GNSS Diagnostics

AGRICULTURE

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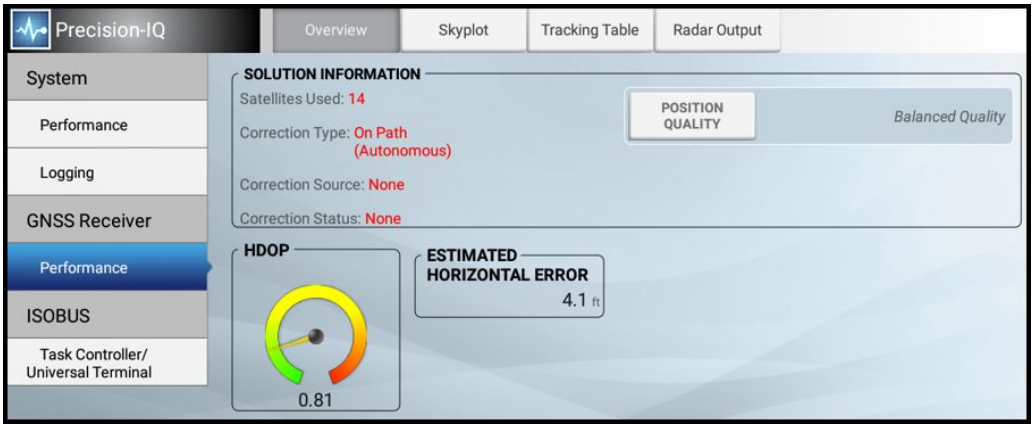
TRIMBLE RESELLER CONFIDENTIAL

GNSS Diagnostics

From the Precision-IQ activity bar, tap the **Diagnostics** icon to display the Diagnostics screen. On the Diagnostics screen, tap **Performance** under GNSS Receiver to display overview details about the GNSS connection:



For information on GNSS connectivity, see Correction Services Supported by Precision-IQ.

CAUTION!

The GNSS antenna may experience interference if you operate the vehicle within 100 m (300 ft) of any power line, radar dish, or cell phone tower.

GNSS Diagnostics Contents		
Overview	GNSS Troubleshooting	
Skyplot	• Conditions Affecting GNSS Accuracy • Poor Accuracy (Multipath) • Intermittent Loss of Lock on Satellite • Loss of Initialization	• Not Tracking RTK Corrections • Poor Signal/Not Receiving a Clear Signal • The Receiver is Not Tracking Any Satellites
Tracking Table		
Radar Output		

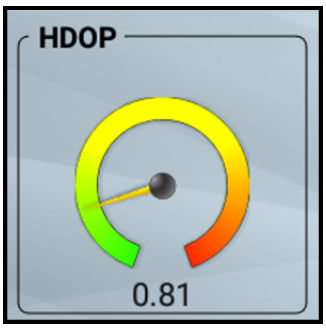
Overview

On the Overview tab, the following GNSS details are provided:

Solution Information

- **Satellites used:** Indicates number of satellites currently being used.
- **Correction Type:** The correction service indicated at setup.
- **Correction Source:** Modem, satellite / fast, satellite /SBAS.
- **Correction Status:** Fixed, Float or xFill.
- **Position Quality:** Tap to change. Favor accuracy, balance quality or favor availability.

HDOP (Horizontal Dilution of Precision)



This image indicates:

- Good (green): <1
- Moderate (yellow): 1 - 3
- Poor (red): >3

Estimated Horizontal Error

Current value in feet/inches or meters/centimeters

Additional Diagnostics	Description
Correction Age	• Good (green): <5 • Moderate (yellow) 5 - 10 • Poor (red) >10
Iono Scintillation	Amount of scintillation in the ionosphere: • Good (green): <2 • Moderate (yellow): 2.0 - 4.0 • Poor (red): >4.0
Max Correction Age	Shows highest value over the last 100 seconds
Cell Signal Strength	Strength of cell signal
CMR %	Shows current CMR percentage
Cell Data Packets	Shows the amount of packets sent and received

Send/Received	
VDOP	Vertical Dilution of Precision: ● Good (green): <2 ● Moderate (yellow): 2- 6 ● Poor (red): >6
ANTENNA	Connection is on (green checkmark) or off (red X).
Correction Status	Status of the correction
Subscription Status	Shows date the subscription ends

Skyplot

Tap **Skyplot** to view the number of satellites nearest to your position:

This screen shows satellites used and unused from all supported GNSS constellations.

Tracking Table

Tap the **Tracking Table** tab for location and connection details for all used and unused satellites from supported GNSS constellations.

Radar Output

Tap the **Radar Output** tab for details on adjusting the radar output frequency.

GNSS Troubleshooting

Refer to the following troubleshooting details:

Conditions Affecting GNSS Accuracy

The GNSS positioning method influences the accuracy of the GNSS position reflected in your GNSS receiver. Additionally, the following conditions can affect GNSS accuracy.

Condition	Description
Atmospheric effects	GNSS signals are degraded as they travel through the ionosphere. The error introduced is in the range of 10 meters. The error is removed by using a differential or RTK positioning method.
Number of satellites used	To calculate a 3D position (latitude and longitude, altitude, and time), four or more satellites must be visible. To calculate a 2D position (latitude and longitude, and time), three or more satellites must be visible. For RTK positioning, five satellites are needed for initialization. Once initialized, four or more satellites provide RTK positions. The number of visible satellites constantly changes and is typically in the range 5 through 9. The receiver can track up to 44 satellites simultaneously.
Condition Explanation	Maximum PDOP Position Dilution of Precision (PDOP) is a unitless, computed measurement of the geometry of satellites above the current location of the receiver. A low PDOP means that the positioning of satellites in the sky is good, and therefore good positional accuracy is obtained.
Signal-to-noise ratio	Signal-to-noise ratio (SNR) is a measure of the signal strength against electrical background noise. A high SNR gives better accuracy. SNR can be degraded by other electronic equipment operating nearby, including transmitters, cell phones, or data modems. It may also be degraded by solar flares and changing atmospheric conditions.
Minimum elevation	Satellites that are low on the horizon typically produce weak and noisy signals and are more difficult for the receiver to track. Satellites below the minimum elevation angle are not tracked.
Multipath environment	Multipath errors are caused when GNSS signals are reflected off nearby objects and reach the receiver by two or more different paths.
RTK Base station coordinate accuracy	For RTK positioning, it is important to know the base station coordinates accurately. Any error in the position of the base station affects the position of the rover; every 10 m of error in a base station coordinate can introduce up to 1 ppm scale error on every measured baseline. For example, an error of 10 m in the base station position produces an error of 10 mm over a 10 km baseline to the rover. For more information about how to make sure the position of your base station is accurate, refer to the manual for your base station receiver.
Multiple RTK base stations	If you are using several base stations to provide RTK corrections to a large site area, all base stations must be coordinated relative to one another. If they are not, the absolute positions at the rover will be in error. For more information about how to use several base stations to cover your site, contact your local Trimble Reseller.

Poor Accuracy (Multipath)

Poor accuracy can be due to GNSS signals reflecting off nearby trees and/or metal buildings and horizontal surfaces. (Reflection is also called multipath.)

To reduce multipath noise, mount the GNSS receiver so that it has a clear view of the sky. The receiver must be away from trees and large metal objects.

Intermittent Loss of Lock on Satellite

- The receiver loses the satellite signal from time to time: Make sure that the receiver is mounted on the highest point of the vehicle and is clear of metal surfaces.
- Signal takes a long time to initialize:
    - In RTK mode, longer baselines require longer initialization times. (The baseline is the distance between the base receiver and the rover receivers.)
    - Wait for the receiver to initialize or consider repositioning the base receiver to shorten the baseline. Make sure the rover receiver is in a clear area.

Loss of Initialization

In RTK mode initialization can be lost when the rover receiver is close to trees or buildings and the number of satellites falls below four. Additionally, initialization may be lost if the receiver has not been tracking RTK corrections for some time.

- Move away from trees and obstructions to initialize. Once initialized, approach the obstructed area again. If the obstructions are severe, GNSS positioning may not work in that area.
- Because the GNSS satellites move, there may be times of the day when you are working in an area with obstructions.

Not Tracking RTK Corrections

The radio link is down or intermittent. Ensure that:

- The line-of-sight between the base and rover receivers is not obstructed.
- The rover receiver is within range of the radio.
- The radio power supply is on.

Poor Signal/Not Receiving a Clear Signal

Problem	Resolution
Interference from 2-way radios	Transmitting FM 2-way radios can interfere with WAAS and GNSS signal reception. Make sure that there is at least 1 m (3 ft) between the FM 2-way radio antenna and the receiver.
Vehicle issues	An unshielded ignition system can cause enough noise to block reception of a differential signal. Use resistor spark plug wires on the vehicle ignition system. An alternator can cause noise that interferes with a differential signal. **Note:** Before replacing engine parts in an attempt to solve this problem, make sure that the problem is not caused by a computer or power source near the receiver. Some computers and their power sources cause noise that disrupts GNSS and satellite DGNSS signals. Possible solutions include: ● Use bypass capacitors, commonly available in automotive stores for cleaning up interference to CB and other radios. If the problem persists, shield engine components with aluminum foil. ● Relocate the antenna on the machine. Determine the optimal antenna location.
GNSS receiver issues	**Mounting location:** The receiver may not be picking up a clear signal due to mounting location. Mount the receiver on the centerline of the vehicle, away from any sources of interference and with a clear view of the sky. **Cable problems:** Use an ohmmeter to check the cable. The resistance of a good cable between connector pins at each end of the cable is zero. If the cable is sound, but the problem persists, try exchanging the cable with one that you know is working. If the cable is defective, contact your local Trimble Reseller for an RMA number (if the Trimble product is still under warranty), or to purchase a replacement cable. **Battery:** A lithium-ion battery in the receiver powers the internal real-time clock. This clock enables the receiver to get an initial fix faster. The battery has a life of 7.5 years. When the battery fails, the internal clock cannot keep accurate time and the receiver may take longer to output GNSS positions. Please contact your local Trimble Reseller to get the batteries replaced. You cannot replace the battery yourself.

The Receiver is Not Tracking Any Satellites

Possible Cause	Solution
The GNSS antenna does not have clear line of sight to the sky.	Ensure the antenna has a clear line of sight.
The cable between the receiver and the GNSS antenna is damaged.	Replace the cable.
The cable connections at receiver or antenna are not tightly seated, or are connected incorrectly.	Check all cable connections.

For More Information

Contact your local Trimble Regional Sales Manager.