Customer FAQ

TRIMBLE GEOSPATIAL DIVISION

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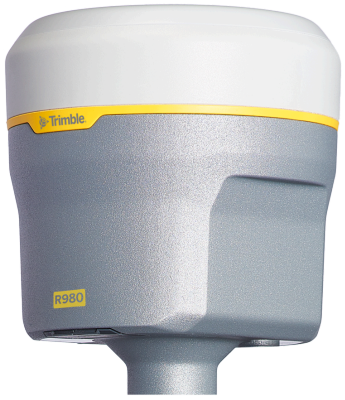
TRIMBLE R980 GNSS SYSTEM

General



What are the differences between the R980 and the R12i?

The Trimble R12i only had a 450 MHz UHF radio, while the Trimble R980 delivers both a 450 AND a 900 MHz radio in one neat package that can be controlled and changed by the user (only available in regions where 900 MHz radios are allowed).

The R12i has a 3.5G cellular modem, while the R980 has a 4G LTE cellular modem.

The R12i has 6 GB of internal memory versus 9 GB in the R980.

Does the R980 come with IonoGuard?

Yes, Trimble IonoGuard™ is included with no additional charge.

Does the R980 come with a one-year Trimble RTX® corrections service subscription?

Yes, the R980 comes with a 12-month Trimble CenterPoint® RTX correction service subscription included and activated at purchase.

Does the R980 work with only a Trimble Access subscription OR perpetual Trimble Access, or both?

The R980 supports all Trimble Access™ field software versions from 2024.00 or later.

https://geospatial.trimble.com

Radio

Can I get the dual-band radio feature in my country?

The dual-band radio feature is enabled or disabled in the receiver setup, but only available in the following countries where 900 MHz is allowed by radio authorities: United States, Australia, Canada and New Zealand.

Does the dual-band model come with two antennas; one for 450 MHz and one for 900 MHz?

The dual-band model of R980 comes with a single antenna that is capable of transmitting and receiving on both 450 and 900 MHz frequencies. There is no need to change the antenna when switching frequencies.

Can the dual-band radio send/receive 450 and 900 simultaneously?

No, the radio uses one band at a time.

Modem

What cellular modem is in the Trimble R980?

The Trimble R10, R12 and R12i GNSS receivers have a 3.5G cellular modem. The R980 has been upgraded to a global 4G LTE cellular modem. 4G networks across the globe are more common and more expansive than any other network type. They also provide more than adequate data transfer for GNSS users who are utilizing VRS or IBSS (Internet Base Station Service) survey types.

Do I need my own SIM Card?

Yes, you will need your own SIM Card that is the standard SIM card size (not micro or nano). Please check with providers in your region.

Can the R980 support 2G service?

The modem supports GSM bands for 2G fallback.

Trimble TIP / IMU-Tilt

What is the R980 TIP integrity monitor?

The Integrity Monitor is a component of the Trimble Inertial Platform™ (TIP) that continuously monitors the IMU Sensor for excessive bias. It will warn the R980 user (through Trimble Access) if excessive bias has been detected and if the receiver needs to be restarted or an in-field re-calibration should be conducted.

What is the difference between a topo point measurement taken with IMU tilt functions enabled and one taken using GNSS-only (i.e. IMU disabled)?

A topo point measurement taken with GNSS-only, i.e. with IMU-tilt functions disabled, produces a solution with a static converging antenna phase center (APC), meaning that the solution quality will improve with time if the system is left to collect static measurements. With IMU-tilt functions enabled, the topo point measurement method doesn't produce a converging static APC position. Therefore, users attempting to achieve the best possible measurement precision, particularly in challenging GNSS environments, should disable IMU-tilt functions and measure using GNSS only.

What is the maximum recommended tilt angle with Trimble TIP technology?

There is no hard limit on the allowable tilt angle with Trimble TIP™ technology. As a result, the primary limiting factor when taking tilted measurements is GNSS satellite reception. If the receiver is tilted such that GNSS signal reception is inhibited then the solution quality will begin to degrade. Users should always exercise caution when measuring points with tilt angles >30°.

I encountered an IMU bias error in Trimble Access. What does this mean for my system?

IMU sensor bias, measured in mG for accelerometers and degrees/hour for gyroscopes, is an inherent source of error affecting any IMU. The Trimble R980 IMU sensor biases are precisely determined for each individual sensor in the factory through a calibration process, allowing for exceptional performance right out of the box. However, IMU biases can and do change over the life of the sensor due to three principal causes: aging, temperature, and physical shock. Trimble TIP technology constantly re-estimates the IMU sensor biases as part of the extended position and attitude solution, so gradual changes in the bias values are not an issue. However, if any of the IMU biases should increase, for whatever reason, beyond a set threshold then the receiver will send a message to Trimble Access field software indicating that the sensor biases need to be rebaselined. At this point, the user can either disable IMU tilt functions and continue to work with RTK GNSS only, or complete a simple calibration procedure to re-baseline the sensor bias values. Once the

sensor bias values have been reset, the user will be able to resume working with IMU tilt functions enabled. If the problem persists, contact your Trimble distributor.

Why does the tilted positioning performance specification have both constant and tilt-dependent components?

The positioning performance specification for TIP tilted surveying has a constant component to account for the effect of residual error in the alignment between the IMU and the receiver housing, which is precisely determined in manufacturing, and a tilt-dependent component which accounts for the effect of uncertainty in the IMU heading or azimuth within the GNSS reference frame. The value of 5 mm for the constant component is the largest potential error that would be anticipated, assuming that the receiver is mounted on a 2 meter fixed-length survey pole and quick release adapter which are mechanically straight, although manufacturing data suggests that most receivers will exhibit less than 5 millimeters of error due to IMU misalignment. The tilt-dependent component grows with increasing tilt angle due to the fact that the IMU heading uncertainty will contribute more to the horizontal pole tip position uncertainty the more the tilt angle grows. This is the reason that the allowable tilt angle with the Trimble R12 and R10 receivers, which use a less precise magnetometer to determine heading, is limited to 15°, whereas the R12i supports tilt angles of 30° or more. However, because the heading precision is a function of the overall solution quality, the value of 0.4 mm/° of tilt assumes a benign GNSS environment and a well-aligned GNSS+IMU solution.

Why is only the horizontal performance specified for Trimble TIP technology?

The reason that horizontal positioning performance is specified for Trimble TIP technology, while vertical positioning performance is not, is that the vertical position is not a function of the IMU heading (or azimuth), which will always be the least precise element of the attitude solution. The tilt magnitude (pitch & roll), by contrast, is relatively simple to observe directly and to a good degree of precision, meaning that the effect on vertical positioning performance is essentially negligible.

Which types of RTK GNSS corrections support Trimble TIP technology?

Trimble TIP technology is supported with most real-time corrections types for survey: single baseline (SBL), whether delivered via UHF or IP; Trimble VRS network RTK; Trimble xFill®, which bridges gaps in the primary RTK correction stream; and, Trimble CenterPoint RTX, which provides RTK-level positioning performance worldwide with no need for a local base station or cellular network coverage.

Why is the Observed Control Point measurement method not supported with IMU tilt functions enabled?

The Observed Control Point method is usually employed when the best possible measurement results are required. Since there will always be some amount of additional error when using TIP tilt compensation technology vs. using GNSS-only and plumbing the pole, the decision was made when designing the measurement workflows to limit support for tilt compensation to the Topo and Rapid point measurement methods. In order to make transitioning between Observed Control Point and other measurement methods as seamless as possible, the system was implemented in such a way that the IMU alignment is preserved when measuring an Observed Control Point, which allows the user to resume measuring or staking out points with tilt compensation enabled without the need to realign the IMU.

What is the process to begin using IMU tilt functions after starting a survey?

To begin using IMU tilt compensation after starting a survey with real-time GNSS corrections, all that is necessary is to provide the system with sufficient motion, i.e. IMU sensor data, to compute a full position and attitude solution, often referred to as "alignment". This is generally a straightforward process that happens automatically while the user moves to their first point, but the user can also align the system on the spot by providing sufficient motion in the form of displacement and rotation. There are multiple indicators in the Trimble Access user interface that tell the user when the system is aligned.

Are IMU tilt functions supported with post-processed kinematic (PPK) surveys?

No. Because Trimble TIP technology relies on having a precisely aligned GNSS+IMU solution in order to provide accurate results when the survey pole is tilted, it is not practical to assume that the system will have sufficient sensor data to provide reliable post-processed kinematic survey results. The Trimble R980 does still support PPK surveys performed with the survey pole held plumb in the traditional manner.

Is the R980 capable of outputting heading information for use with other software?

At this time there is no open data format which supports heading output from the R980.

What are the different eBubble calibration methods and in what circumstances should one be chosen over the other?

With the Trimble R980, there are now two eBubble calibration methods: calibrate to vial and calibrate to IMU. Calibrate to vial is the same calibration method that has been in use since the

launch of the Trimble R10. This method requires a well-calibrated level reference, such as a tribrach, to align the tilt sensor with the local gravity vector. Calibrate to IMU is a new method which allows the eBubble to be calibrated to the vertical vector from the INS solution. The calibration process is the same in practice, but an aligned RTK+IMU solution is needed before the calibration can be performed. Calibrating the eBubble to the IMU has the advantage of not requiring a level reference, allowing a user who is out on the jobsite to calibrate their system's eBubble without any special tools. Calibrating the eBubble to the IMU is also recommended when employing a Pole Bias Adjustment, as this will align the eBubble to the adjusted vertical such that points measured with GNSS-only will be corrected for pole bias. If the eBubble is calibrated to the IMU because a Pole Bias Adjustment has been applied, it is important to remember that the calibration is **only** valid for that particular receiver/pole/quick release adapter combination and that a new eBubble calibration must be performed if **any** of these system components are changed.

What is the purpose of the Pole Bias Adjustment, when should it be performed, and what type of results can be achieved?

The purpose of the Pole Bias Adjustment (PBA) is to correct for position errors caused by gross mechanical misalignment in a particular survey pole and quick release adapter combination when used in conjunction with an R980 receiver utilizing TIP. If there is sufficient deflection from vertical along the length of the survey pole the result will be a discrepancy between the computed pole tip position and the position of the physical pole tip, which can be easily observed by measuring the same point on the ground in two orientations 180° apart. This simple concept forms the basis of the Pole Bias Adjustment procedure, which uses a series of measurements in two orientations separated by 180° to compute roll and pitch angle corrections which can then be applied to the computed pole tip position to bring it into alignment with the physical pole tip position (within the level of RTK noise). A Pole Bias Adjustment should therefore only be performed if there is reason to believe that the survey pole and quick release adapter combination being used is not straight along its entire length. It follows also that a PBA is only valid for a particular survey pole and quick release adapter combination. If the pole and/or quick release adapter is changed at any point then the PBA should be cleared and a new set of correction values determined, if necessary.

It is important to note that PBA corrections **cannot** be "backed out" or removed from points once they've been stored. It must also be emphasized that the PBA is not a means of completely removing the additional error that comes along with TIP tilt compensation, as the procedure will only ever be able to resolve the corrections to the level of RTK noise, or about 4 millimeters. For this reason, it is suggested that PBA correction values smaller than 5 millimeters can be discarded, while values of 5-10 millimeters should be accepted in order to achieve repeatable results no matter which way the receiver is oriented when measuring a point. Correction values greater than 10 mm should serve as a warning that the survey pole and quick release adapter combination

being used may have significant mechanical deflection from vertical and should therefore be treated with caution.

What is the effect of changing the antenna height after a point has been stored?

While not an obvious consideration, the pole length (or antenna height) factors into the estimated system attitude when IMU tilt compensation is enabled. This is why, for example, the IMU alignment is invalidated if the antenna height is changed during the course of a survey. What this means is that, by changing the antenna height after a point has been stored, there will still be some additional position error—proportional to the tilt angle—which cannot be entirely accounted for. If any critical points have been measured or staked out while using IMU tilt compensation with an incorrect antenna height it is advisable to return to those points to verify that the results meet the accuracy requirements for the job.

Why is it recommended to use a two-piece, fixed-length range pole with the R980?

It is recommended to use a two-piece, fixed length range pole with the Trimble R980 in order to minimize the potential for position errors caused by mechanical deflection in the pole. Recall that any misalignment between the IMU and the receiver body will result in a separation between the computed pole tip position and the physical pole tip, so every effort should be made to minimize the potential for such errors in order to achieve the most accurate and repeatable measurement results.

Does the R980 with IMU enabled produce a pole tip solution or an APC solution?

With TIP tilt compensation enabled, the R980 will provide a position solution for the pole tip. The lone exception is when the user selects the Observed Control Point measurement method. In this unique situation, the receiver will output the position of the APC, allowing Trimble Access to calculate the position of the pole tip by subtracting the pole length (plus APC offset), thereby eliminating the IMU from the equation. Of course, this only works when the pole can be assumed to be perfectly plumb, which is why Trimble Access reminds the user to level the system when measuring an Observed Control Point with IMU tilt compensation enabled.

Why is a pole tip solution better to use for setting out compared to an APC solution?

The main advantages of staking out points with a pole tip solution rather than an APC solution are that it is faster and that it is much less fatiguing for the user. Not only does the process of iteratively minimizing the stakeout deltas take more time than directly navigating the pole tip to the design point, but it can be a tiresome process for the surveyor, particularly on jobs that involve a lot of

staking. Of all the ways in which the Trimble R980 with TIP technology saves the user time and effort in the field, these benefits are perhaps most significant when it comes to stakeout.

Will the R980 get an RTK initialization without an IMU alignment?

While the R980 technically has the ability to provide the antenna phase center (APC) position solution while TIP tilt compensation is enabled, which is what the system does when switching from topo or rapid point methods to the observed control point method, the APC position is not otherwise reported unless IMU tilt compensation is disabled.

What is an IMU alignment?

IMU alignment refers to the process by which the IMU reference frame (often referred to as the body frame) is aligned with the GNSS reference frame (also referred to as the datum). Once this process is complete, it is possible to directly obtain the position of the pole tip within the GNSS reference frame given that the IMU-pole tip lever arm is known in the IMU reference frame. With the Trimble R980, this process is completed automatically once the receiver has real-time GNSS corrections and sufficient IMU data input (motion) to compute a position and attitude solution.

What makes the receiver lose the alignment and what do I have to do to re-align the sensor?

The Trimble R980 will generally only lose alignment when the GNSS environment becomes sufficiently degraded to affect the system's ability to maintain its position solution. In these situations, the alignment will usually improve sufficiently for the system to resume performing precise tilt compensation once the user moves into a less hostile GNSS environment. One benefit of Trimble TIP technology relative to its competitors is that the system will detect if the pole tip becomes static and will freeze the heading alignment until the system moves again. What this means is that the user is free to set their system aside while performing another task and as long as the receiver maintains good GNSS satellite reception the system will still be aligned when the user picks up the system to resume their work.

Can I still use the eBubble?

Yes. The eBubble remains an integral feature of the R980 when being used in GNSS-only mode. The eBubble will automatically disappear from view when IMU tilt functions are enabled and will likewise automatically appear when IMU tilt functions are enabled or when the Observed Control Point method is selected when measuring points with IMU tilt compensation enabled.

Bias monitoring – how are age, shock and temperature being monitored and at what ranges?

As we've discussed, the inherent biases in the three accelerometers and three gyroscopes that comprise the IMU can and will change over the life of the receiver. These changes can be caused by physical shock, changes in temperature, and sensor aging. Rather than looking at the cause of IMU bias changes, Trimble TIP technology continually re-estimates the sensor biases as part of the position and attitude solution and monitors for large changes, which can have an impact on the overall solution quality if left unaddressed. A sufficiently large change in any of the bias values will trigger a bias alert, prompting the user to take action to recover the system.

Does the orientation of the R980 matter when performing a stakeout with the IMU enabled?

As long as the survey pole and quick release adapter are in good condition, meaning that any discrepancy between the computed pole tip position and the physical pole tip position will be minimal, then the orientation of the R980 will not matter when staking out points with tilt compensation enabled. However, it is important to remember that the receiver needs to be oriented with the LED panel facing the user in order for the graphical stakeout screen and the rover heading in the map screen to match with the user's orientation in their environment.

Configurations

If I purchased a subscription R980, can I be upgraded to a perpetual configuration at a later time?

Yes - you can buy/use a perpetual configuration after using a subscription configuration.

If I bought a LT or lite configuration, can I buy IMU-tilt?

Yes, you can buy upgradeable options: Tilt, Base, Rover, xFill.

I have a subscription configuration, can I purchase an upgrade after 6 months?

No, the subscription configuration does not have the capability to upgrade mid-term. If you wish to upgrade you will need to at the point of subscription rollover.

Is an R980 subscription connected to my Trimble ID or the receiver's serial number?

The subscription configuration of an R980 is aligned with the receiver's serial number.

For more information

For more information contact your local authorized Trimble distributor.

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