

TRIUMPH-3NR

User Manual



Version 6

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1. Introduction

1.1. 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-3NR and its use is subject to these terms and conditions (the “Terms and Conditions”). Please read these Terms and Conditions carefully.

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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 TRIUMPH-3NR can lead to injury to persons or property and/or malfunction of the product. The TRIUMPH-3NR receiver should only be repaired by authorized JAVAD GNSS warranty service centers. Users should review and heed the safety warnings.

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1.2. Safety Information

Please ensure that you read and understand all safety requirements before using Javad GNSS products.

1.3. Usage and Safety

This product is designed to operate in harsh environments typically encountered in surveying applications.

1.4. Radio Frequency Exposure

Built-in radio emitters:

The radiated power of the built-in WIFI and Bluetooth modules is well below the RF exposure limits set by the FCC. However, the modules must be used in such a way that the satellite receiver is no closer than 20 cm from the human body. The built-in wireless modules operate in accordance with international regulations and recommendations for the safety of RF emissions.

JAVAD GNSS ensures that the built-in wireless radio modules are completely safe for the consumer. The level of emitted electromagnetic energy is hundreds of times lower than the electromagnetic radiation of other wireless devices, such as mobile phones. However, the use of wireless radios may be prohibited in some situations and places, such as on an airplane. If you are not familiar with the current prohibitions, it is recommended that you obtain permission before turning on the wireless radios.

1.5. Warranty

Please contact JAVAD sales managers to find detailed information about company warranty policies.

1.6. Technical Support

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 support@javad.com.

2. Receiver Overview

Check the packing labels on all boxes to make sure you have received the required items. Notify the dealer about any shortages.

Before starting, check that all the following items have been included with your TRIUMPH-3NR device shipping pack. If anything is missing, contact your dealer as soon as possible.

Check all documentation. Read the documentation that came with the equipment and keep it for future reference. Check all documentation. Read the documentation that came with the receiver and keep it for future reference.

2.1. Shipping Contents

Please check if you have all the items listed:

Description	Part Number
TRIUMPH -3NR GNSS Receiver	01-630100-21
TRIUMPH -3NR Pole Adaptor	10-590293-01
Extension Cable SAE/SAE (1.8m)	14-578102-01
Power Cable, 1-3.5 plug / SAE (0.33m)	14-578125-01
AC Power Cable, C13/C14, 6 ft.	14-578153-01
USB Cable, A / micro-B, 1m	14-578156-01
JAVAD Transport case for Triumph-3 series	20-720300-01
Power Supply/Charger 24VDC 90W	22-570106-01
AC Power Adapter*	23-590029-0X

* AC Power adapter depends on the AC socket type in your country

2.2. Appearance



Figure 1: Front View



Figure 2: Back View



Figure 3: Side View



Figure 4: Bottom View

2.3. Ports and Buttons

The TRIUMPH-3NR has two ports on the back panel of the unit. Both ports are closed with protective rubber covers. It is recommended to keep them closed while not in use.

2.3.1.1. Ports:

- USB type Micro B (High Speed).
- Power port type 1-3.5 DC power input.

Note: Please use only the power charger system packed with the device. Using any other type of power charger can cause unit damage.

2.3.1.2. Buttons:

- Power Button (PWR).
- Record Button (REC).

Note: REC button is one programmable button. In advanced using instructions it is called FN button (“functional”).

2.4. Wireless interfaces

The TRIUMPH-3NR has two built-in antennas, Bluetooth and Wi-Fi.

2.5. LED interfaces

The TRIUMPH-3NR has 6 RGB LEDs on the front panel, these are:

- Power with External Charge
- Power without External Charge
- Bluetooth
- Wi-Fi
- Satellite
- Position
- Logging

Each item is further described below.

2.5.1. Power (PWR) LED (without external charge):

- **Green** – battery power level >30%.
- **Yellow** – battery power level from 15% to 30%.
- **Red** – battery power level <15%.
- **Blue** – instantly flashes while pressing PWR button.
- **No Light** – device is off.

2.5.2. Power (PWR) LED (with external charge):

- **Green** – TRIUMPH-3NR is fully charged.
- **Yellow** – TRIUMPH-3NR is charging.
- **Red** – failed charging.
- **No Light** – charger connector is not plugged in properly; no charging.

2.5.3. Bluetooth (BT) LED:

- **Blue** – Bluetooth is on, connection established (for multiple SPP connection Blue LED is flashing every 15 sec).
- **Red** – Bluetooth is on, no connection.
- **No Light** – Bluetooth is off.

2.5.4. Wi-Fi (WLAN) LED:

- **Green** – Wi-Fi is on, connection established.
- **Red** – Wi-Fi is on, no connection.
- **No Light** – Wi-Fi is off.

2.5.5. Satellite (SAT) LED:

- **Green** – more than 8 usable satellites.
- **Yellow** – 5 - 8 usable satellites.
- **Red** – 1 - 5 usable satellites.
- **No light** – no satellites tracked.

Note: Number of usable 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 number of usable satellites is 12.

2.5.6. Position (POS) LED:

- **Green** – position type matches requested type.
- **Yellow** – position type is less than requested type (e.g., current position computed is stand-alone when RTK fixed positioning mode is configured)
- **Red** – no position
- **Red/Yellow/Green flashing one-by-one** – SV tracking option is not active.

Note: POS LED is always blinking. If the light of this LED stands still, the device is frozen and needs to be rebooted.

2.5.7. Record (REC) LED:

- **Green** – log file is being recorded.
- **No Light** – no file is being recorded by now.

The usual stable tracking/positioning indicator is shown by a constant green light for <SAT> LED and flashing green for <POS> LED. The flashing is for indicating that the unit is not hanging or frozen (the heartbeat).

If no satellites are being tracked (impossible to compute position), the <SAT> LED will be off and the <POS> LED with flash with red lights.

2.6. Options Authorization File (OAF)

JAVAD GNSS issues an Option Authorization File (OAF) to enable the specific options purchased. An Option Authorization File allows customers to customize and configure the TRIUMPH-3NR receiver according to their needs.

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

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

2.6.1. Current OAF Status

The current status of the TRIUMPH-3NR OAF file can be viewed at any time using the NetView&Modem software. To achieve this, connect the TRIUMPH-3NR to a PC and launch the NetView&Modem software using a valid connection time. For more details see the NetView&Modem user manual.

In the NetView&Modem “Options” tab, the list of options available and their status is shown:

- **Option name / Description** – 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.

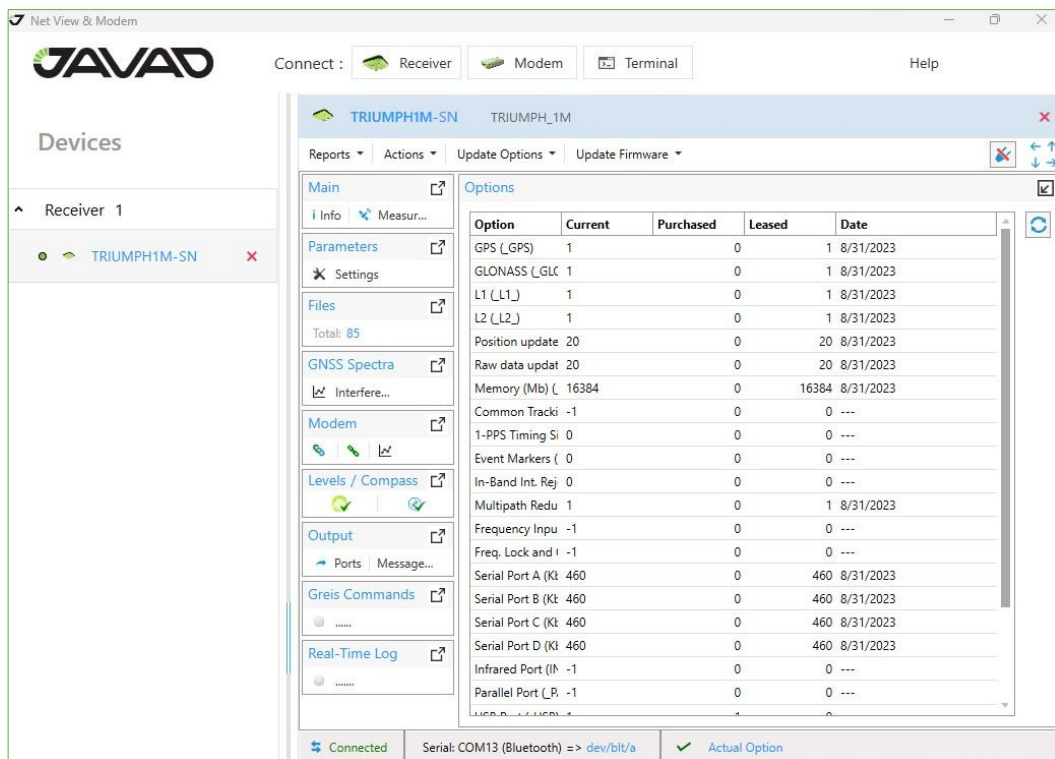


Figure 5: NetView&Modem Options Tab

2.7. Firmware update

Use NetView&Modem to check the firmware version of the TRIUMPH-3NR. Information about the current firmware version is shown on the main tab of the connected receiver. On the right from the receiver picture appears receiver information, including receiver model, ID, firmware version.

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 using NetView&Modem on a main tab click Action Update firmware. Select the file with the latest firmware. The firmware will be uploaded automatically, and the receiver will reboot.

2.8. Mounting

TRIUMPH-3NR Receiver can be mounted using the standard 1/4" thread hole on the bottom of the unit. Additionally, there is a thread adapter 1/4" to 5/8" available in shipping kit for mounting on a standard surveying 5/8" pole thread.

3. Port and Connections

3.1. Block Diagram

The block diagram illustrates the internal connections of the TRIUMPH-3NR.

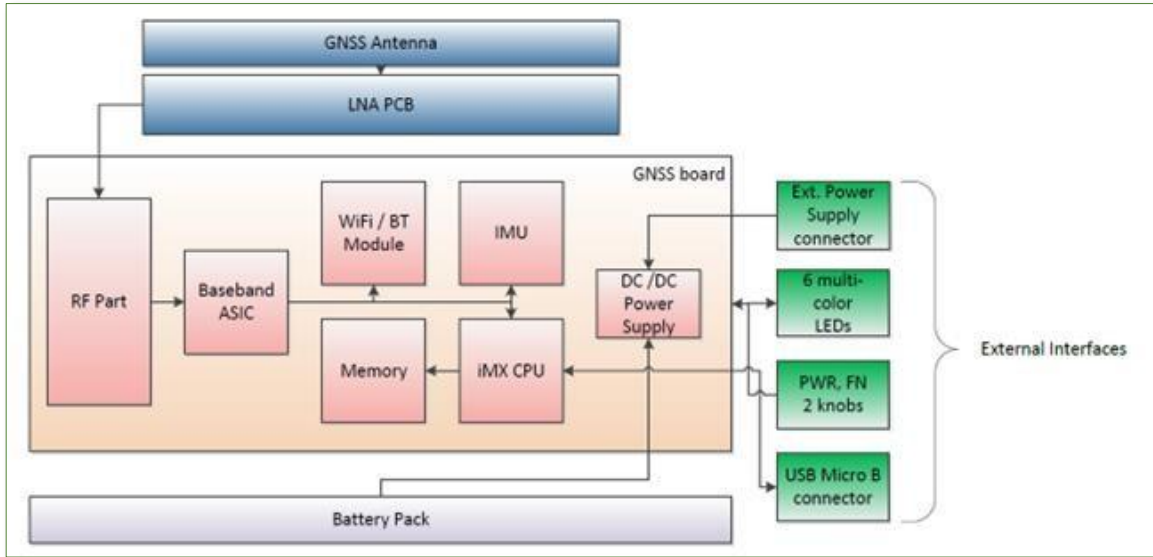


Figure 6: TRIUMPH-3NR Block Diagram

3.2. Power Management

The TRIUMPH-3NR receiver has an embedded battery pack inside the housing. The battery pack features:

- Power voltage up to 8.3V
- Internal Fuel Gauge system that prevents any occasions that can damage the battery and device (shortcuts, overheating, etc.)
- Battery lifecycle – about 25 working hours (all systems on).
- Battery charge input – up to 30V.

3.2.1. Battery Status

The internal battery pack status is shown via LED color on the front panel.

Battery status LED indicator:

PWR LED green	PWR LED yellow	PWR LED red
more than 30%	from 30% to 15%	less than 15%

3.2.2. Power on/off

To turn TRIUMPH-3NR on:

- Press and hold the PWR button for about 2 sec. (the LED will blink blue; this means the power button is active).
- Release the PWR button. The PWR LED will flash yellow (device turning on). Then SAT and POS LEDs will flash red/yellow/green several times (system is loading).
- Wait until the PWR, SAT and POS LEDs stop blinking. The PWR will constantly stay with the color from the table above. The rest of LEDs will work according to their status.

Note: If after pressing PWR button the PWR LED flashes several times red and turns off, this means the battery is discharged.

To turn TRIUMPH-3NR off:

- Press and hold the PWR button for 2 sec. (the LED will flash yellow).
- The device will turn off by itself.

For a long life of internal battery pack with a long life, use the JAVAD supplied power cables and Power Charger that came with the unit.

3.2.3. Device Charging

A single external power supply with a 3.5mm DC connector or SAE connector is necessary to operate the TRIUMPH-3NR. If external power supply has only an SAE connector, the Receiver-to-SAE power cable is be used. The external power supply needs to be approved for the US and EU, and have an output rated for 10 - 30 V DC, 3A. This may not be the same range as other JAVAD GNSS products. To avoid the introduction of hazards when operating and installing, before connecting the TRIUMPH-3NR to the supply, make sure that the supply meets local and national safety ordinances and matches the equipment's voltage and current requirements.

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

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

Make sure cords are located so that they will not be stepped on, tripped over, or otherwise subjected to damage or stress. Do not operate the TRIUMPH-3NR with a damaged cord or plug – replace immediately. To reduce the risk of damage to the TRIUMPH-3NR, pull by the plug body rather than the output cord when disconnecting the equipment.

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

The TRIUMPH-3NR comes from the factory with the batteries charged and ready to use so you can begin exploring its interface and familiarizing yourself right away while reading this manual.

To check the status of the internal battery pack, view the BAT LED or check the status using JAVAD GNSS software. When the TRIUMPH-3NR is turned off and charging, the BAT LEDs will keep you apprised of its charging progress.

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

- Plug the Receiver-to-SAE cable's connector into the power port of the TRIUMPH-3NR.
- Connect the opposite end of this cable with the battery charger's SAE connector.
- Plug the other end of this cable into an AC outlet with cable. Leave overnight.

A complete charging cycle is less than 9.5 hours.

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 battery for maximum operating time. An approximately 6-hour charge cycle will fully charge the battery. The batteries cannot be overcharged.

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 battery! Lithium-Ion batteries can be dangerous if mishandled!

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

Warning: The battery 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 from 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.

3.3. USB Connector

For manual connection, the TRIUMPH-3NR uses a standard USB port (Micro B type) on the back panel covered by protective rubber cover. The USB connector supports connection of any USB 2.0 (High Speed) cable and above. It is recommended to use the cable included in the shipping kit.

The USB connector provides a connection to the TRIUMPH-3NR from a PC (or any other electronic device with USB connection support). Besides USB connection, it is possible to establish other connections using virtual connection ports (physically it will remain the USB cable), these are:

- Serial (COM) port A (for Windows OS based devices).
- Serial (COM) port B (for Linux OS based devices).
- Ethernet (Ethernet-over-USB protocol).

For NetView&Modem application and for Windows/Linux OS, the default connection type is a COM connection (Serial A/B respectively). The physical parameters of the connection types are the same.

3.4. Bluetooth Connection

The TRIUMPH-3NR can establish a connection with any bluetooth device via serial port profile or PAN profile. To turn the Bluetooth on use Netview&Modem software and:

- Connect the device to PC using Netview&Modem.
- Go to section Parameters Ports Bluetooth.
- At Mode line drop-down list select on.
- Press OK for rebooting the device to turn bluetooth on.

The TRIUMPH-3NR has two Bluetooth serial ports (A and B). One can select modes for these ports (which port uses the connection) separately or automatic (if both ports are on). To connect an external bluetooth device to the TRIUMPH-3NR:

- Establish or review unit ID and password.
- Using external device, find the TRIUMPH-3NR ID in the listed devices and select it.
- Type password and connect.

To establish PAN connection, first connect to the device in regular way (see list above), then use function "Internet access" on the external device. The TRIUMPH-3NR will generate IP address for the external device.

3.5. Wi-Fi Connection

To establish a Wi-Fi connection to the receiver:

- Connect the device to PC using Netview&Modem.
- Go to section Parameters Connections WLAN.
- At mode line drop-down list, select mode type and confirm action for rebooting device (if needed).
- For connecting to the TRIUMPH-3NR (Server mode) use the corresponding block of parameters with SSID and password data. Connect to the unit using external Wi-Fi device.
- For connecting the TRIUMPH-3NR (Client mode) use the corresponding block of parameters with SSID and password data. Fill in the SSID and password of working WLAN network.

For more details, please see the Netview&Modem User Manual.

3.6. Connecting to an External UHF Modem

The TRIUMPH-3NR does not have an internal UHF modem, but it is possible to send and receive data by UHF using an external UHF modem.

For example, it is possible to use any JAVAD HPT***BT modem and connect it to the device using Bluetooth:

- Connect the device to PC using Netview&Modem (any connection type except Bluetooth).
- Prepare the external modem – connect it to the power supply and connect it to the Netview&Modem.
- Turn Bluetooth on for both external modem and receiver if needed.
- Connect the receiver to the external modem using Bluetooth SPP connection.
- In Receiver application of Netview&Modem go to section Parameters Ports UHF and set the mode of UHF device as needed, depending on Rover or Base configuration.

4. Receiver Operation

4.1. NetView&Modem

The TRIUMPH-3NR can be operated using Netview&Modem software. This application provides all receiver functions. The device can be connected to the PC with software installed via USB cable and can be adjusted by the driver configured for the USB port of the PC:

- USB data transfer driver.
- Serial port driver.
- Ethernet-over-USB driver.

Netview&Modem can also connect to the device via wireless connection – Bluetooth and Wi-Fi. Make sure you have the hardware application ready in your PC.

For more details, please see the Netview&Modem User Manual.

4.2. Mobile tools

JAVAD can connect to the TRIUMPH-3NR using a mobile application (with Android) using JAVAD Mobile Tools software.

For more details see the Mobile Tools information on JAVAD website www.javad.com.

5. RTK / Post-Processing Configuration

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 Rover.
- Set up the Rover receiver to begin collecting measurements data.
- Configure RTPK parameters and source for post-process surveying.
- Apply RTPK calculations for the measurements made with the Rover.

5.1. RTK Setup for Base and Rover

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&Modem Software Manual.

Parameter	Base	Rover
Implicit Message Output Period	15 seconds	15 seconds
Evaluation Mask angle	15 degrees	15 degrees
File name prefix	Enter a unique ID, such as the last 3 digits of receiver's serial number. By default, the prefix is log	
REC (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)

1. Connect the receiver and computer, start NetView&Modem and establish the connection as described above.
2. Click **Receiver>Parameters** on the left panel.
3. In the **General** tab check antenna status of the parameter **Antenna Input** to be **Internal** (External antenna input is not available for TRIUMPH-3NR).
4. Open the **Log files** tab and then **TriPad** tab and set the following parameters, click **Apply**.

Parameters

General | Log-Files | TriPad | Positioning | Base | Rover | Ports | Networking | Event | Advanced | IMU/Mag

File a | File b | File c (TRE3) | File d (TRE3) | File e (TRE3)

Current Log-file:

Number of Messages Enabled...:

Output Epochs Counters:

Implicit Message Output Period:

Elevation Mask for...:

Satellites Number Mask for...:

File Name Prefix:

Manage by AFRM/TriPad:

Implicit Message Set to Enable:

AFRM

File Rotation Mode:

File Rotation Running Counter:

Force File Rotation:

Enable Oldest Log-file Removal:

Scheduling Parameters

File rotation counter:

File Rotation Period:

File Rotation Phase:

File Push

File Push Mode:

File Push Suspend:

File Push Reset:

Version of jps2rin:

CGGTTS Converter Version:

Destination A	Destination B	Destination C	Destination D	Destination E	Destination F
File Push Host or IP Address: <input type="text" value="*192.168.2.1*"/>					
File Push IP Port: <input type="text" value="21"/>					
File Push User: <input type="text" value="*anonymous*"/>					
File Push Password: <input type="text" value="**"/>					
File Push Working Directory: <input type="text" value="*filepush*"/>					
File Push Timeout: <input type="text" value="600"/>					
Rinex Options: <input type="text"/>					
CGGTTS Options: <input type="text"/>					

Files for pushing: a b c d e

Push State

File Push Stage:

Other

Logging Period:

Figure 7: Parameters - Log Files

Parameters

General | Log-Files | TriPad | Positioning | Base | Rover | Ports | Networking | Event | Advanced | IMU/Mag

Function key

<FN> Push Behavior

<FN> Push Action:

Turn Data Recording On at...:

Appending Data to a Specific File:

<FN> Click Behavior

<FN> Click Action:

Initial Dynamic Mode:

Figure 8: Parameters - TriPad

5. Open the **Positioning** tab and set the Elevation mask (15° is recommended).

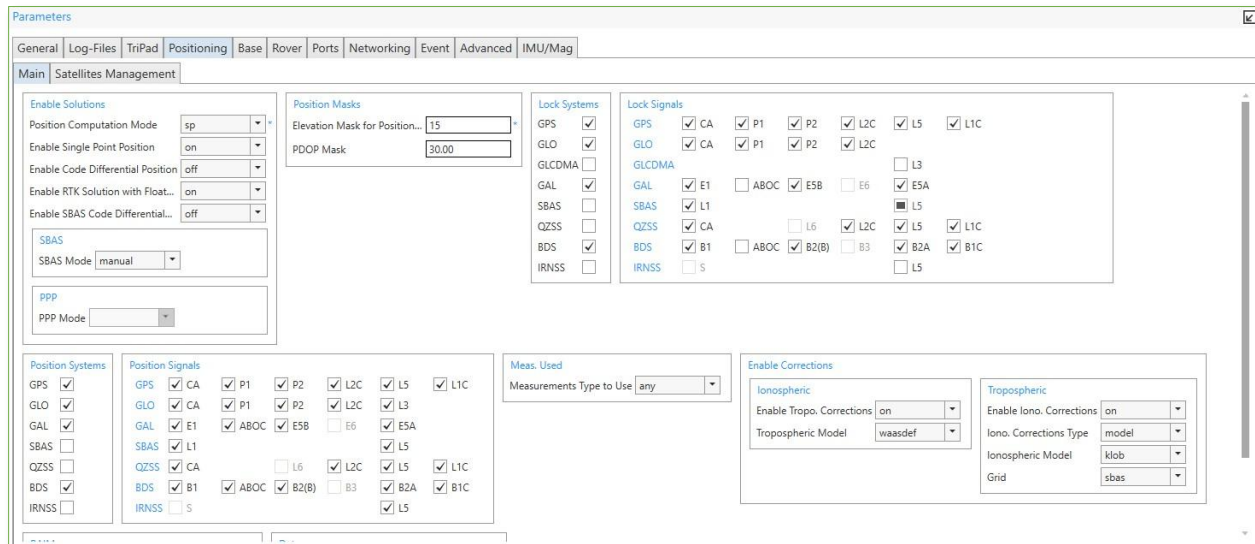


Figure 9: Parameters - Positioning - Elevation Mask

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.

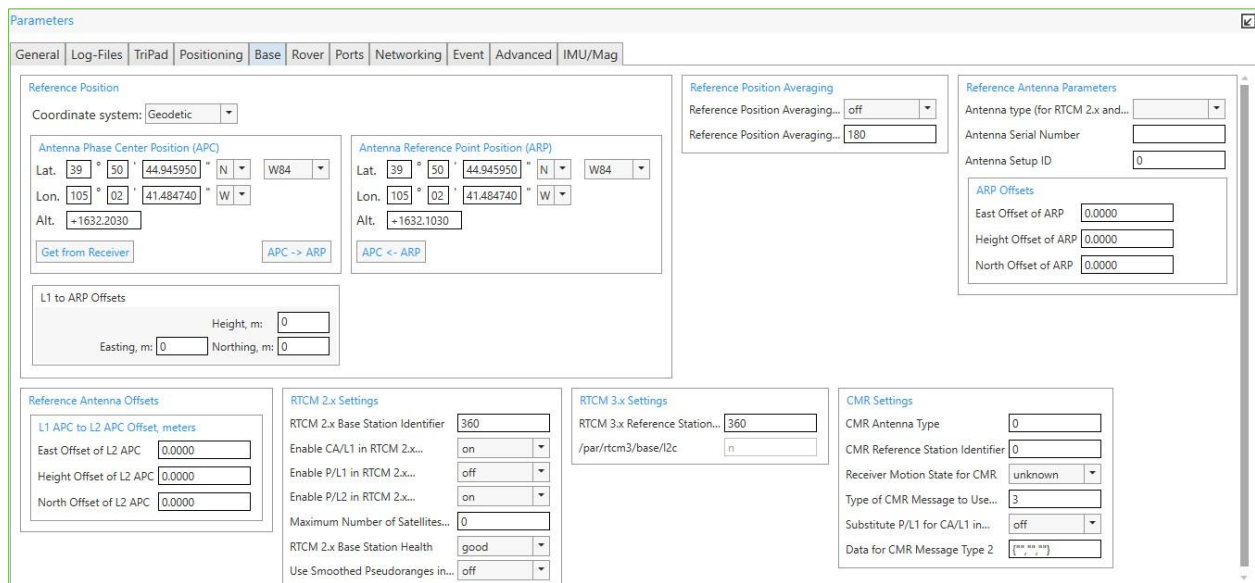


Figure 10: Parameters - Base

8. To set up the rover, open the **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
9. 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. **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.

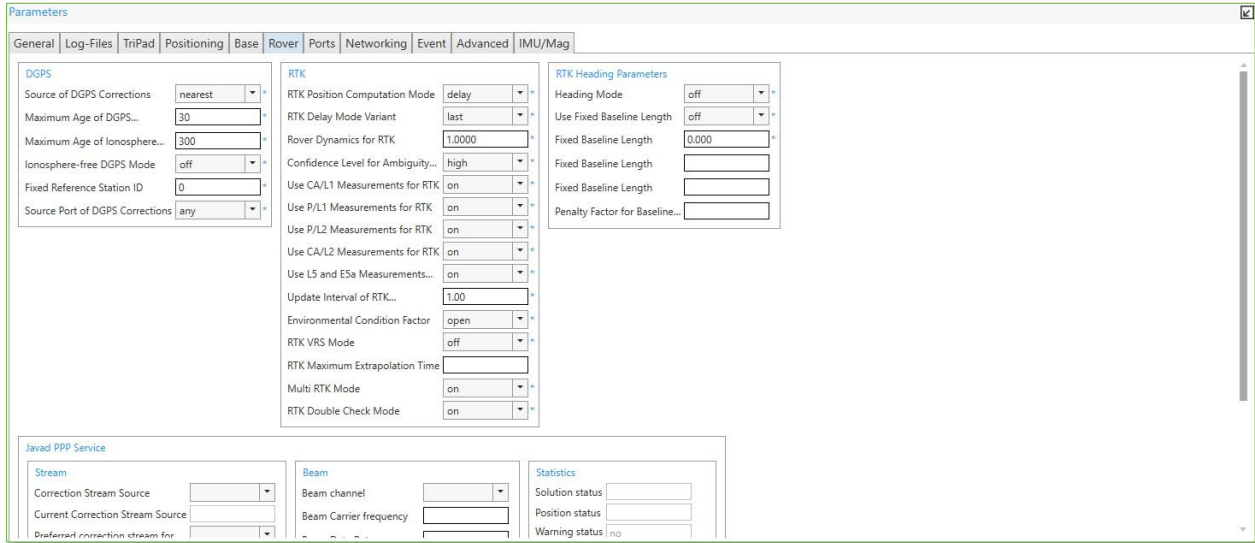


Figure 11: Parameters - Rover

10. For RTK survey, open the **Ports** tab and set up the parameters according to the table below, then click **Apply**.

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

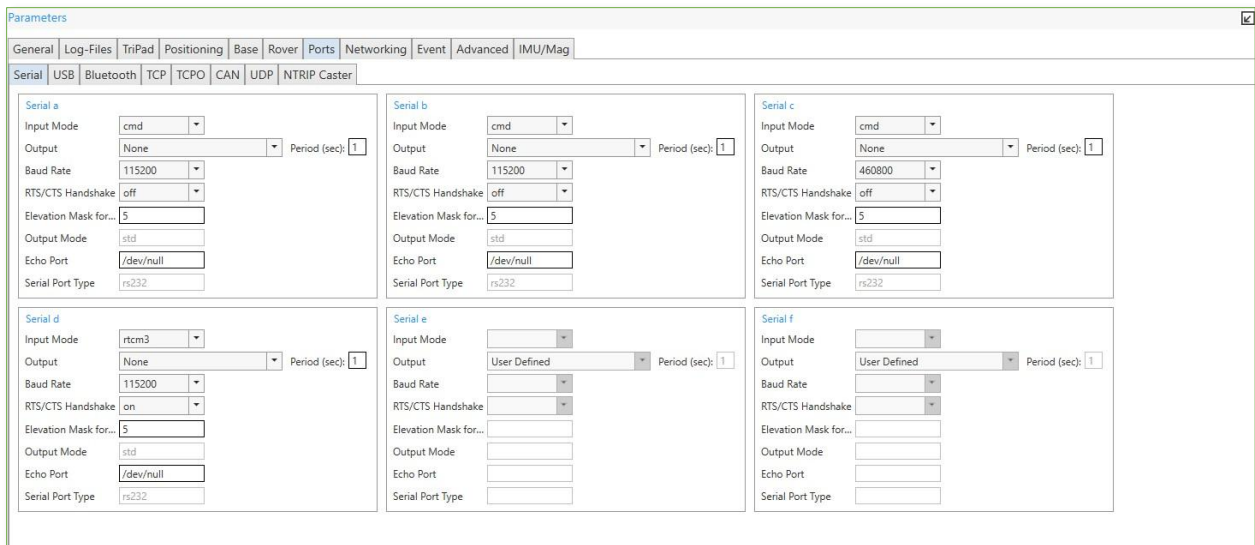


Figure 12: Parameters – Ports – Serial

Parameter	Base	Rover
Input	-	The same correction type as Base
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	Enable

11. Open **Advanced** tab, and then **Multipath Reduction** subtab. Activate **Code multipath reduction** on base and rover for DGPS mode. For RTK mode activate **Carrier multipath reduction** as well.

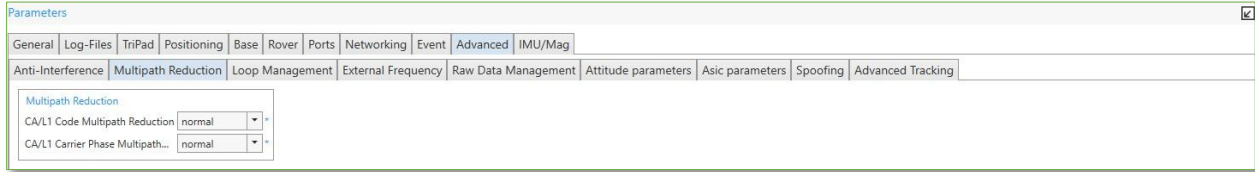


Figure 13: Parameters – Advanced – Multipath Reduction

12. 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 until changed or the NVRAM is cleared.

Note: For detailed description of settings and parameters, please see the NetView&Modem Software Manual.

6. Setup and Survey

After configuring the receivers for surveying, each receiver needs to be setup up and the receiver's height measured before 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.

6.1. 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 1/4 thread.
- **Slant** – measured from the marker to the lower edge of the antenna slant height measure mark (SHMM) located on the side panel of the receiver (green triangle).

The point to which surveying with GNSS measures is called the Antenna Phase Center (APC). 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 the difference in distance from the surface of the prism to the center of the object measured. For a GNSS antenna, the offset is entered depending on the type of measurement taken.

To prevent tilting of the receiver, you can use embedded IMU module, which determines deviations from the vertical (relative Earth surface) in real time.

For vertical, the offset is simply added to the measured vertical height to produce a "true" vertical height. For example, surveying poles can be set on specific height. In this case the "true" height will be summary of pole length set and adapter height (if you use one).

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 to the control point or marker edge, either the slant height or the vertical height.

6.2. Data Logging

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

- Turn on the receiver.
- Once the receiver has locked onto eight or more satellites the SAT light will green.
- The 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 onto 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 (FN) 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 button until all lights go out, then release.

6.3. Static Survey

Static surveying is a 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. 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.
- Satellite geometry (DOP).
- The antenna's location.
- The ionospheric activity levels.
- 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 is complete, data the receivers collect can be downloaded onto a computer and processed using post-processing software (for example, JAVAD GNSS Justin3).

6.4. Kinematic Survey

In a kinematic or a 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 the Power button.
- 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 Record (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 Record (FN) button for less than a second to collect the data in static mode for two to ten minutes.
- Repeat the two previous steps 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 Record (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.

6.5. RTK

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.

1. **Standalone** – where the receiver computes 3D coordinates in autonomous mode without using differential corrections.
2. **Differential (DGPS)** – where the Rover receiver computes the current relative coordinate in differential mode using only pseudo ranges.
3. **Float RTK** – 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.
4. **Fixed RTK**– 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).

6.6. File Maintenance

If post-processing the data after completing a task, the data in the receiver’s memory will need to be downloaded to a PC. Downloading and deleting files will also prepare the receiver’s memory for the next task. 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.

When measuring is complete, download the files to a PC for storage, post-processing, or backup. Also, the memory holds a finite amount of data, so downloading the files to a computer ensures that no data is lost or overwritten. Download files as soon as possible after collecting data at the jobsite.

- Connect your receiver and computer. Start NetView&Modem. Establish a connection between NetView&Modem and receiver.
- Click **Files** on the left panel. On the right panel appears the list of files, saved in receiver’s memory. Select the file(s) to download:

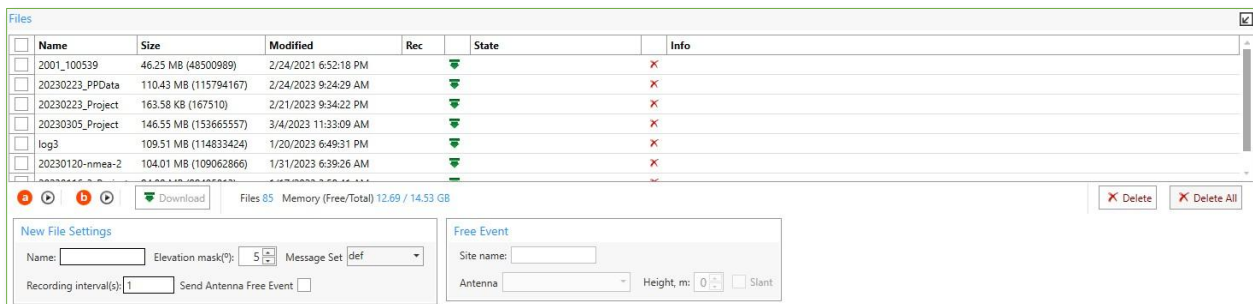


Figure 14: Downloading Files

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&Modem will delete the selected files.

7. Physical Dimensions

The TRIUMPH-3NR housing is made from lightweight armored plastic and covered from the bottom with magnesium bottom cover.

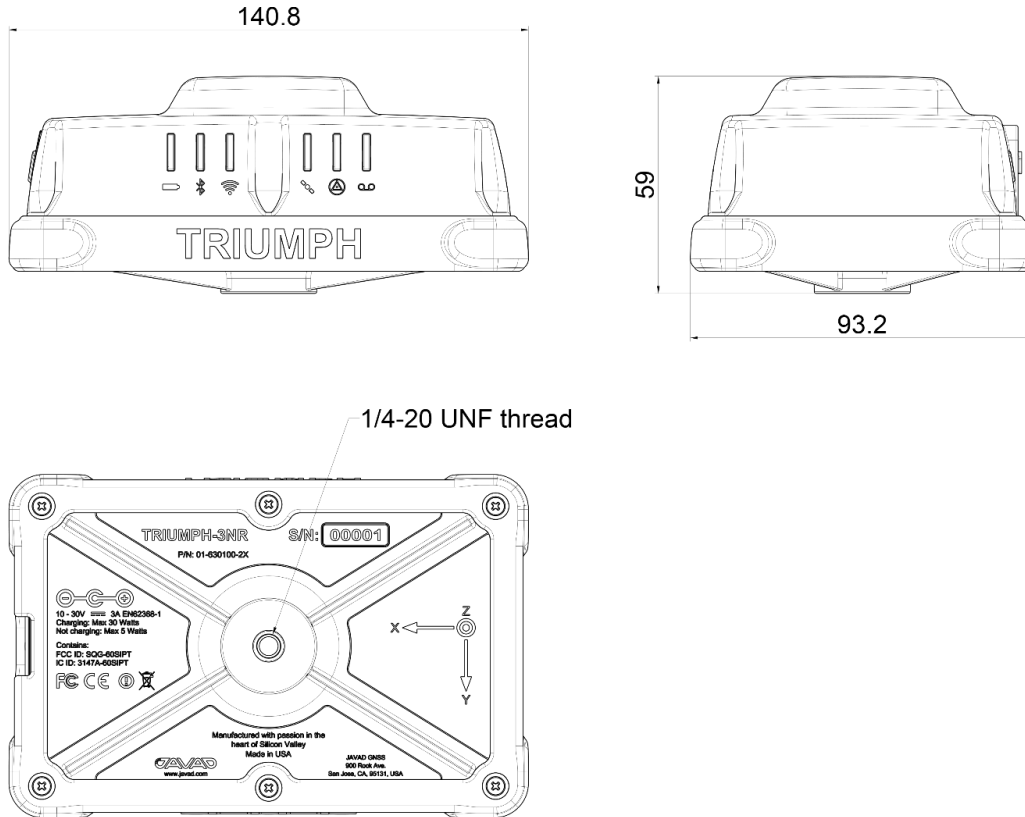


Figure 15: TRIUMPH-3NR - Physical Dimensions

8. Troubleshooting

This chapter will help diagnose and solve some common problems.

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

8.1. Prior to Contacting Support

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&Modem: Receiver name (on the left panel)4Actions 4Reset.
- Restore default settings using NetView&Modem Receiver name (on the left panel).
- Clear the NVRAM.

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

For NVRAM cleaning do the following:

- Turn the device off.
- Press and hold Record (FN) button.
- While Record (FN) button is held, press Power button for 1-2 seconds to turn the receiver on.
- Wait until both first and last LEDs turn green.
- In five seconds, both LEDs will blink orange.
- Release Record (FN) button while LEDs are blinking. Note that you have only five seconds while orange-blinking state is on to clean NVRAM.

8.2. FAQ

The following are some of the most common receiver problems.

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

- Connect your receiver and PC using a free port and start NetView&Modem.
- Change the Input for the port used for connection to “Command”.

The receiver does not lock on to satellites for a long period of time.

- Check current OAF options.
- Order a new OAF with the desired options activated to enable or extend validity of the corresponding receiver options. Contact your dealer or visit the JAVAD GNSS website for details.
- Refer to the NetView&Modem Software Manual for a detailed description of options.

The receiver tracks too few satellites

- The elevation mask value is too high.
- Lower 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 PC using a free port and start NetView&Modem.
- Click enable Multipath reduction and click Apply.
- Move to an area free of obstructions, if applicable.

The receiver cannot obtain Code Differential and/or RTK solutions.

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

The receiver is not configured as a Base or Rover.

- If the receiver should function as a Base, ensure it has the proper configuration.
- If the receiver should function as a Rover, ensure it has the proper configuration.
- The corresponding receiver options may be disabled or expired.
- Order a new OAF with the desired options activated to enable or extend validity of the corresponding receiver options. Contact your dealer or visit the JAVAD GNSS website for details.
- Refer to the NetView&Modem Software Manual for a detailed description of options.

There are not enough common satellites.

- In order to obtain a fixed solution, the Base and Rover should track at least five common satellites.
- Ensure that both the Rover and Base receivers use the same, and updated, almanac.
- Check the elevation masks of the Rover and Base receivers; they should be the same.

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&Modem.
- Click 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 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.
- The receiver's memory has no free space.
- Download and/or delete data files to free up space for new files.

9. Product Specifications – JAVAD TRIUMPH-3NR (T3-NR) GNSS Receiver

9.1. GNSS Performance

- **Number of Channels:** 874
- **Supported GNSS Constellations:**
 - **GPS:** L1 C/A, L1C (P+D), P1, P2, L2C (L+M), L5 (I+Q)
 - **GLONASS:** L1 C/A, P1, P2, L2C, L3 (I+Q)
 - **Galileo:** E1 (B+C), CBOC, E5A (I+Q), E5B (I+Q), AltBOC
 - **BeiDou:** B1, B1C (P+D), TMBOC, B2B (I+Q), B2, B2A (I+Q), AltBOC
 - **QZSS:** L1 C/A, L1C (P+D), L1S, L1Sb, L2C (L+M), L5 (I+Q), L5S
 - **SBAS:** L1, L5
 - **NavIC (IRNSS):** L5
 - **L-Band:** 1525–1560 MHz (for PPP support)

9.2. Positioning Accuracy

- **Mode:** Accuracy
- **Autonomous:** < 2 m
- **DGPS:** < 0.5 m
- **RTK: Horizontal:** 8 mm + 1 ppm
- **RTK: Vertical:** 15 mm + 1 ppm
- **Tilt-Compensated RTK:** RTK + 5 mm + 0.5 mm/° (up to 30° tilt)
- **Static / Fast Static:** Horizontal: 3 mm + 0.5 ppm
- **Vertical:** 5 mm + 0.4 ppm
- **JStar (PPP): Horizontal:** < 20 mm
- **JStar (PPP): Vertical:** < 40 mm

9.3. Time to First Fix

- **Cold Start:** < 35 seconds
- **Warm Start:** < 5 seconds
- **Reacquisition:** < 1 second

9.4. Antenna

- **Type:** Internal GNSS Antenna
- **Technology:** Microstrip (Zero-Centered)
- **Ground Plane:** Flat

9.5. Memory & Data Recording

- **Internal Memory:** 32 GB
- **Data Logging Rate:** Up to 100 Hz

9.6. Status Indicators & User Interface

9.6.1 LED Indicators:

- Battery / External Power
- Bluetooth
- Wi-Fi
- Satellites
- Position Mode
- Recording Status

9.6.2 Buttons:

- Power On/Off
- Recording On/Off

9.7. Interfaces & Connectivity

- **USB:** USB Host / Device, USB 2.0, Micro-B
- **Wi-Fi:** Dual Band 2.4 & 5 GHz, IEEE 802.11 ac/a/b/g/n
- **Bluetooth:** Version 5.1, Class 2

9.8. Power System

- **Internal Battery:** Rechargeable Li-Ion (63.7 Wh)
- **Battery Charger:** Integrated
- **Battery Life:** Up to 25 hours of operation
- **External Power Input:** 10–30 V DC via 3.5 mm jack

9.9. Physical & Environmental Characteristics

- **Material:** Ruggedized Plastic Cover with Metal Base
- **Dimensions:** 132 × 85 × 61 mm (5.20 × 3.34 × 2.40 in)
- **Weight:** 0.63 kg (1.39 lbs)
- **Operating Temperature:** –40°C to +60°C (–40°F to +140°F)
- **Storage Temperature:** –45°C to +85°C (–49°F to +185°F)
- **Humidity:** 100% Condensing
- **Ingress Protection:** IP68 (Dust-tight, waterproof submersion >1 m)

10. Appendix A: Shock Resistance and Durability

The **TRIUMPH-3NR GNSS Receiver** is meticulously engineered to deliver optimal performance in demanding field environments. Its rugged construction, military-grade certifications, and ingress protection ensure reliability in challenging survey and geospatial operations.

10.1. Drop Test Certification

- The TRIUMPH-3NR has been subjected to stringent drop testing to replicate real-world field scenarios:
- **Test Height:** 2 meters
- **Surface Type:** Hard surface (e.g., concrete or stone)
- **Test Method:** Vertical drop from standard survey pole height
- **Result:** No functional or structural damage; device remained operational after multiple impacts
- This test simulates accidental drops during field use, ensuring the receiver withstands day-to-day handling hazards.

10.2. MIL-STD Environmental Compliance

- To further validate its durability, the TRIUMPH-3NR complies with U.S. military environmental testing standards:
- **MIL-STD-810G Method 516.6 (Shock):**
Demonstrates resistance to mechanical shock from drops, impacts, and handling stresses.
- **MIL-STD-810F Method 514.5 (Vibration):**
Verifies the receiver's performance during transport and usage on vehicles or unstable surfaces.
- **MIL-STD-810H Method 514.8 (Updated Vibration):**
Confirms enhanced durability under modern vibration conditions including helicopter, vehicle, and operational deployment vibrations.
- These standards ensure the receiver remains accurate and stable in environments prone to intense mechanical stress.

10.3. Ingress Protection (IP Rating)

- The TRIUMPH-3NR is certified to **IP68**, indicating superior protection against environmental factors:
- **Dust Protection:**
Complete protection against dust ingress, ensuring internal components remain uncontaminated.
- **Water Resistance:**
Capable of withstanding submersion in water up to **1.5 meters for 30 minutes**, making it ideal for operations in heavy rain, mud, shallow water, or flooding conditions

11. Appendix B: Supported Correction Formats

The **TRIUMPH-3NR GNSS Receiver** supports a comprehensive range of correction data formats for both **real-time** and **post-processing** applications. These correction types are essential for achieving **high-precision positioning** in RTK (Real-Time Kinematic) and differential GNSS survey modes.

11.1 Real-Time Kinematic (RTK) Correction Support

- The following correction formats are supported for **transmitting** and **receiving** data over radio links or network interfaces:

• Correction Type	• Description
• RTCM 3.x MSM3	• Modernized State-Space Messages, Level 3
• RTCM 3.x MSM4 (Short)	• Optimized for minimal bandwidth usage
• RTCM 3.x MSM4	• Full MSM4 data
• RTCM 3.0 Minimal (GPS+GLO only)	• Basic support for GPS and GLONASS
• RTCM 3.0 Full	• Full GPS/GLO data
• RTCM 2.0 Full	• Legacy differential corrections
• RTCM 2.0 Corrs. Only	• Code-phase correction only
• RTCM 2.x DGPS Full	• Full legacy DGPS message support
• RTCM 2.x DGPS Partial	• Subset of RTCM 2.x DGPS formats
• JPS Full	• JAVAD proprietary full message set
• JPS Minimal	• JAVAD minimal message set
• CMR	• Trimble proprietary correction format
• CMR+	• Extended CMR with additional GNSS data

11.2 Input/Output Configuration Options

- Users can configure the receiver to **accept** or **broadcast** these correction formats using the following interfaces:
 - **Serial ports**
 - **USB**
 - **Bluetooth**
 - **TCP/IP**
- Configuration can be performed via:
 - **NetView & Modem software**
 - **JMT (Javad Mobile Tools)**
- The receiver supports **mixed-mode operation**, allowing base and rover roles to use different protocols simultaneously.

11.3 Applications and Compatibility

- Fully compatible with:
- External GNSS post-processing software
- National or private **CORS** networks
- Third-party **radio modems**
- Correction formats can be **enabled or switched** through user interface settings under **Port Settings** in NetView & Modem or JMT.