH-1M MinPad

The BAT (battery) LED displays the power status for battery and receiver's mode:

- No light - receiver is off/ no external power/sleep mode is off

- The LED color indicates the battery status:
- Green - greater than 85% charge.
- Yellow - an intermediate charge.
- Red - less than 15% charge.

Blinking every 1 sec according to the battery means receiver is ON without external power. LED solid according to the battery means external power is connected.

The BT (Bluetooth) LED indicates the level of activity at the Bluetooth® wireless technology communication link:

- Blue – the Bluetooth® module is on and a connection has been established.
- Yellow – the Bluetooth® module is on and a connection is establishing.
- Red – connection is not established.
- No light – the Bluetooth® module is not active.

The WLAN LED displays the status of the WiFi connection.

- Green – WLAN module is connected to access point or adhoc mode is initialized correctly.
- Yellow – WLAN module is on and in process of initialization.
- Red – WLAN module error.
- No light – WLAN is not active.

The SAT (satellites) 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 POS (position) LED indicates position solution for current surveying mode:

- Green – Fixed/Diff position solution is obtained.
- Yellow – Float/No-Diff position solution is obtained.
- Red – No position.
- No light - no satellites.

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 Record button starts/stops data recording.

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 key for more than one and less than four seconds (until both the SAT and the REC LEDs are off).

CHARGING THE BATTERIES

Warning: Risk of explosion if battery is replaced by an incorrect type. Dispose of used battery according to the instructions.

Warning: Before beginning to work, fully charge the batteries for maximum operating time. An approximately 6-hour charge cycle will fully charge the batteries; the batteries will charge simultaneously. The batteries can not be overcharged.

CAUTION: RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE. DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS

Warning: The Li-Ion batteries used in the battery packs should run at no less than 80% capacity after 500 charging cycles. These batteries do not need to be drained before recharging.

Warning: Never attempt to open the casing of the detachable batteries! Lithium-Ion batteries can be dangerous if mishandled!

Warning:

Warning: Do not incinerate or heat battery pack above 212 degrees Fahrenheit (100 degrees Celsius). Excessive heat can cause serious damage and possible explosion.

Warning: The batteries (or batteries installed) shall not be exposed to excessive heat such as sunshine, fire or the like.

Warning: Do not attempt to open the battery pack.

Warning: Do not disassemble the battery pack.

Warning: Do not charge in conditions different than specified.

Warning: Do not use other than the specified battery charger.

Warning: Do not short circuit the battery pack.

Warning: Do not crush or modify the battery pack.

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

TRIUMPH-2. 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 10...16 V DC, 3A. 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.

Figure 5. Power supply / Charger

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.

POWERING THE RECEIVER

To check the status of the internal batteries, view the BAT LED or check the status using JAVAD GNSS software. Check the BAT LED for battery status.

To charge the receiver internal batteries, take the following steps:

- Plug the Receiver-to-SAE cable's connector into the power port of the receiver (14-578125-01).
- Connect the opposite end of this cable with the battery charger'-s SAE connector (22-570101-01).
- Plug the other end of this cable into an AC outlet with cable (14-508053-01). Leave overnight.

SIM CARD SLOT

The SIM card slot allows a standard microSIM card to be installed in the receiver. Once installed, the SIM card provides a unique identification for the receiver's GSM module and enables the receiver's GSM functionality based on the subscribed services (the receiver board accesses the GSM module which accesses the SIM card). The SIM card usually remains inside the receiver.

Note: A SIM card can be purchased from your local cellular provider.

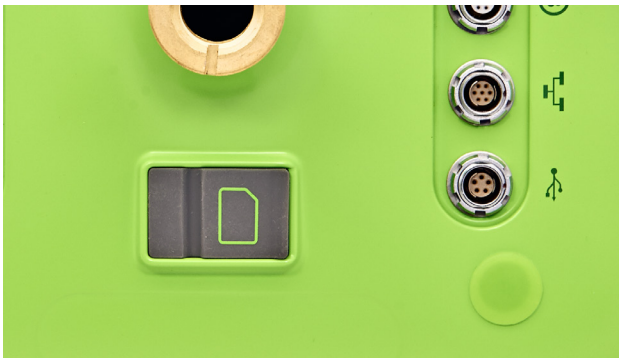


Figure 6. SIM-card slot

DATA AND POWER PORTS

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

Figure 7. Receiver's ports

EXTERNAL ANTENNA CONNECTOR (OPTIONAL)

The external antenna connects to the TNC external antenna connector (optional).

ATTACHING UHF/GSM ANTENNA

A broadband, rugged, in-building or outdoor antenna designed to service the whole 406-470 MHz UHF band and GSM quad band. With modest dimensions of 25 mm (OD) x 182 mm (height), this antenna radiates with a typical peak omnidirectional gain of +1 dBi. Internally, the radiating element is DC shunted to help protect the transceiver from nearby, but not direct ElectroStatic Discharge (ESD).

The TRIUMPH-1M modem antenna can be mounted on standard poles (5/8-11inches thread). Attached to the 1 receiver this antenna gets a part of survey pole, making handling with receiver easy and simple

MOUNTING

The bottom connector connects the receiver to either a standard 5/8-11'' mounting thread pole/adapter or the quick disconnects.

CABLES

The TRIUMPH-1M 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
- Power supply with SAE connector p/n 22-570101-01
- Cable Power/Charger Euro p/n14-508053-01/ Cable Power/Charger US p/n 14-508052-01

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 TRIUMPH-1M receiver according to particular needs, thus only purchasing those options needed.

Typically, all TRIUMPH-1M 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 USING NETVIEW

This software is available on the JAVAD GNSS website. If downloading the program(s) from the website, extract the program's files into a folder on your hard drive. The following sections describe installing this software, and other sections throughout the manual describe using this software with the receiver.

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. If desired, create a shortcut on the computer's desktop for quick access to NetView.

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:

- a USB cable and a computer/controller with the JAVAD GNSS USB driver installed;
- a Bluetooth®-enabled external device (computer/controller).

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 USB connection

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

Using the USB cable, connect the USB port on the receiver to a USB port on the computer.

Press the power buttons on the receiver and computer to turn them on.

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

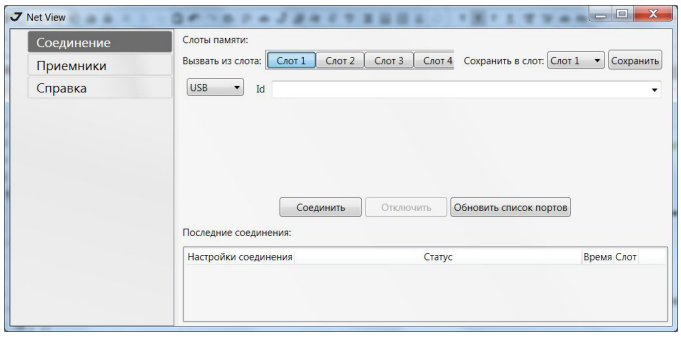


Figure 8. NetView: USB connection

Establishing a Wireless Connection

The TRIUMPH-1M receiver contains Bluetooth® wireless technology that allows file transfer and synchronization between the receiver and any other external device that supports Bluetooth® wireless technology. TRIUMPH-1M and external device connection procedure varies slightly depending on the type of external device used.

Refer to your Bluetooth®-enabled external device documentation for more detailed connection information.

In general, the connection procedure with PC is as follows:

1. Turn on a Bluetooth®-enabled PC and your receiver. The default external device mode is Master; the receiver's Bluetooth® module mode is Slave.
2. Instruct the external device (Master) to search for the receiver (Slave).
3. Once the Master device detects the receiver, use the procedure described in the external device's documentation to connect it with the receiver.
4. Start NetView, select SER as type of connection mode, and specify the port the receiver is connected to

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 GPS/GLONASS 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.

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 GPS/GLONASS 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).

The following Base and Rover configurations are recommended for the most common applications. However, you can select configuration parameters as needed for your particular jobsite.

Note: Do not make other changes without consulting the NetView Software Manual.

1. Connect the receiver and computer, start NetView and establish the connection as described above.

2. Click Receiver ▸ Parameters on the left panel.

3. In the General tab check antenna status and set the parameter Antenna Input to External if the external antenna will be used.

4. Open the Log files tab and then TriPad tab and set the following parameters, click Apply.

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)

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.

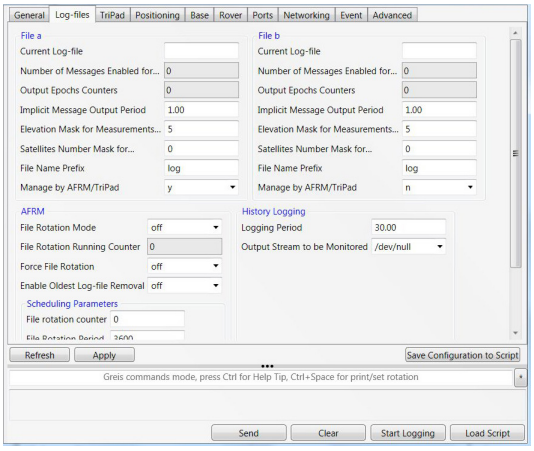


Figure 9. Log Files tab

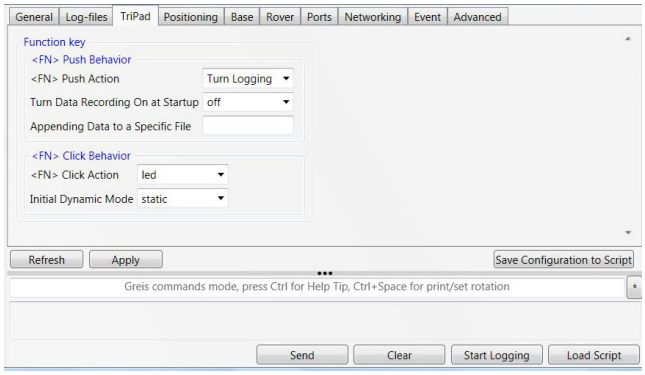


Figure 10. TriPad tab

5. Open Positioning tab and set the Elevation mask to 15 degrees .

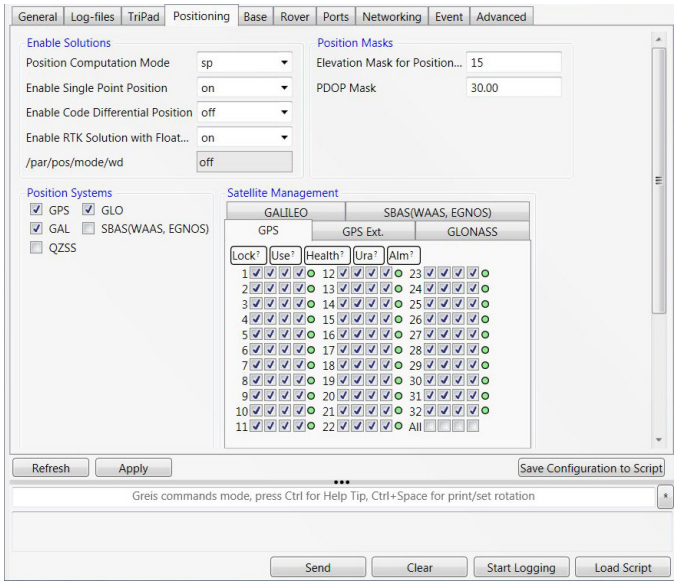


Figure 11. Elevation mask

6. To set up the base station, open the Base tab and set the following parameters: 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.

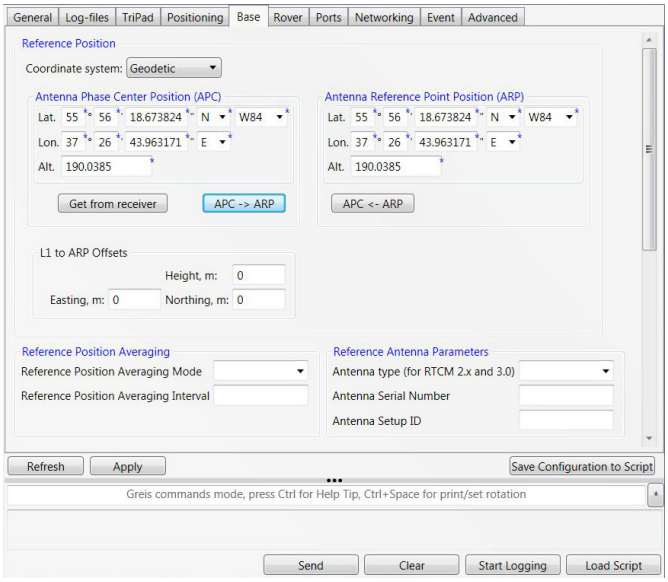


Figure 12. Base tab

7. 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.

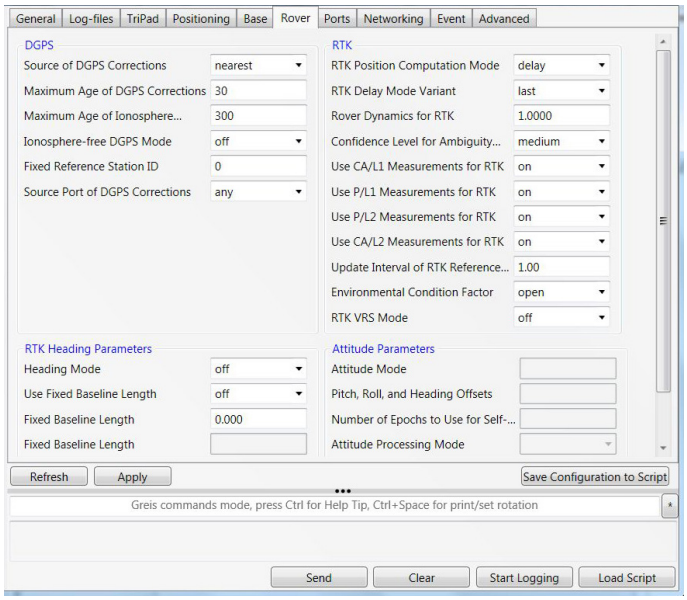


Figure 13. Rover tab

9. For RTK survey, open the Ports tab and set up the parameters according Table 2, then click Apply.

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

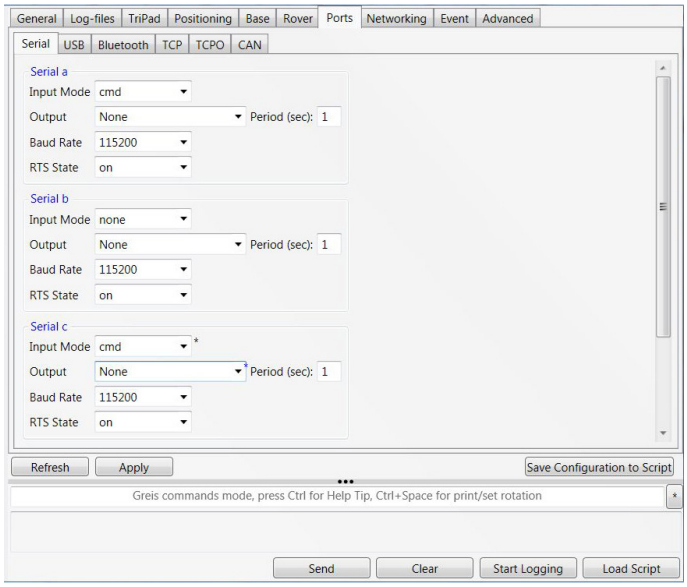


Figure 14. Ports tab

Parameter	Base	Rover
Input	-	The same correction type as Base has
Output	Select the correction type.	-
Period (sec)	Set the period of correction output	-
Baud rate	Baud rate for the corresponding receiver port	
RTS/CTS	Enable	

10. 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 (mpnew).

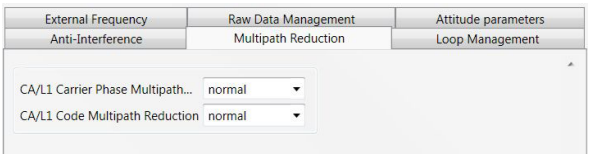


Figure 15. Multipath Reduction

11. 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.

Note: For detailed description of settings and parameters see NetView Software Manual..

MINPAD CONFIGURATION

The TRIUMPH-1M's simple user interface (MinPad) consists of two keys (Power and Record) and up to six LEDs that control and display the receiver's operation (see Figure 3 on page 12).

The MinPad performs numerous functions:

- Turn the receiver on/off.
- Turn data recording on or off (Record button).
- Show the status of satellites being tracked (SAT 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 Record button (REC LED).
- Show the status of the battery (BAT LED).
- Show the power source for TRIUMPH-2 (BAT

LED).

- Show the modem's status (MOD LED).
- Show the Bluetooth® module status (BT LED).
- Show the position solution status (POS LED).

You use NetView to configure MinPad settings. Refer to the NetView Software Manual for all possible MinPad configurations.

Connect the receiver and PC as described above. Start NetView. Establish connection with the receiver.

Open TriPad tab. Set the following parameters and click Apply:

- "File a, File b"
- "Function Key"
- "Automatic File Rotation Mode (AFRM)"

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

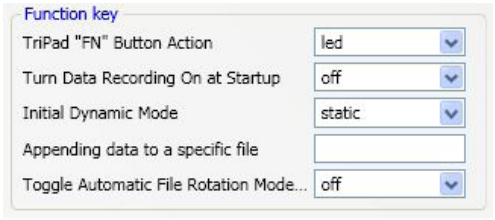


Figure 16. Funktion Key

- 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 MinPad'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 MinPad. 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)

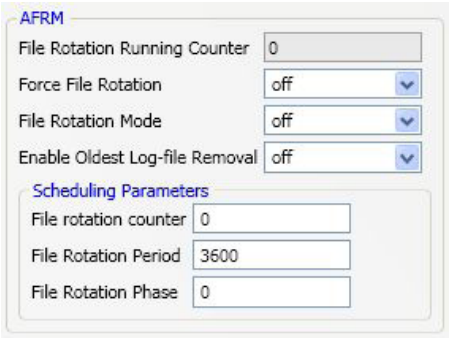


Figure 17. AFRM

- 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

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 MinPad 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.

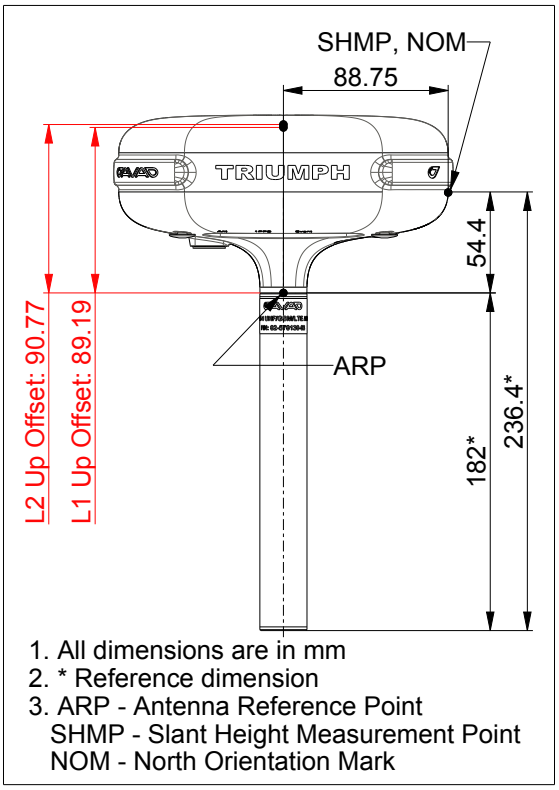
The receiver calculates the coordinates of the antenna's phase center. To determine the coordinates of the station marker, the user must specify the following:

- 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

Figure 18. Установка TRIUMPH-1M

To start survey TRIUMPH-1M should be set up on a tripod or in a pole. TRIUMPH-1M has 5/8" mount to connect to monopod, to tripod or to surveying 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 SAT light will green.
- A red color of POS LED indicates that the receiver has not solved a position. Four or more satellites provide optimal positioning.
- Once the red POS LED is green, the receiver has a position and surveying can begin; wait for green light before beginning data collection. This ensures that the receiver has the correct date and time, and is locked on to enough satellites to ensure good quality data.
- 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 Record button (for more than one second and less than five seconds).
- Release the Record 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 Record 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 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.

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

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:

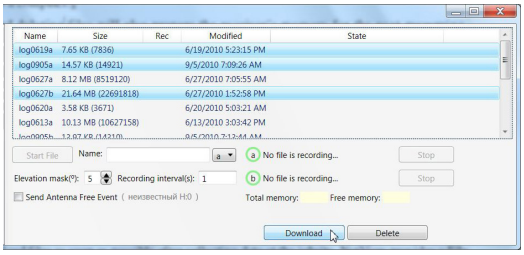


Figure 19. Downloading files

Click the Download 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. NetView deletes the selected files.

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 NetView.

Connect your receiver and computer. See "Connecting the Receiver and a Computer" on page 28 for this procedure. Start NetView. Establish connection between NetView and receiver.

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. For any OAF related questions, E-mail at support@javad.com. Please have your receiver ID number available.

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

Click on the receiver name on the left panel. On the right open Options tab.

To upload a new options file, click on Upload button, and select the options file. Refresh – Updates the window

Navigate to the location of the new Option Authorization File. OAFs have .jpo extension and are unique to each receiver.

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'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 MinPad 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.

Using NetView to Clear NVRAM

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

Click on the receiver name on the left panel. On the right click on Actions4Clear NVRAM.

Confirm NVRAM clearing.

CHECKING FIRMWARE VERSION

Use NetView to check the firmware version of your receiver.

Connect your receiver and computer. Start NetView. Establish connection between NetView 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 Reports4Receiver 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.

Connect your receiver and computer. Start NetView. Establish connection between NetView 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 using NetView: Receiver name (on the left panel)4Actions 4Reset.

Restore default settings using NetView Receiver name (on the left panel) ▸ Actions ▸ Initial parameters.

Clear the NVRAM.

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

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.

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.

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” 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.

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” 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” 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.

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" .

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.

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