This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

This product has been tested and found to comply with the requirements for a Class B device pursuant to European Council Directive 89/336/EEC on EMC, thereby satisfying the requirements for CE Marking and sale within the European Economic Area (EEA). Contains Infineon radio module ROK 10401. These requirements are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential or commercial environment.

This product conforms with the regulatory requirements of the Australian Communications Authority (ACA) EMC framework, thus satisfying the requirements for C-Tick Marking and sale within Australia and New Zealand.

Taiwan – Battery Recycling Requirements

The product contains a removable Lithium-ion battery. Taiwanese regulations require that waste batteries are recycled.

Notice to Our European Union Customers

For product recycling instructions and more information, please go to www.trimble.com/ev.shtml.

Recycling in Europe: To recycle Trimble WEEE (Waste Electrical and Electronic Equipment, products that run on electrical power), Call +31 497 53 24 30, and ask for the "WEEE Associate" or mail a request for recycling instructions to:

Trimble Europe BV
Or, mail a request for recycling instructions to:

Taiwanese regulations require that waste batteries are recycled.

feit電池請回收

Notice to Our European Union Customers

For product recycling instructions and more information, please go to www.trimble.com/ev.shtml.

Recycling in Europe: To recycle Trimble WEEE (Waste Electrical and Electronic Equipment, products that run on electrical power), Call +31 497 53 24 35, and ask for the "WEEE Associate" or mail a request for recycling instructions to:

Trimble Europe BV
c/o Menlo Worldwide Logistics
Meerheide 45
5521 DZ Ersel, NL

Declaration of Conformity

We, Trimble Navigation Limited,
935 Stewart Drive
PO Box 3642
Sunnyvale, CA 94088-3642
United States
+1-408-481-8000
declare under sole responsibility that the products:

Trimble R8 GNSS receiver and Trimble R6/5800 II GPS receivers

comply with Part 15 of FCC Rules.

Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.
Safety Information

This manual describes the Trimble® R8 GNSS and R6/5800 II GPS receivers. Unless otherwise specified, “the receiver” refers to all receivers covered in this User Guide.

Note – To determine if you have a 5800 II GPS receiver, look underneath for a label that shows the part number and the product name.

Before you use your receiver make sure that you have read and understood this publication, as well as all safety requirements.

Warnings and Cautions

An absence of specific alerts does not mean that there are no safety risks involved.

Always follow the instructions that accompany a Warning or Caution. The information they provide is intended to minimize the risk of personal injury and/or damage to the equipment. In particular, observe safety instructions that are presented in the following formats:

WARNING – A Warning alerts you to a likely risk of serious injury to your person and/or damage to the equipment. A warning identifies the nature of the risk and the extent of possible injury and/or damage. It also describes how to protect yourself and/or the equipment from this risk. Warnings that appear in the text are repeated at the front of the manual.

CAUTION – A Caution alerts you to a possible risk of damage to the equipment and/or loss of data. A Caution describes how to protect the equipment and/or data from this risk.

Regulations and safety

The receivers contain an internal radio-modem and can send signals through Bluetooth® wireless technology or through an external data communications radio. Regulations regarding the use of the 450 MHz radio-modems vary greatly from country to country. In some countries, the unit can be used without obtaining an end-user license. Other countries require end-user licensing. For licensing information, consult your local Trimble dealer. Bluetooth operates in license-free bands.

Before operating this receiver, determine if authorization or a license to operate the receiver is required in your country. It is the responsibility of the end user to obtain an operator’s permit or license for the receiver for the location or country of use. For FCC regulations, see Notices, page 2.
Type approval

Type approval, or acceptance, covers technical parameters of the equipment related to emissions that can cause interference. Type approval is granted to the manufacturer of the transmission equipment, independent from the operation or licensing of the units. Some countries have unique technical requirements for operation in particular radio-modem frequency bands. To comply with those requirements, Trimble may have modified your equipment to be granted Type approval. Unauthorized modification of the units voids the Type approval, the warranty, and the operational license of the equipment.

Exposure to radio frequency radiation

For 450 MHz radio

Safety. Exposure to RF energy is an important safety consideration. The FCC has adopted a safety standard for human exposure to radio frequency electromagnetic energy.

Proper use of this radio modem results in exposure below government limits. The following precautions are recommended:

- **DO NOT** operate the transmitter when someone is 20 cm (7.8 inches) of the antenna.
- **DO NOT** collocate (place within 20 cm) the radio antenna with any other transmitting device.
- **DO NOT** operate the transmitter unless all RF connectors are secure and any open connectors are properly terminated.
- **DO NOT** operate the equipment near electrical blasting caps or in an explosive atmosphere.
- All equipment must be properly grounded according to Trimble installation instructions for safe operation.
- All equipment should be serviced only by a qualified technician.

For GSM radio

⚠️ **CAUTION** – For your own safety, and in terms of the RF Exposure requirements of the FCC, always observe the precautions listed here.
- Always maintain a minimum separation distance of 20 cm (7.8 inches) between yourself and the radiating antenna on the Trimble R8 GNSS or the Trimble R6 radio-modem.
- Do not collocate (place within 20 cm) the radio antenna with any other transmitting device.
**For Bluetooth radio**

The radiated output power of the internal Bluetooth wireless radio is far below the FCC radio frequency exposure limits. Nevertheless, the wireless radio shall be used in such a manner that the Trimble receiver is 20 cm or further from the human body. The internal wireless radio operates within guidelines found in radio frequency safety standards and recommendations, which reflect the consensus of the scientific community. Trimble therefore believes the internal wireless radio is safe for use by consumers. The level of energy emitted is far less than the electromagnetic energy emitted by wireless devices such as mobile phones. However, the use of wireless radios may be restricted in some situations or environments, such as on aircraft. If you are unsure of restrictions, you are encouraged to ask for authorization before turning on the wireless radio.

**Installing antennas**

**CAUTION –** For your own safety, and in terms of the RF Exposure requirements of the FCC, always observe these precautions:
- Always maintain a minimum separation distance of 20 cm (7.8 inches) between yourself and the radiating antenna.
- Do not collocate (place within 20cm) the radio antenna with any other transmitting device.

This device has been designed to operate with the antennas listed below.

UHF Antennas not included in this list, or having a gain greater than 5 dBi, are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

GSM Antennas having a gain greater than 3 dBi (for mobile applications) are strictly prohibited for use with this device.

The antennas that can be used (country dependent) with the **450 MHz radio** are 0 dBi and 5 dBi whip antennas.

The antenna that can be used with the **GSM radio** is the 0 dBi whip antenna.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.
Rechargeable Lithium-ion batteries

These receivers use a rechargeable Lithium-ion battery.

**WARNING** – Do not damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage. To prevent injury or damage:
– Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
– Do not expose the battery to fire, high temperature, or direct sunlight.
– Do not immerse the battery in water.
– Do not use or store the battery inside a vehicle during hot weather.
– Do not drop or puncture the battery.
– Do not open the battery or short-circuit its contacts.

**WARNING** – Avoid contact with the rechargeable Lithium-ion battery if it appears to be leaking. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage. To prevent injury or damage:
– If the battery leaks, avoid contact with the battery fluid.
– If battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes!
– If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid.

**WARNING** – Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage. To prevent injury or damage:
– Do not charge or use the battery if it appears to be damaged or leaking.
– Charge the Lithium-ion battery only in a Trimble product that is specified to charge it. Be sure to follow all instructions that are provided with the battery charger.
– Discontinue charging a battery that gives off extreme heat or a burning odor.
– Use the battery only in Trimble equipment that is specified to use it.
– Use the battery only for its intended use and according to the instructions in the product documentation.
Other Warnings

WARNING – Operating or storing the receiver outside the specified temperature range can damage it. For more information, see Physical specifications, page 50.

WARNING – Do not hold down the power button for more than 30 seconds. After 30 seconds, any application files stored in the receiver are deleted.

WARNING – Upgrading the firmware deletes all application files on the receiver.

WARNING – Operating or storing the receiver outside the specified temperature range can damage it. For more information, see Chapter 7, Specifications and Chapter 7, Specifications.

WARNING – The receiver allows a maximum of 200 files on the internal memory. The filenames must be in 8.3 format, otherwise, files copied to the internal memory may cause data corruption or loss of data when logging. Data is logged using the current logging settings configured in the receiver. Data files logged internally are named automatically.
Contents

Safety Information ................................................................................. 3
  Warnings and Cautions ................................................................... 3
  Regulations and safety .................................................................. 3
  Type approval .............................................................................. 4
  Exposure to radio frequency radiation ........................................... 4
    For 450 MHz radio .................................................................. 4
    For GSM radio ....................................................................... 4
    For Bluetooth radio ............................................................... 5
  Installing antennas ....................................................................... 5
  Rechargeable Lithium-ion batteries .............................................. 6
  Other Warnings .......................................................................... 7

1 Introduction .................................................................................... 13
  Related information ....................................................................... 13
  Technical assistance ..................................................................... 14
  Your comments ............................................................................ 14

2 Overview .......................................................................................... 15
  Features ....................................................................................... 16
  Use and care ................................................................................ 16
  COCOM limits ............................................................................. 17

3 Setting up the Receiver .................................................................. 19
  Parts of the receiver ...................................................................... 20
    Front panel ................................................................................ 20
    Lower housing .......................................................................... 21
  Setup guidelines .......................................................................... 22
    Environmental conditions ......................................................... 22
    Sources of electrical interference ............................................ 22
    General guidelines ................................................................... 23
  Pole-mounted setup ...................................................................... 23
  Other system components ........................................................... 25
    Radios ....................................................................................... 25
    Cellular modems and external radios ....................................... 26

4 General Operation .......................................................................... 27
  Front panel controls ..................................................................... 28
  Button functions .......................................................................... 28
  LED behavior ............................................................................. 28
    LED flash patterns .................................................................... 29
  Starting and stopping the receiver ............................................... 29
  Logging data ............................................................................... 29
  Logging internally ....................................................................... 29
B  RTCM Output .................................................. 73
  Generated messages ........................................... 74
  Message scheduling .......................................... 74

C  Troubleshooting ................................................. 75
  LED conditions ................................................... 76
  Receiver issues .................................................. 76

D  Index ............................................................ 79
Introduction

Welcome to the *Trimble R8 GNSS and R6/5800 GPS Receivers User Guide*. This manual describes how to install, set up, and use a Trimble® R8 GNSS receiver or a Trimble R6/5800 II GPS receiver.

Unless otherwise specified, “the receiver” refers to all receivers covered in this User Guide.

*Note – To determine if you have a 5800 II GPS receiver, look underneath for a label that shows the part number and the product name.*

Even if you have used other Global Positioning System (GPS) products before, Trimble recommends that you spend some time reading this manual to learn about the special features of your receiver.

If you are not familiar with GPS, visit our website for an interactive look at Trimble and GPS at [www.trimble.com](http://www.trimble.com)

Trimble assumes that you are familiar with the Windows® operating system and know how to use a mouse, select options from menus and dialogs, make selections from lists, and refer to online help.

Related information

An electronic copy of this manual is available in portable document format (PDF) on the receiver CD-ROM. Use Adobe Reader to view the contents of this file.

Other sources of related information are:

- **Release notes** – the release notes describe new features of the product, information not included in the manual, and any changes to the manual. They are provided as a PDF on the CD. Use Adobe Reader to view the contents of the release notes.

- **Registration** – register your receiver to automatically receive e-mail notifications of receiver firmware upgrades and new functionality. To register, do one of the following:
  - Run the receiver CD.
  - Register electronically at [www.trimble.com](http://www.trimble.com).
  - Print the registration form that is on the CD, fill it in, and fax or mail it to the address shown.

  Contact your local Trimble Dealer for more information about the support agreement contracts for software and firmware, and an extended warranty program for hardware.

- **Trimble training courses** – consider a training course to help you use your GPS system to its fullest potential. For more information, visit the Trimble website at [www.trimble.com/training.html](http://www.trimble.com/training.html).


**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 Trimble website at (www.trimble.com/support.html).

**Your comments**

Your feedback about the supporting documentation helps us to improve it with each revision. E-mail your comments to ReaderFeedback@trimble.com.
Overview

In this chapter:

- Features
- Use and care
- COCOM limits

This chapter introduces the Trimble R8 GNSS and R6/5800 GPS receivers for GPS surveying applications.

Unless otherwise specified, “the receiver” refers to all receivers covered in this User Guide.

The receiver incorporates a GPS antenna, receiver, internal radio with a transmit option or an internal GSM module, and a battery in a rugged light-weight unit that is ideally suited as an all-on-the-pole RTK rover. Three LEDs allow you to monitor the satellite tracking, radio reception, data logging status, and power. Bluetooth wireless technology provides cable-free communications between receiver and controller.

- The Trimble R6 GPS and Trimble R8 GNSS receivers provide 72 channels for satellite tracking and support, and to log raw GPS observables to the handheld controller for postprocessed applications.
- The 5800 II GPS receiver provides 24 channels for satellite tracking, and supports logging raw GPS observables to the handheld controller for postprocessed applications.

The receiver is available as a standalone rover, base station, or as part of the GPS Total Station® system, offering maximum versatility in the system configuration to meet your specific requirements.
Features

The receiver provides the following features:

- Trimble R-track technology, which allows the receivers to track the following:
  - GLONASS (Trimble R6 GPS and Trimble R8 GNSS receivers)
  - L2C and L5 (Trimble R8 GNSS receiver)
- Centimeter-accuracy, real-time positioning with RTK/OTF data, up to 10 Hz position updates
- Submeter-accuracy, real-time positioning using pseudorange corrections
- Adaptive dual-frequency RTK engine
- WAAS/EGNOS capability (Wide Area Augmentation System/European Geo-Stationary Navigation System)
- Automatic OTF (on-the-fly) initialization while moving
- Single Lithium-ion rechargeable battery
- Cable-free Bluetooth communications with the Trimble controllers
- Two RS-232 serial ports for:
  - NMEA output
  - RTCM SC-104 input and output
  - Trimble Format (CMR+™) input and output
- One TNC radio antenna connector
- Internal memory for data storage
- Internal 450 MHz radio with a transmit option or GSM module options

Use and care

The receiver can withstand the rough treatment that typically occurs in the field. However, it is a high-precision electronic instrument and should be treated with reasonable care.

WARNING – Operating or storing the receiver outside the specified temperature range can damage it. For more information, see Chapter 7, Specifications.

High-power signals from a nearby radio or radar transmitter can overwhelm the receiver circuits. This does not harm the instrument, but it can prevent the receiver electronics from functioning correctly. Avoid using the receiver within 400 meters of powerful radar, television, or other transmitters. Low-power transmitters such as those used in cellphones and two-way radios normally do not interfere with receiver operations.
For more information, contact your local Trimble distributor.

**COCOM limits**

The U.S. Department of Commerce requires that all exportable GPS products contain performance limitations so that they cannot be used in a manner that could threaten the security of the United States. The following limitations are implemented on the receiver.

Immediate access to satellite measurements and navigation results is disabled when the receiver's velocity is computed to be greater than 1000 knots, or its altitude is computed to be above 18,000 meters. The receiver continuously resets until the COCOM situation is cleared.
Setting up the Receiver

In this chapter:

- Parts of the receiver
- Setup guidelines
- Pole-mounted setup
- Other system components

This chapter provides general information on setup, connection, and cabling for the most common uses of the receiver.
Parts of the receiver

All operating controls on the receiver are located on the front panel. Serial ports and connectors are located on the bottom of the unit.

Front panel

Figure 3.1 shows the receiver front panel, which contains the three indicator light emitting diodes (LEDs), and the power button.

Figure 3.1 Receiver front panel

The power button controls the receiver’s power on or off functions.

The indicator LEDs show the status of power, satellite tracking, and radio reception. For more information, see LED behavior, page 28.
Lower housing

Figure 3.2 shows the receiver lower housing, which contains the two serial ports, one TNC radio antenna or GSM antenna connector (depending on the internal communication module ordered), the removable battery compartment and the 5/8-11 threaded insert.

![Receiver lower housing](image)

Each port or connector on the receiver is marked with an icon to indicate its main function as shown below.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Name</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Port 1 icon" /></td>
<td>Port 1</td>
<td>Device, computer, external radio, power in</td>
</tr>
<tr>
<td><img src="image" alt="Port 2 icon" /></td>
<td>Port 2</td>
<td>Device, computer, external radio</td>
</tr>
<tr>
<td><img src="image" alt="RADIO icon" /></td>
<td>RADIO</td>
<td>Radio communications antenna</td>
</tr>
</tbody>
</table>

Port 1 is a 7-pin 0-shell Lemo connector that supports RS-232 comms and external power input. Port 1 has no power outputs.

Port 2 is a DB-9 male connector that allows for full 9-pin RS-232 comms. Port 2 does not support power in or out. For more information, see Chapter 8, Default Settings and Chapter 9, Cables and Connectors.
The TNC connector is for connecting a radio antenna to the receiver internal radio. A whip “rubber duck” antenna is supplied with the system for units with internal UHF radios. This connector is not used if you are using an external UHF radio or GSM.

**External UHF or GSM antenna**

Depending on which module you have purchased, use this TNC connection for an external antenna to enhance the UHF or GSM.

The UHF and GSM antennas are both approximately 16.5 cm long. The UHF antennas have color coded dots on the top where the GSM antenna has a black cap.

For more information on connecting the receiver, see the following sections in this chapter.

### Setup guidelines

Consider the following guidelines when setting up the receiver.

---

**CAUTION** – To satisfy the RF Exposure requirements of the FCC, you must maintain a minimum separation distance of 20 cm (approximately 8 in.) between yourself and the radiating GSM antenna for this device.

For mobile operation, the maximum gain of the GSM antenna must not exceed 0 dBi.

---

### Environmental conditions

Although the receiver has a waterproof housing, take reasonable care to protect the unit. Avoid exposure to extreme environmental conditions, including:

- Water
- Heat greater than 65 °C (149 °F)
- Cold less than –40 °C (–40 °F)
- Corrosive fluids and gases

### Sources of electrical interference

Avoid the following sources of electrical and magnetic noise:

- Gasoline engines (spark plugs)
- Televisions and PC monitors
- Alternators and generators
- Electric motors
- Equipment with DC-to-AC converters
- Fluorescent lights
• Switching power supplies

**General guidelines**

**WARNING** – These receivers use a rechargeable Lithium-ion battery. To avoid personal injury or equipment damage, make sure that you read and understand the Safety Information on page 3 at the front of this manual.

The following guidelines apply whenever you set up the receiver for operation:

• When plugging in a Lemo cable, make sure that the red dots on the receiver port and the cable connector line up. Do not use force to plug cables in, as this may damage the connector pins.

• When disconnecting a Lemo cable, grasp the cable by the sliding collar or lanyard and then pull the cable connector straight out of the port. Do not twist the connector or pull on the cable itself.

• To securely connect a TNC cable, align the cable connector with the receiver receptacle and then thread the cable connector onto the receptacle until it is snug.

• To insert the internal battery, place the battery in the battery compartment, ensuring that the contact points are in the correct position to align with the contacts in the receiver. Slide the battery and compartment as a unit upward into the receiver until the battery compartment latches are locked into position.

**Pole-mounted setup**

Figure 3.3 on page 24 shows the pole-mounted setup for the receiver. To mount the receiver on a range pole:

1. Thread the receiver onto the range pole.
2. Attach the controller bracket to the pole.
3. Insert the controller into the bracket.

*Note* – When using a Trimble TCU, Trimble Recon®, TSCe™ with BlueCap®, or a TSC2 controller, no cabling is required, as shown in Figure 3.3.
Figure 3.3  Receiver pole-mounted setup
Other system components

This section describes optional components that you can use with the receiver.

Radios

Radios are the most common data link for Real-Time Kinematic (RTK) surveying. The receiver is available with an optional internal radio in the 450 MHz UHF band, or with an internal GSM module (Trimble R8 GNSS / R6 GPS receivers only). You can also connect an external radio to either receiver port, whether or not the internal radio is installed.

The receiver supports the following Trimble base radios with the internal 450 MHz radio:

- Trimble HPB450
- Trimble PDL450
- Receiver internal 450 MHz transmitter
- TRIMMARK™ 3 radio
- SiteNet™ 450 radio

Internal GSM setup

You can configure the optional internal GSM Module using the Trimble Survey Controller™ software. For more information, refer to the Trimble Survey Controller User Guide.

Internal radio setup

To configure the receiver optional internal radio, use one of the following:

- The GPS Configurator software
- The WinFlash utility
- The Trimble Survey Controller software
- The Trimble Digital Fieldbook™ software

For more information, refer to the documentation for these applications.

By default, the internal radio has only a few “test” frequencies installed at the factory. If you purchased the transmit option, the broadcast frequencies must be programmed at the factory. You can program the receive frequencies using the WinFlash utility. For more information, see The WinFlash Utility, page 43.

Note – A Frequency Configuration sheet accompanies every receiver order that contains the transmit option.
Cellular modems and external radios

For a data communications link, you can use an internal or external radio, or an internal or external cellular modem.

To connect an external cellular modem to the receiver, you need the following:

- A Trimble R8 GNSS or R6/5800 GPS receiver.
- A cellular modem, or a cellphone that can transmit and receive data.
- Serial (cellphone to DB9) cable (supplied with the cellular modem or phone).

Note – For more information, refer to the document Using Cellular and CDPD Modems for RTK, which is available from your local Trimble Reseller.

- Port 2 of the receiver supports full RS-232 protocol, and should function properly with most cellular phone cables. Some cellular units may require custom cabling.

Alternatively, the receiver also supports a cable-free Bluetooth connection with Bluetooth-enabled cell phones.

For more information on using an external cellular modem as a data link, refer to the Trimble Survey Controller User Guide.

To connect an external radio modem to a receiver, you need the following:

- A receiver.
- An external radio capable of receiving and decoding Trimble data packets.
- Serial cable for either Port 1 or Port 2 of the receiver, as supplied by the radio manufacturer.
- Radio mount for the range pole.
All the controls that you need for general receiver operation are on the front panel.

For more information about other receiver panels, see Parts of the receiver, page 20.

General Operation

In this chapter:

- Button functions
- LED behavior
- Starting and stopping the receiver
- Logging data
- Resetting to defaults
- Batteries and power
Front panel controls

Figure 4.1 shows the receiver front panel controls for the power on/off functions, or receiver reset. The LEDs provide power, radio, data logging, and SV tracking status information.

![Receiver front panel controls and LEDs](image)

4.2 Button functions

The receiver has only one button, the Power button. Press the Power button to turn on or turn off the receiver, and to perform other functions, as described below.

<table>
<thead>
<tr>
<th>To ...</th>
<th>Power button</th>
</tr>
</thead>
<tbody>
<tr>
<td>turn on the receiver</td>
<td>Press</td>
</tr>
<tr>
<td>turn off the receiver</td>
<td>Hold for 2 seconds</td>
</tr>
<tr>
<td>delete the ephemeris file</td>
<td>Hold for 15 seconds</td>
</tr>
<tr>
<td>reset the receiver to factory defaults</td>
<td>Hold for 15 seconds</td>
</tr>
<tr>
<td>delete application files</td>
<td>Hold for 30 seconds</td>
</tr>
</tbody>
</table>

Note – The term “press” means to press the button and release it immediately. The term “hold” means to press the button and hold it down for the given time.

LED behavior

The three LEDs on the front panel of the receiver indicate various operating conditions. Generally, a lit or slowly flashing LED indicates normal operation, a LED that is flashing quickly indicates a condition that may require attention, and an unlit LED indicates that no operation is occurring. The following table defines each possible LED state.

<table>
<thead>
<tr>
<th>The term ...</th>
<th>means that the LED ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow flash</td>
<td>alternates on/off for 500 milliseconds.</td>
</tr>
<tr>
<td>Fast flash</td>
<td>alternates rapidly on/off for 100 milliseconds</td>
</tr>
</tbody>
</table>
The following table details the possible flash patterns to indicate various states of receiver operation.

<table>
<thead>
<tr>
<th>Receiver mode</th>
<th>Power LED</th>
<th>Radio LED</th>
<th>Satellite LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Receiver ON:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy power</td>
<td>ON</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Low power</td>
<td>Fast flash</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Tracking &lt;4 SVs</td>
<td>ON</td>
<td>N/A</td>
<td>Fast flash</td>
</tr>
<tr>
<td>Tracking &gt;4 SVs</td>
<td>ON</td>
<td>N/A</td>
<td>Slow flash</td>
</tr>
<tr>
<td>Logging data internally</td>
<td>Flashes off every 3 seconds</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Transmitting internally</td>
<td>N/A</td>
<td>Flashes off when transmitting</td>
<td>N/A</td>
</tr>
<tr>
<td>Receiving valid data packets</td>
<td>ON</td>
<td>Slow flash</td>
<td>N/A</td>
</tr>
<tr>
<td>No data packets</td>
<td>ON</td>
<td>OFF</td>
<td>N/A</td>
</tr>
<tr>
<td>Receiver in Monitor</td>
<td>ON</td>
<td>Slow flash</td>
<td>ON</td>
</tr>
</tbody>
</table>

Note – If a column shows “N/A”, that specific LED may or may not be on, but it is not relevant to that particular mode.

Starting and stopping the receiver

To turn on the receiver, press the Power button.

To turn off the receiver, hold down the Power button for two seconds.

Logging data

You can log data internally or to a Trimble controller.

Logging internally

The receiver logs raw data on internal memory.

You can then use the Trimble Data Transfer utility or Business Center software to transfer logged data files to the office computer.
Note – If you use the Data Transfer utility to download the internally-logged files, you lose any collected GLONASS data. Consider this if you plan to use the Trimble Geomatics Office™ software to process the *.dat files because that software does not process GLONASS data.

If you have the Trimble Business Center software, the *.T01 file that is stored on the receiver can be directly downloaded. The *.T01 files will contain any collected GLONASS data. The Trimble Business Center software can process GLONASS data, if you have purchased that option.

**WARNING** – The receiver allows for a maximum of 200 files on the internal memory. The filenames must be in 8.3 format, otherwise, files copied to the internal memory may cause data corruption or loss of data when logging.

Data is logged using the current logging settings configured in the receiver. Data files logged internally are named automatically.

To begin internal logging, you must use a Trimble controller, or the GPS Configurator software. The receiver does not have a continuously running internal clock when it is turned off, so you can conduct timed survey sessions only if the receiver is turned on and connected to a power source.

When the internal memory is full, the receiver stops logging data, and the Power LED stops flashing and remains on continuously. Existing data files are not overwritten. You can use the Auto-delete option to override this action and automatically delete the oldest files when the receiver memory is full. However, you should use this option with caution because it can result in loss of data.

Approximate storage requirements for different logging rates are shown below. The values shown are for a one-hour logging session with six satellites visible.

<table>
<thead>
<tr>
<th>Logging rate</th>
<th>Memory required</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Hz</td>
<td>2,588 KB</td>
</tr>
<tr>
<td>1 Hz</td>
<td>335 KB</td>
</tr>
<tr>
<td>5 seconds</td>
<td>87 KB</td>
</tr>
<tr>
<td>15 seconds</td>
<td>37 KB</td>
</tr>
</tbody>
</table>

**Logging to a Trimble controller**

When the receiver is connected to a Trimble controller, you can log GPS data from the receiver to the controller, or to a data card inserted in the controller. When you use a Trimble controller, you do not use the receiver’s controls. Instead, you use the controller functions to set logging options, specify filenames, and control when logging occurs.

Controller software job files and the corresponding raw data files can be transferred to an office computer using the Trimble Data Transfer utility.

For more information on logging data from a receiver using a Trimble controller, refer to the user guide for your particular controller.
Resetting to defaults

To reset the receiver to its factory default settings, hold down the Power button for at least 15 seconds.

For more information, see Default settings, page 54.

Batteries and power

**WARNING** – Do not damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage. To prevent injury or damage:

- Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
- Do not expose the battery to fire, high temperature, or direct sunlight.
- Do not immerse the battery in water.
- Do not use or store the battery inside a vehicle during hot weather.
- Do not drop or puncture the battery.
- Do not open the battery or short-circuit its contacts.

The receiver can be powered by its internal battery or by an external power source connected to Port 1.

If an external power source is connected to Port 1, it is used in preference to the internal battery. When there is no external power source connected, or if the external power supply fails, the internal battery is used.

**WARNING** – Avoid contact with the rechargeable Lithium-ion battery if it appears to be leaking. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage. To prevent injury or damage:

- If the battery leaks, avoid contact with the battery fluid.
- If battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes!
- If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid.

The receiver is supplied with two rechargeable Lithium-ion batteries, and a dual battery charger. The two batteries charge sequentially and take approximately four hours each to fully charge.

Battery charging and storage

All battery types discharge over time when they are not being used. Batteries also discharge faster in colder temperatures. If a Lithium-ion battery is to be stored for long periods of time, make sure it is fully charged before storing and re-charged at least every three months.
**WARNING** – Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage.

To prevent injury or damage:
- Do not charge or use the battery if it appears to be damaged or leaking.
- Charge the Lithium-ion battery only in a Trimble product that is specified to charge it.
- Be sure to follow all instructions that are provided with the battery charger.
- Discontinue charging a battery that gives off extreme heat or a burning odor.
- Use the battery only in Trimble equipment that is specified to use it.
- Use the battery only for its intended use and according to the instructions in the product documentation.

**Charging the Lithium-ion battery**

The rechargeable Lithium-ion battery is supplied partially charged. Charge the battery completely before using it for the first time. If the battery has been stored for longer than six months, charge it before use.

To protect the battery from deep discharge (5 V or less), the receiver is designed to switch batteries or cease drawing power when the battery pack discharges to 5.9 V.

A battery that has reached the deep discharge level cannot be recharged and must be replaced. The following recommendations provide optimal performance and extend the life of your batteries:

- Fully charge all new batteries prior to use.
- Do not allow the batteries to discharge below 5 V.
- Keep all batteries on continuous charge when not in use. Batteries may be kept on charge indefinitely without damage to the receiver or batteries.
- Do not store batteries in the receiver or external charger unless power is applied.
- If you must store the batteries, fully charge them before storing and then recharge them at least every three months.

**Disposing of the rechargeable Lithium-ion battery**

Discharge the Lithium-ion battery before disposing of it. When disposing of the battery, be sure to do so in an environmentally sensitive manner. Adhere to any local and national regulations concerning battery disposal or recycling.

**Power output**

The receiver does not supply power from either of its two ports.
Firmware

A receiver’s *firmware* is the program inside the receiver that controls receiver operations and hardware. You can upgrade the firmware for the receiver using the WinFlash utility provided on the receiver CD.

For more information, see *The WinFlash Utility, page 43.*

⚠️ **CAUTION** – Downgrading the firmware deletes all application files on the receiver.
In this chapter:
- Configuring the receiver in real time
- Configuring the receiver using application files
- Application files

The receiver has no controls to change settings. To configure the receiver, use external software such as GPS Configurator, WinFlash, Trimble Survey Controller, or Trimble Digital Fieldbook.

To configure the receiver, do one of the following:
- Configure the receiver in real time.
- Apply the settings in an application file.

This chapter provides a brief overview of each of these methods and describes the contents and use of application files.
Configuring the receiver in real time

GPS Configurator, Trimble Survey Controller, and Trimble Digital Filedbook software support real-time configuration of the receiver.

When you configure the receiver in real time, you use one of these software applications to specify which settings you want to change. When you apply the changes, the receiver settings change immediately.

Any changes that you apply to the receiver are reflected in the current application file, which is always present in the receiver. The current application file always records the most recent configuration, so if you apply further changes (either in real time or using an application file) the current file is updated and there is no record of the changes that you applied originally.

For more information on configuring the receiver in real time, see Chapter 6, Software Utilities.

Configuring the receiver using application files

An application file contains information for configuring a receiver. To configure a receiver using an application file, you need to create the application file, transfer it to the receiver and then apply the file's settings. The GPS Configurator software does this automatically when you work with configuration files.

For more information on applying application files, see Chapter 6, Software Utilities.

Application files

An application file is organized into records. Each record stores configuration information for a particular area of receiver operation. Application files can include the following records:

- File Storage
- General Controls
- Serial Port Baud/Format
- Reference Position
- Logging Rate
- SV Enable/Disable
- Output Message
- Antenna
- Device Control
- Static/Kinematic
- Input Message
An application file does not have to contain all of these records. When you apply an application file, any option that is not included in the records in the file remains at its current setting. For example, if you apply an application file that only specifies the elevation mask to use, all other settings remain as they were before the application file was applied.

You can store up to ten different application files in the receiver. You can apply an application file’s settings at the time it is transferred to the receiver, or at any time afterwards.

**Special application files**

The receiver has three special application files, which control important aspects of the receiver’s configuration.

**Default application file**

The default application file (Default.cfg) contains the original receiver configuration, and cannot be changed. This file configures the receiver after it is reset. You can reset the receiver by holding down [P] for at least 15 seconds, or by using the reset option in the GPS Configurator software.

For more information, see Default settings, page 54.

Although you cannot change or delete the default application file, you can use a power up application file to override any or all of the default settings.

**Current application file**

The current application file (Current.cfg) reflects the current receiver configuration. Whenever you change the receiver’s configuration, either in real time or by applying an application file, the current file changes to match the new configuration.

You cannot delete the current file or change it directly, but every change to the receiver’s current configuration is applied to the current file as well.

When you switch off the receiver then turn it on again, all the settings from the current application file are applied, so you do not lose any changes that you have made. The only exceptions are the following logging parameters:

- Logging rate
- Position rate
- Elevation mask

These parameters are always reset to the factory default values whenever the receiver is switched off.
**Power up application file**

The power up application file (`Power_up.cfg`) is used to set the receiver to a specific configuration any time the unit is turned on.

In this file, you can specify that the receiver is reset to defaults before the power up settings are applied. This ensures that restarting the receiver always results in the same configuration. This method is useful for defining “default” settings for the receiver that differ from those in the default file, which cannot be changed.

Alternatively, you can specify that the power up settings are applied immediately after the current application file’s settings have been applied. Restarting the receiver results in a configuration that uses your default settings for the options you define in the power up file, but the current settings for all other options.

By default, there is no power_up application file on the receiver. To use a power up application file, you must create and save a power_up application file in the GPS Configurator software. If you save this file to disk, the file is called `power_up.cfg`. The extension `.cfg` is used, by convention, to identify application files on the office computer. When you transfer this file to the receiver, the file is saved on the receiver as `power_up`, and becomes the new power up file.

**Applying application files**

An application file’s settings do not affect the receiver’s configuration until you apply the application file. You can do this at the same time that you save the file. Alternatively, you can save the file on the computer or in the receiver, then open it later and apply its settings.

**Storing application files**

You can store application files that you create in the GPS Configurator software on the receiver and on the computer. For example, each file can represent a different user sharing the same receiver, or a particular mode of operation or survey style. Saving application files on your computer as well as in your receiver is optional, but it is useful because:

- it gives you a permanent copy of the settings you have sent to a receiver, for audit or your own reference.
- you can use the same file to configure multiple receivers identically.
- you can use an existing application file as a template to create other application files with similar settings.
Naming application files

The application filename in the office computer and in the receiver are always the same. This makes it easier to recognize and keep track of your application files.

When you change the name of the application file in the receiver, this changes the application filename on your computer. When you transfer an application file from the receiver and save it to the computer, the system renames the file to match the internal receiver file. However, if you use Windows Explorer, for example, to change the .cfg filename on the computer, this does not change the internal receiver filename. This means that the GPS receiver does not recognize the change to the filename on the computer.
Software Utilities

In this chapter:

- The GPS Configurator software
- The WinFlash Utility

This chapter describes the software utilities that you can use with the receiver.
The GPS Configurator software

GPS Configurator is office software that configures selected Trimble GPS or GNSS receivers.

GPS Configurator software enables you to:

- edit and save configuration files to the receiver and the computer
- check current receiver settings and operation
- configure receiver settings with your office computer

Installing the GPS Configurator software

A copy of GPS Configurator software is included on the receiver CD.

1. Insert the CD into the CD drive on your computer.
2. From the main menu, select Install individual software packages.
3. Select Install GPS Configurator vX.XX.
4. Follow the onscreen instructions.

Configuring the receiver using GPS Configurator software

1. Connect Port 1 or 2 on the receiver to a serial (COM) port on the computer and apply power.
2. To start GPS Configurator, click Start and then select Programs / Trimble / GPS Configurator / GPS Configurator.
3. In the Device Type dialog, select Trimble R8/R6.
   The software automatically establishes a connection with the receiver.
4. Make appropriate selections for your required receiver settings.
   For more information, refer to the GPS Configurator Help.
5. Click Apply.
   The settings in GPS Configurator software are applied to the receiver.
The WinFlash Utility

The WinFlash utility communicates with Trimble products to perform various functions including:

- installing software, firmware, and option upgrades
- running diagnostics (for example, retrieving configuration information)
- configuring radios

For more information, online help is also available when using the WinFlash utility.

Note – The WinFlash utility runs on Windows 2000, XP, or Windows Vista® operating systems.

Installing the WinFlash utility

1. Insert the receiver CD into the CD drive on the computer.
2. From the main menu, select Install individual software packages.
3. Select Install WinFlash vX.XX for R/5000/NetR5 receivers and then follow the on-screen instructions.

Alternatively, install the WinFlash utility from the Trimble website

Upgrading firmware

Your receiver is supplied with the latest version of receiver firmware installed. If a later version becomes available, upgrade the firmware installed on your receiver.

The WinFlash utility guides you through the firmware upgrade process. The steps required are described below. For more information, refer to the WinFlash Help.

To upgrade the receiver firmware:

1. Start the WinFlash utility. The Device Configuration screen appears.
2. From the Device type list, select Trimble R8/R6.
3. From the PC serial port field, select the serial (COM) port on the computer that the receiver is connected to.
4. Click Next.

The Operation Selection screen appears. The Operations list shows all of the supported operations for the selected device. A description of the selected operation is shown in the Description field.

5. Select GPS software upgrade and click Next.

The GPS Software Selection window appears. This screen prompts you to select the software that you want to install on the receiver.

6. Select the latest version from the Available Software list and then click Next.
The **Settings Review** window appears. This screen prompts you to connect the receiver, suggests a connection method and then lists the receiver configuration and selected operation.

7. If all is correct, click **Finish**.

   Based on your selections, the **Software Upgrade** window appears and shows the status of the operation (for example, *Establishing communication with the 5800. Please wait...*)

8. Click **OK**.

   The **Software Upgrade** window appears again and states that the operation was completed successfully.

9. Click **Menu** to select another operation, or click **Exit** to quit WinFlash.

10. If you click **Exit**, another screen appears asking you to confirm that you want to quit. Click **OK**.

### Adding frequencies for the 450 MHz internal radio

If your receiver has the optional internal radio installed, you can use the WinFlash utility to add receiving frequencies to the default list. If you purchase a transmit upgrade (after initial purchase), the broadcast frequencies must be programmed using a .set file obtained from a Trimble service provider.

1. Start the WinFlash utility. The **Device Configuration** screen appears.

2. From the **Device type** list, select the appropriate receiver name.

3. From the **PC serial port** field, select the serial (COM) port on the computer that the receiver is connected to.

4. Click **Next**.

   The **Operation Selection** screen appears. The **Operations** list shows all of the supported operations for the selected device. A description of the selected operation is shown in the **Description** field.

5. Select **Configure Radio** and then click **Next**.
The *Frequency Selection* dialog appears:

6. In the *Wireless Format* group, select the appropriate channel and wireless mode. The Wireless Mode must be the same for all radios in your network.

7. In the *Specify Frequency* field, enter the frequency you require.

8. Click **Add**. The new frequency appears in the *Selected Frequencies* list.

   **Note** – The frequencies that you program must conform to the channel spacing and minimum tuning requirements for the radio. To view this information, click **Radio Info**. You may select either 12.5 or 25 kHz channel spacing. All radios in your network must use the same channel spacing.

9. When you have configured all the frequencies you require, click **OK**.

   The WinFlash utility updates the receiver radio frequencies and then restarts the receiver.

   **Note** – You can only configure receive frequencies. The FCC approved transmit frequencies must be specified and configured by Trimble.
Configuring the internal transceiver

Use the WinFlash *Internal Transceiver Configuration* dialog to configure the internal transceiver.

**Tip** – To view a list of all radio information, including the current configuration, click **Radio Info**.

1. Select the *Current Channel*, which determines the radio operating frequency.
2. Select the *Wireless Mode*, which determines the over-the-air communications parameters. The following example shows a rover setup:

   ![Image of Internal Transceiver Configuration dialog]

To reduce battery consumption on your base receiver, set the wireless mode as high as possible. For example, 9600 bits per second (bps) consumes half the power of 4800 bps for the same data format and time of operation.

**Note** – *All radios in the network must be configured with the same wireless setting.*
3. Select the appropriate operating mode, depending on how you intend to use the receiver, for example, **Base with No Repeaters**:

![Internal Transceiver Configuration](image)

4. Select one of the following channel sharing configurations (base modes only; not available for rover):

   - **Off**. The carrier detect mode is off. The unit will ignore other transmissions on your frequency and continue to transmit data.

     **Note** – **It may be illegal in your country of use to set channel sharing to Off. You may be subject to penalties or fines based upon the specific licensing requirements for your country of use. Please consult your radio license documentation or licensing agency for operational guidelines.**

   - **Avoid Weak Signals**. The carrier detect mode is on. The radio will cease transmitting if it detects another radio transmission on its frequency. It will resume transmission when the channel is free of radio traffic.

   - **Avoid Strong Signals**. The carrier detect mode is on, but the radio will stop transmitting only when there is a strong signal present (receive level greater than 90 dBm).

5. If you are operating in Base mode, select the **Enable Station ID** check box and then enter your call sign in the **Call Sign** field. This FCC requirement is for U.S. licensed users. It sets your radio to transmit your call sign in Morse code every 15 minutes.

6. To update the configuration, click **OK**.

   In the **Status** dialog that appears, select an option to return to the main menu or to exit the WinFlash utility.

   **Tip** – You can print or save the radio configuration information for future reference. If required, you can fax or e-mail the file to Trimble Support to aid in troubleshooting radio problems.
Updating the frequency list

You can program the internal transceiver modem with a list of up to 20 frequencies, which are stored in non-volatile memory. This list is pre-configured based on the frequencies that you requested when you ordered the unit. Government regulations stipulate that only manufacturers or authorized dealers can create this frequency list and that all frequencies programmed into a unit must comply with the host country regulations. If you need to add, delete, or replace frequencies, contact your Trimble dealer, and provide the radio modem serial number and an updated list of the frequencies you require. Once you receive the frequency file, you can upgrade the radio using the WinFlash utility.
Specifications

In this chapter:

- Physical specifications
- Positioning specifications
- Technical specifications

This chapter lists the receiver specifications. Where specifications apply to only one receiver model, this is clearly indicated.
Physical specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>19.0 cm (7.5”) wide x 11.2 cm (4.4”) deep including connectors</td>
</tr>
<tr>
<td>Weight: with internal battery, radio, and standard antenna</td>
<td>1.35 kg (2.97 lbs)</td>
</tr>
<tr>
<td>Operating times on internal 2.4 Ah battery (varies with temperature)</td>
<td>450 MHZ receive only - 5.3 hours</td>
</tr>
<tr>
<td></td>
<td>450 MHZ receive/transmit: 3.5 hours (varies with wireless data rate)</td>
</tr>
<tr>
<td></td>
<td>GSM: 3.8 hours</td>
</tr>
<tr>
<td>Power input</td>
<td>11–28 V DC with over-voltage protection on port 1 (7-pin lemo)</td>
</tr>
<tr>
<td>Operating temperature&lt;sup&gt;a&lt;/sup&gt;</td>
<td>–40 °C to +65 °C (–40 °F to +149 °F)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>–40 °C to +75 °C (–40 °F to +167 °F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>100% condensing, unit fully sealed</td>
</tr>
<tr>
<td>Casing</td>
<td>Water/dustproof IP67 dustproof, protected from temporary immersion to depth of 1 m (3.28 ft)</td>
</tr>
</tbody>
</table>

<sup>a</sup>Receiver will operate normally to –40 °C. Bluetooth module and internal batteries are rated to –20 °C. GSM module is rated to -30°C.

Positioning specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code differential GPS positioning&lt;sup&gt;a&lt;/sup&gt;</strong></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>±0.25 m + 1ppm RMS</td>
</tr>
<tr>
<td>Vertical</td>
<td>±0.50 m + 1ppm RMS</td>
</tr>
<tr>
<td>WAAS differential positioning accuracy&lt;sup&gt;b&lt;/sup&gt;</td>
<td>typically &lt;5 m 3DRMS</td>
</tr>
<tr>
<td><strong>Static and FastStatic GPS surveying&lt;sup&gt;a&lt;/sup&gt;</strong></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>±5 mm + 0.5 ppm RMS</td>
</tr>
<tr>
<td>Vertical</td>
<td>±5 mm + 1 ppm RMS</td>
</tr>
<tr>
<td><strong>Kinematic surveying&lt;sup&gt;a&lt;/sup&gt;</strong></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>±10 mm + 1 ppm RMS</td>
</tr>
<tr>
<td>Vertical</td>
<td>±20 mm + 1 ppm RMS</td>
</tr>
</tbody>
</table>

<sup>a</sup> Accuracy and reliability may be subject to anomalies due to multipath, obstructions, satellite geometry, and atmospheric conditions. Always follow recommended survey practices.

<sup>b</sup> Depends on WAAS/EGNOS system performance.
## Technical specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tracking:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 additional channels for SBAS WAAS/EGNOS support</td>
</tr>
<tr>
<td></td>
<td>Fully operational during P-code encryption</td>
</tr>
<tr>
<td></td>
<td>4 additional channels for SBAS WAAS/EGNOS support</td>
</tr>
<tr>
<td></td>
<td>Fully operational during P-code encryption</td>
</tr>
<tr>
<td>5800 GPS receiver</td>
<td>24 Channels GPS L1 C/A Code, L1/L2 Full Cycle Carrier</td>
</tr>
<tr>
<td></td>
<td>2 additional channels for SBAS WAAS/EGNOS support</td>
</tr>
<tr>
<td></td>
<td>Fully operational during P-code encryption</td>
</tr>
<tr>
<td><strong>Signal processing</strong></td>
<td>Advanced Trimble Maxwell™ Custom Survey GNSS chip</td>
</tr>
<tr>
<td></td>
<td>Very low-noise GNSS carrier phase measurements with &lt;1 mm precision in a 1 Hz bandwidth</td>
</tr>
<tr>
<td></td>
<td>Multipath suppression</td>
</tr>
<tr>
<td><strong>Start-up</strong></td>
<td>Cold start: &lt; 60 seconds from power on</td>
</tr>
<tr>
<td></td>
<td>Warm start: &lt; 30 seconds with recent ephemeris</td>
</tr>
<tr>
<td><strong>Initialization</strong></td>
<td>Automatic while moving or static</td>
</tr>
<tr>
<td><strong>Initialization time</strong></td>
<td>Typically:</td>
</tr>
<tr>
<td></td>
<td>• &lt;10 seconds (Trimble R8 GNSS)</td>
</tr>
<tr>
<td></td>
<td>• &lt;20 seconds (Trimble R6 &amp; 5800)</td>
</tr>
<tr>
<td><strong>Initialization reliability</strong></td>
<td>Typically &gt;99.9%</td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td>Two RS-232 serial ports (Port 1, Port 2,)</td>
</tr>
<tr>
<td></td>
<td>Baud Rates up to 115,200 bps</td>
</tr>
<tr>
<td></td>
<td>RTS/CTS flow control negotiation supported on port 2</td>
</tr>
<tr>
<td></td>
<td>Bluetooth communications through Trimble controller with Bluetooth support</td>
</tr>
<tr>
<td><strong>Configuration</strong></td>
<td>Through user-definable application files or GPS Configurator</td>
</tr>
<tr>
<td><strong>Output formats</strong></td>
<td>NMEA-0183: AVR; GGA; GSA; GST; GSV; PTNL,GGK; PTNL,GHK_SYNC; HDT; PTNL,PJK; PTNL,PJT; RMC; ROT; PTNL,VGK; VHD; VTG; ZDA</td>
</tr>
<tr>
<td></td>
<td>GSOF (Trimble Binary Streamed Output)</td>
</tr>
<tr>
<td></td>
<td>RT17</td>
</tr>
</tbody>
</table>

a May be affected by atmospheric conditions, signal multipath, obstructions and satellite geometry.

b May be affected by atmospheric conditions, signal multipath, and satellite geometry. Initialization reliability is continuously monitored to ensure highest quality.
All receiver settings are stored in application files. The default application file, Default.cfg, is stored permanently in the receiver, and contains the factory default settings for the receiver. Whenever the receiver is reset to its factory defaults, the current settings (stored in the current application file, current.cfg) are reset to the values in the default application file.

You cannot modify the default application file. However, if there is a power up application file (Power_up.cfg) in the receiver, the settings in this file can be applied immediately after the default application file, overriding the factory defaults.

For more information, see Application files, page 36.
Default settings

These settings are defined in the default application file.

### Table 8.1 Default settings

<table>
<thead>
<tr>
<th>Function</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV Enable</td>
<td>All SVs enabled</td>
</tr>
<tr>
<td>General Controls:</td>
<td></td>
</tr>
<tr>
<td>Elevation mask</td>
<td>13°</td>
</tr>
<tr>
<td>PDOP mask</td>
<td>7</td>
</tr>
<tr>
<td>RTK positioning mode</td>
<td>Low Latency</td>
</tr>
<tr>
<td>Motion</td>
<td>Kinematic</td>
</tr>
<tr>
<td>Serial Port 1:</td>
<td></td>
</tr>
<tr>
<td>Baud rate</td>
<td>38400</td>
</tr>
<tr>
<td>Format</td>
<td>8-None-1</td>
</tr>
<tr>
<td>Flow control</td>
<td>None</td>
</tr>
<tr>
<td>Serial Port 2:</td>
<td></td>
</tr>
<tr>
<td>Baud rate</td>
<td>38400</td>
</tr>
<tr>
<td>Format</td>
<td>8-None-1</td>
</tr>
<tr>
<td>Flow control</td>
<td>None</td>
</tr>
<tr>
<td>Input Setup:</td>
<td></td>
</tr>
<tr>
<td>Station</td>
<td>Any</td>
</tr>
<tr>
<td>NMEA/ASCII (all supported messages)</td>
<td>All ports Off</td>
</tr>
<tr>
<td>Streamed output</td>
<td></td>
</tr>
<tr>
<td>All Types Off</td>
<td></td>
</tr>
<tr>
<td>Offset = 0</td>
<td></td>
</tr>
<tr>
<td>RT17/Binary</td>
<td></td>
</tr>
<tr>
<td>All ports Off</td>
<td></td>
</tr>
<tr>
<td>Reference position:</td>
<td></td>
</tr>
<tr>
<td>Latitude</td>
<td>0°</td>
</tr>
<tr>
<td>Longitude</td>
<td>0°</td>
</tr>
<tr>
<td>Altitude</td>
<td>0.00 m HAE</td>
</tr>
<tr>
<td>Antenna:</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Trimble R6 Internal /Trimble R8 Model 2 internal/5800 internal</td>
</tr>
<tr>
<td>Height (true vertical)</td>
<td>0.00 m</td>
</tr>
<tr>
<td>Group</td>
<td>All</td>
</tr>
<tr>
<td>Measurement method</td>
<td>Bottom of mount</td>
</tr>
</tbody>
</table>

Resetting to factory defaults

To reset the receiver to its factory defaults, do one of the following:

- On the receiver, press and hold down the Power button for 15 seconds.
- In the GPS Configurator software, select Connect to Receiver and then click Reset receiver in the General tab.
Default behavior

The factory defaults specified above are applied whenever you start the receiver. If a power up file is present in the receiver, its settings are applied immediately after the default settings, so you can use a power up file to define your own set of defaults.

<table>
<thead>
<tr>
<th>When you turn the receiver on and ...</th>
<th>then logging settings are ...</th>
<th>and logging ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>it is the first time that the receiver has been used</td>
<td>the factory defaults</td>
<td>does not begin automatically</td>
</tr>
<tr>
<td>you have reset the receiver to its factory defaults</td>
<td>the factory defaults, or those in the power up file&lt;sup&gt;a&lt;/sup&gt;</td>
<td>does not begin automatically</td>
</tr>
<tr>
<td>you have performed a full reset</td>
<td>the factory defaults, because resetting deletes any power up file</td>
<td>does not begin automatically</td>
</tr>
</tbody>
</table>

<sup>a</sup>A factory default setting is used only if the setting is not defined in the power up file.

Power up settings

When you turn off the receiver, any changes that you have made to logging settings are lost and these settings are returned to the factory defaults. Other settings remain as defined in the current file. The next time you turn on the receiver, the receiver checks for a power up file and, if one is present, applies the settings in this file.

<table>
<thead>
<tr>
<th>When you use the Power button to turn off and then turn on the receiver and ...</th>
<th>then logging settings are ...</th>
<th>and all other settings are ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>you changed the receiver settings by applying an application file</td>
<td>the factory defaults</td>
<td>the last settings used</td>
</tr>
<tr>
<td>you changed the receiver settings using configuration software</td>
<td>the factory defaults</td>
<td>the last settings used</td>
</tr>
<tr>
<td>there is a power up application file in the receiver</td>
<td>the factory defaults, or those in the power up file&lt;sup&gt;a&lt;/sup&gt;</td>
<td>the last settings used, or those in the power up file</td>
</tr>
</tbody>
</table>

<sup>a</sup>A factory default setting is used only if the setting is not defined in the power up file.
Cables and Connectors

In this chapter:

- Port 1 and 2 connectors
- Power/serial data cables

This chapter describes the pinouts for the receiver standard and optional cables. This information can be used to prepare special cables for connecting the receiver to devices and instruments not supported by the standard and optional cables.
Port 1 and 2 connectors

Figure 9.1 Receiver serial ports

Figure 9.2 Port 1 connector pinouts

Figure 9.3 Port 2 connector pinouts

<table>
<thead>
<tr>
<th>Pin</th>
<th>Pinout function</th>
<th>Port 1 – 7-pin Lemo</th>
<th>Port 2 – DB-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Signal ground</td>
<td>DCD</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Power ground</td>
<td>RXD</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>TXD</td>
<td>TXD</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>DTR</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>Signal ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>+ Power in</td>
<td>DSR</td>
<td></td>
</tr>
</tbody>
</table>
Power/serial data cables

The data-I/O cable is supplied with the receiver.

Table 9.1 Data-I/O cable pinouts

<table>
<thead>
<tr>
<th>Pin</th>
<th>Pinout function</th>
<th>Port 1 – 7-pin Lemo</th>
<th>Port 2 – DB-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>TRXD</td>
<td></td>
<td>RTS</td>
</tr>
<tr>
<td>8</td>
<td>N/A</td>
<td></td>
<td>CTS</td>
</tr>
<tr>
<td>9</td>
<td>N/A</td>
<td></td>
<td>Ring indicator</td>
</tr>
</tbody>
</table>

Note – Table 9.1 assumes that the cable is attached to the connector labeled Port 2.

This data cable may be used for firmware upgrades and other computer functions with the receiver. Power must be supplied to the receiver through Port 1, or from the internal battery.

Note – This pinout information also applies to the power/serial data cable, which is optional for use with the receiver. This cable can be used for firmware upgrades through Port 1, while also supplying external power.

Note – Table 9.2 assumes that the cable is attached to the connector labeled Port 1.

Table 9.2 Power/serial data cable pinouts

<table>
<thead>
<tr>
<th>Lemo 0-shell connector 7-Pin</th>
<th>Direction</th>
<th>DE9-F connector 7 Cond</th>
<th>Power lead 2 Cond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin</td>
<td>Function</td>
<td>Pin</td>
<td>Color</td>
</tr>
<tr>
<td>-----</td>
<td>----------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>1</td>
<td>GND</td>
<td>↔</td>
<td>Brown</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>→</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>TX3_232</td>
<td>→</td>
<td>Orange</td>
</tr>
<tr>
<td>4</td>
<td>RTS/TXD</td>
<td>→</td>
<td>Blue</td>
</tr>
<tr>
<td>5</td>
<td>CTS/RXD</td>
<td>←</td>
<td>Green</td>
</tr>
</tbody>
</table>
### Table 9.2  Power/serial data cable pinouts (continued)

<table>
<thead>
<tr>
<th>Lemo 0-shell connector 7-Pin</th>
<th>Direction</th>
<th>DE9-F connector 7 Cond</th>
<th>Power lead 2 Cond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin</td>
<td>Function</td>
<td>Pin</td>
<td>Color</td>
</tr>
<tr>
<td>6</td>
<td>PWR_IN</td>
<td>←</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RX3_232</td>
<td>←</td>
<td>3</td>
</tr>
</tbody>
</table>
This appendix describes the formats of the subset of NMEA-0183 messages that are available for output by the receiver. For a copy of the NMEA-0183 Standard, go to the National Marine Electronics Association website at www.nmea.org.

In this appendix:

- NMEA-0183 Outputs
- Common Message Elements
- NMEA Messages
**NMEA-0183 Outputs**

When NMEA-0183 output is enabled, a subset of NMEA-0183 messages can be output to external instruments and equipment connected to the Trimble receiver serial ports. These NMEA-0183 messages let external devices use selected data collected or computed by the receiver.

All messages conform to the NMEA-0183 version 3.01 format. All begin with $ and end with a carriage return and a line feed. Data fields follow comma (,) delimiters and are variable in length. Null fields still follow comma (,) delimiters but contain no information.

An asterisk (*) delimiter and checksum value follow the last field of data contained in an NMEA-0183 message. The checksum is the 8-bit exclusive OR of all characters in the message, including the commas between fields, but not including the $ and asterisk delimiters. The hexadecimal result is converted to two ASCII characters (0–9, A–F). The most significant character appears first.

The following table summarizes the set of NMEA messages supported by the receiver, and shows the page where detailed information about each message can be found.

<table>
<thead>
<tr>
<th>Message</th>
<th>Function</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVR</td>
<td>Time, yaw, tilt, range, mode, PDOP, and number of SVs for Moving Baseline RTK</td>
<td>64</td>
</tr>
<tr>
<td>GGA</td>
<td>Time, position, and fix related data</td>
<td>64</td>
</tr>
<tr>
<td>GSA</td>
<td>GNSS DOP and active satellites</td>
<td>65</td>
</tr>
<tr>
<td>GST</td>
<td>Position error statistics</td>
<td>66</td>
</tr>
<tr>
<td>GSV</td>
<td>Number of SVs in view, PRN, elevation, azimuth, and SNR</td>
<td>66</td>
</tr>
<tr>
<td>HDT</td>
<td>Heading from True North</td>
<td>67</td>
</tr>
<tr>
<td>PTNL,GGK</td>
<td>Time, position, position type and DOP values</td>
<td>67</td>
</tr>
<tr>
<td>PTNL,GGK_SYNC</td>
<td>Time, synchronized position, position type and DOP values</td>
<td>68</td>
</tr>
<tr>
<td>PTNL,PJK</td>
<td>Local coordinate position output</td>
<td>69</td>
</tr>
<tr>
<td>PTNL,PJT</td>
<td>Projection type</td>
<td>69</td>
</tr>
<tr>
<td>PTNL,VGK</td>
<td>Time, locator vector, type and DOP values</td>
<td>70</td>
</tr>
<tr>
<td>PTNL,VHD</td>
<td>Heading Information</td>
<td>70</td>
</tr>
<tr>
<td>RMC</td>
<td>Position, Velocity, and Time</td>
<td>71</td>
</tr>
<tr>
<td>ROT</td>
<td>Rate of turn</td>
<td>71</td>
</tr>
<tr>
<td>VTG</td>
<td>Actual track made good and speed over ground</td>
<td>72</td>
</tr>
<tr>
<td>ZDA</td>
<td>UTC day, month, and year, and local time zone offset</td>
<td>72</td>
</tr>
</tbody>
</table>

To enable or disable the output of individual NMEA messages, do one of the following:

- Create an application file in the GPS Configurator software that contains NMEA output settings and then send the file to the receiver.
- Add NMEA outputs in the Serial outputs tab of the GPS Configurator software and then apply the settings.
Common Message Elements

Each message contains:

- A message ID consisting of $GP followed by the message type. For example, the message ID of the GGA message is $GPGGA.
- A comma
- A number of fields, depending on the message type, separated by commas
- An asterisk
- A checksum value

Below is an example of a simple message with a message ID ($GPGGA), followed by 13 fields and a checksum value:

$GPGGA,172814.0,3723.46587704,N,12202.26957864,W,2,6,1.2,18.893,M,-
25.669,M,2.0,0031*4F

Message values

The following values can be found in NMEA messages that the receiver generates.

Latitude and longitude

Latitude is represented as $ddmm.mmmm$ and longitude is represented as $dddmm.mmmm$, where:

- $dd$ or $ddd$ is degrees
- $mm.mmm$ is minutes and decimal fractions of minutes

Direction

Direction (north, south, east, or west) is represented by a single character: $N$, $S$, $E$, or $W$.

Time

Time values are presented in Universal Time Coordinated (UTC) and are represented as $hhmmss.cc$, where:

- $hh$ is hours, from 00 to 23
- $mm$ is minutes
- $ss$ is seconds
- $cc$ is hundredths of seconds

NMEA Messages

When NMEA-0183 output is enabled, the following messages can be generated.
**AVR**

**Time, Yaw, Tilt, Range for Moving Baseline RTK**

The AVR message string is shown below, and Table A.1 describes the message fields.

$$\text{PTNL,AVR,181059.6,+149.4688,Yaw,+0.0134,Tilt,,,60.191,3,2.5,6*00}$$

Table A.1 AVR message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC of vector fix</td>
</tr>
<tr>
<td>2</td>
<td>Yaw angle in degrees</td>
</tr>
<tr>
<td>3</td>
<td>Yaw</td>
</tr>
<tr>
<td>4</td>
<td>Tilt angle in degrees</td>
</tr>
<tr>
<td>5</td>
<td>Tilt</td>
</tr>
<tr>
<td>6</td>
<td>Reserved</td>
</tr>
<tr>
<td>7</td>
<td>Reserved</td>
</tr>
<tr>
<td>8</td>
<td>Range in meters</td>
</tr>
</tbody>
</table>
| 9 | Quality indicator:  
  0: Fix not available or invalid  
  1: Autonomous GPS fix  
  2: Differential carrier phase solution RTK (Float)  
  3: Differential carrier phase solution RTK (Fix)  
  4: Differential code-based solution, DGPS |
| 10 | PDOP |
| 11 | Number of satellites used in solution |

**GGA**

**Time, Position, and Fix Related Data**

An example of the GGA message string is shown below. Table A.2 describes the message fields.

$$\text{GPGGA,172814.0,3723.46587704,N,12202.26957864,W,2,6,1.2,18.893,M,-25.669,M,2.0,0031*4F}$$

Table A.2 GGA message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC of position fix</td>
</tr>
<tr>
<td>2</td>
<td>Latitude</td>
</tr>
</tbody>
</table>
| 3 | Direction of latitude:  
  N: North  
  S: South |
| 4 | Longitude |
| 5 | Direction of longitude:  
  E: East  
  W: West |
NMEA-0183 Output

Table A.3 GSA message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mode 1, M = manual, A = automatic</td>
</tr>
<tr>
<td>2</td>
<td>Mode 2, Fix type, 1 = not available, 2 = 2D, 3 = 3D</td>
</tr>
<tr>
<td>3</td>
<td>PRN number, 01 to 32, of satellite used in solution, up to 12 transmitted</td>
</tr>
<tr>
<td>4</td>
<td>PDOP-Position dilution of precision, 0.5 to 99.9</td>
</tr>
<tr>
<td>5</td>
<td>HDOP-Horizontal dilution of precision, 0.5 to 99.9</td>
</tr>
<tr>
<td>6</td>
<td>VDOP-Vertical dilution of precision, 0.5 to 99.9</td>
</tr>
</tbody>
</table>

GSA GNSS DOP and active satellites

An example of the GSA message string is shown below. Table A.3 describes the message fields.

$GPGSA,<1>,<2>,<3>,<3>,<3>,<3>,<4>,<5>,<6>*<7><CR><LF>

Table A.3 GSA message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mode 1, M = manual, A = automatic</td>
</tr>
<tr>
<td>2</td>
<td>Mode 2, Fix type, 1 = not available, 2 = 2D, 3 = 3D</td>
</tr>
<tr>
<td>3</td>
<td>PRN number, 01 to 32, of satellite used in solution, up to 12 transmitted</td>
</tr>
<tr>
<td>4</td>
<td>PDOP-Position dilution of precision, 0.5 to 99.9</td>
</tr>
<tr>
<td>5</td>
<td>HDOP-Horizontal dilution of precision, 0.5 to 99.9</td>
</tr>
<tr>
<td>6</td>
<td>VDOP-Vertical dilution of precision, 0.5 to 99.9</td>
</tr>
</tbody>
</table>

Trimble R8 GNSS and R6/5800 GPS Receivers User Guide 65
**GST**  
**Position Error Statistics**  
An example of the GST message string is shown below. Table A.4 describes the message fields.

\[$\text{GPGST,172814.0,0.006,0.023,0.020,273.6,0.023,0.020,0.031*6A}$\]

**Table A.4** GST message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC of position fix</td>
</tr>
<tr>
<td>2</td>
<td>RMS value of the pseudorange residuals (includes carrier phase residuals during periods of RTK(float) and RTK(fixed) processing)</td>
</tr>
<tr>
<td>3</td>
<td>Error ellipse semi-major axis 1 sigma error, in meters</td>
</tr>
<tr>
<td>4</td>
<td>Error ellipse semi-minor axis 1 sigma error, in meters</td>
</tr>
<tr>
<td>5</td>
<td>Error ellipse orientation, degrees from true north</td>
</tr>
<tr>
<td>6</td>
<td>Latitude 1 sigma error, in meters</td>
</tr>
<tr>
<td>7</td>
<td>Longitude 1 sigma error, in meters</td>
</tr>
<tr>
<td>8</td>
<td>Height 1 sigma error, in meters</td>
</tr>
</tbody>
</table>

**GSV**  
**Satellite Information**  
The GSV message string identifies the number of SVs in view, the PRN numbers, elevations, azimuths, and SNR values. An example of the GSV message string is shown below. Table A.5 describes the message fields.

\[$\text{GPGSV,4,1,13,02,02,213,,03,-3,000,,11,00,121,,14,13,172,05*67}$\]

**Table A.5** GSV message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total number of messages of this type in this cycle</td>
</tr>
<tr>
<td>2</td>
<td>Message number</td>
</tr>
<tr>
<td>3</td>
<td>Total number of SVs visible</td>
</tr>
<tr>
<td>4</td>
<td>SV PRN number</td>
</tr>
<tr>
<td>5</td>
<td>Elevation, in degrees, 90° maximum</td>
</tr>
<tr>
<td>6</td>
<td>Azimuth, degrees from True North, 000° to 359°</td>
</tr>
<tr>
<td>7</td>
<td>SNR, 00–99 dB (null when not tracking)</td>
</tr>
<tr>
<td>8–11</td>
<td>Information about second SV, same format as fields 4–7</td>
</tr>
<tr>
<td>12–15</td>
<td>Information about third SV, same format as fields 4–7</td>
</tr>
<tr>
<td>16–19</td>
<td>Information about fourth SV, same format as fields 4–7</td>
</tr>
</tbody>
</table>
HDT

**Heading from True North**

The HDT string is shown below, and Table A.6 describes the message fields.

\[ \$GPHDT,123.456,T^*00 \]

<table>
<thead>
<tr>
<th>Table A.6</th>
<th>Heading from true north fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field</td>
<td>Meaning</td>
</tr>
<tr>
<td>1</td>
<td>Heading in degrees</td>
</tr>
<tr>
<td>2</td>
<td>T: Indicates heading relative to True North</td>
</tr>
</tbody>
</table>

PTNL,GGK

**Time, Position, Position Type, DOP**

An example of the PTNL,GGK message string is shown below. Table A.7 describes the message fields.

\[ \$PTNL,GGK,172814.00,071296,\]
\[ 3723.46587704,N,12202.26957864,W,\]
\[ 3,06,1.7,EHT-6.777,M^*48 \]

<table>
<thead>
<tr>
<th>Table A.7</th>
<th>PTNL,GGK message fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field</td>
<td>Meaning</td>
</tr>
<tr>
<td>1</td>
<td>UTC of position fix</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
</tr>
<tr>
<td>3</td>
<td>Latitude</td>
</tr>
<tr>
<td>4</td>
<td>Direction of latitude:</td>
</tr>
<tr>
<td>N: North</td>
<td></td>
</tr>
<tr>
<td>S: South</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Longitude</td>
</tr>
<tr>
<td>6</td>
<td>Direction of Longitude:</td>
</tr>
<tr>
<td>E: East</td>
<td></td>
</tr>
<tr>
<td>W: West</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>GPS Quality indicator:</td>
</tr>
<tr>
<td>0: Fix not available or invalid</td>
<td></td>
</tr>
<tr>
<td>1: Autonomous GPS fix</td>
<td></td>
</tr>
<tr>
<td>2: Differential, floating carrier phase integer-based solution, RTK(float)</td>
<td></td>
</tr>
<tr>
<td>3: Differential, fixed carrier phase integer-based solution, RTK(fixed)</td>
<td></td>
</tr>
<tr>
<td>4: Differential, code phase only solution (DGPS)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Number of satellites in fix</td>
</tr>
<tr>
<td>9</td>
<td>DOP of fix</td>
</tr>
<tr>
<td>10</td>
<td>Ellipsoidal height of fix</td>
</tr>
<tr>
<td>11</td>
<td>M: ellipsoidal height is measured in meters</td>
</tr>
</tbody>
</table>

*Note* – The PTNL,GGK message is longer than the NMEA-0183 standard of 80 characters.
The PTNL,GGK_SYNC message has the same format as the PTNL,GGK message, but outputs Synchronized 1 Hz positions even in Low Latency mode. An example of the PTNL,GGK_SYNC message string is shown below. Table A.8 describes the message fields.

```
$PTNL,GGK_SYNC,172814.00,071296,
3723.46587704,N,12202.26957864,W,
3,06,1.7,EHT-6.777,M*48
```

Table A.8  PTNL,GGK_SYNC message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC of position fix</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
</tr>
<tr>
<td>3</td>
<td>Latitude</td>
</tr>
</tbody>
</table>
| 4     | Direction of latitude:  
|       | N: North  
|       | S: South |
| 5     | Longitude |
| 6     | Direction of Longitude:  
|       | E: East  
|       | W: West |
| 7     | GPS Quality indicator:  
|       | 0: Fix not available or invalid  
|       | 1: Autonomous GPS fix  
|       | 2: Differential, floating carrier phase integer-based solution, RTK(float)  
|       | 3: Differential, fixed carrier phase integer-based solution, RTK(fixed)  
|       | 4: Differential, code phase only solution (DGPS) |
| 8     | Number of satellites in fix |
| 9     | DOP of fix |
| 10    | Ellipsoidal height of fix |
| 11    | M: ellipsoidal height is measured in meters |

*Note – The PTNL,GGK_SYNC message is longer than the NMEA-0183 standard of 80 characters.*
**PTNL,PJK Local Coordinate Position Output**

An example of the PTNL,PJK message string is shown below. Table A.9 describes the message fields.

```
$PTNL,PJK,010717.00,081796,
+732646.511,N,+1731051.091,E,
1.0527,EHT-28.345,M*7C
```

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC of position fix</td>
</tr>
<tr>
<td>2</td>
<td>Date</td>
</tr>
<tr>
<td>3</td>
<td>Northing, in meters</td>
</tr>
<tr>
<td>4</td>
<td>Direction of Northing will always be N (North)</td>
</tr>
<tr>
<td>5</td>
<td>Easting, in meters</td>
</tr>
<tr>
<td>6</td>
<td>Direction of Easting will always be E (East)</td>
</tr>
</tbody>
</table>
| 7     | GPS Quality indicator:  
|       | 0: Fix not available or invalid  
|       | 1: Autonomous GPS fix  
|       | 2: Differential, floating carrier phase integer-based solution, RTK (float)  
|       | 3: Differential, fixed carrier integer-based solution, RTK (fixed)  
|       | 4: Differential, code phase only solution (DGPS) |
| 8     | Number of satellites in fix |
| 9     | DOP of fix |
| 10    | Ellipsoidal height of fix |
| 11    | M: ellipsoidal height is measured in meters |

*Note* - The PTNL,PJK message is longer than the NMEA-0183 standard of 80 characters.

**PTNL,PJT Projection Type**

An example of the PTNL,PJT message string is shown below. Table A.10 describes the message fields.

```
$PTNL,PJT,NAD83(Conus),California Zone 4 0404,*51
```

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coordinate system name (can include multiple words)</td>
</tr>
<tr>
<td>2</td>
<td>Projection name (can include multiple coordinates)</td>
</tr>
</tbody>
</table>
PTNL,VGK

Vector Information

An example of the PTNL,VGK message string is shown below. Table A.11 describes the message fields.

```
$PTNL,VGK,160159.00,010997,-0000.161,00009.985,-0000.002,3,07,1,4,M*0B
```

Table A.11 PTNL,VGK message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC of vector in hhmmss.ss format</td>
</tr>
<tr>
<td>2</td>
<td>Date in mmddyy format</td>
</tr>
<tr>
<td>3</td>
<td>East component of vector, in meters</td>
</tr>
<tr>
<td>4</td>
<td>North component of vector, in meters</td>
</tr>
<tr>
<td>5</td>
<td>Up component of vector, in meters</td>
</tr>
<tr>
<td>6</td>
<td>GPS quality indicator:</td>
</tr>
<tr>
<td></td>
<td>0: Fix not available or invalid</td>
</tr>
<tr>
<td></td>
<td>1: Autonomous GPS fix</td>
</tr>
<tr>
<td></td>
<td>2: Differential carrier phase solution RTK(float)</td>
</tr>
<tr>
<td></td>
<td>3: Differential carrier phase solution RTK(fix)</td>
</tr>
<tr>
<td></td>
<td>4: Differential code-based solution, DGPS</td>
</tr>
<tr>
<td>7</td>
<td>Number of satellites if fix solution</td>
</tr>
<tr>
<td>8</td>
<td>DOP of fix</td>
</tr>
<tr>
<td>9</td>
<td>M: Vector components are in meters</td>
</tr>
</tbody>
</table>

PTNL,VHD

Heading Information

An example of the PTNL,VHD message string is shown below. Table A.12 describes the message fields.

```
$PTNL,VHD,030556.00,093098,187.718,-22.138,-76.929,-5.015,0.033,0.006,3,07,2.4,M*22
```

Table A.12 PTNL,VHD message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC of position, in hhmmss.ss,ddmmyy format</td>
</tr>
<tr>
<td>2</td>
<td>Date in mmddyy format</td>
</tr>
<tr>
<td>3</td>
<td>Azimuth</td>
</tr>
<tr>
<td>4</td>
<td>ΔAzimuth/ΔTime</td>
</tr>
<tr>
<td>5</td>
<td>Vertical Angle</td>
</tr>
<tr>
<td>6</td>
<td>ΔVertical/ΔTime</td>
</tr>
<tr>
<td>7</td>
<td>Range</td>
</tr>
<tr>
<td>8</td>
<td>ΔRange/ΔTime</td>
</tr>
</tbody>
</table>
### NMEA-0183 Output

#### RMC

**Position, Velocity, and Time**

The RMC string is shown below, and Table A.13 describes the message fields.

```
$GPRMC,123519,A,4807.038,N,01131.000,E,022.4,084.4,230394,003.1,W*6A
```

Table A.13  GPRMC message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC of position fix</td>
</tr>
<tr>
<td>2</td>
<td>Status A=active or V=void</td>
</tr>
<tr>
<td>3</td>
<td>Latitude</td>
</tr>
<tr>
<td>4</td>
<td>Longitude</td>
</tr>
<tr>
<td>5</td>
<td>Speed over the ground in knots</td>
</tr>
<tr>
<td>6</td>
<td>Track angle in degrees (True)</td>
</tr>
<tr>
<td>7</td>
<td>Date</td>
</tr>
<tr>
<td>8</td>
<td>Magnetic variation</td>
</tr>
<tr>
<td>9</td>
<td>The checksum data, always begins with *</td>
</tr>
</tbody>
</table>

#### ROT

**Rate of Turn**

The ROT string is shown below, and Table A.14 describes the message fields.

```
$GPROT,35.6,A*4E
```

Table A.14  ROT message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rate of turn, degrees/minutes, “-” indicates bow turns to port</td>
</tr>
</tbody>
</table>
| 2     | A: Valid data  
V: Invalid data |
VTG  Actual Track Made Good Over and Speed Over Ground

An example of the VTG message string is shown below. Table A.15 describes the message fields.

$GPVTG,,T,,M,0.00,N,0.00,K*4E

Table A.15  VTG message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Track made good (degrees true)</td>
</tr>
<tr>
<td>2</td>
<td>T: track made good is relative to true north</td>
</tr>
<tr>
<td>3</td>
<td>Track made good (degrees magnetic)</td>
</tr>
<tr>
<td>4</td>
<td>M: track made good is relative to magnetic north</td>
</tr>
<tr>
<td>5</td>
<td>Speed, in knots</td>
</tr>
<tr>
<td>6</td>
<td>N: speed is measured in knots</td>
</tr>
<tr>
<td>7</td>
<td>Speed over ground in kilometers/hour (kph)</td>
</tr>
<tr>
<td>8</td>
<td>K: speed over ground is measured in kph</td>
</tr>
</tbody>
</table>

ZDA  UTC Day, Month, And Year, and Local Time Zone Offset

An example of the ZDA message string is shown below. Table A.16 describes the message fields.

$GPZDA,172809,12,07,1996,00,00*45

Table A.16  ZDA message fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC</td>
</tr>
<tr>
<td>2</td>
<td>Day, ranging between 01 and 31</td>
</tr>
<tr>
<td>3</td>
<td>Month, ranging between 01 and 12</td>
</tr>
<tr>
<td>4</td>
<td>Year</td>
</tr>
<tr>
<td>5</td>
<td>Local time zone offset from GMT, ranging from 00 to ±13 hours</td>
</tr>
<tr>
<td>6</td>
<td>Local time zone offset from GMT, ranging from 00 to 59 minutes</td>
</tr>
</tbody>
</table>

Fields 5 and 6 together yield the total offset. For example, if field 5 is –5 and field 6 is +15, local time is 5 hours and 15 minutes earlier than GMT.
RTCM Output

In this appendix:

- Generated messages
- Message scheduling
Generated messages

Table B.1 shows the messages that are generated when you select a specific RTCM version. The messages in the table are in the same order as they appear in the GPS Configurator software. For the details of the contents of individual messages, refer to the RTCM documentation.

Table B.1  RTCM output

<table>
<thead>
<tr>
<th>Selection</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 2</td>
<td>1 3 22 59</td>
</tr>
<tr>
<td>USCG 9-3</td>
<td>3 9-3</td>
</tr>
<tr>
<td>RTCM/RTK 2.2+2.3</td>
<td>1 3 18 19 22 23 24 59</td>
</tr>
<tr>
<td>RTK Only 2.2+2.3</td>
<td>3 18 19 22 23 24 59</td>
</tr>
<tr>
<td>RTCM/RTK 2.3</td>
<td>1 18 19 23 24</td>
</tr>
<tr>
<td>RTK Only 2.3</td>
<td>18 19 22</td>
</tr>
<tr>
<td>RTCM/RTK 2.2</td>
<td>1 3 18 19 22 59</td>
</tr>
<tr>
<td>RTK Only 2.2</td>
<td>3 18 19 22 59</td>
</tr>
<tr>
<td>RTCM/RTK 2.1</td>
<td>1 3 18 19 22 59</td>
</tr>
<tr>
<td>RTK Only 2.1</td>
<td>3 18 19 22 59</td>
</tr>
<tr>
<td>RTCM/RTK 3.00</td>
<td>1004 1006 1008 1013</td>
</tr>
</tbody>
</table>

Message scheduling

Table B.2 describes the frequency at which messages are generated when they are enabled in a base receiver.

Table B.2  Message scheduling

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Every second</td>
</tr>
<tr>
<td>3</td>
<td>The 10th second after the first measurement, then every 10 seconds after that</td>
</tr>
<tr>
<td>9-3</td>
<td>Every second</td>
</tr>
<tr>
<td>18</td>
<td>Every second</td>
</tr>
<tr>
<td>19</td>
<td>Every second</td>
</tr>
<tr>
<td>22</td>
<td>The 5th second after the first measurement, then every 10 seconds after that</td>
</tr>
<tr>
<td>23</td>
<td>The 4th second after the first measurement, then every 10 seconds after that</td>
</tr>
<tr>
<td>24</td>
<td>The 4th second after the first measurement, then every 10 seconds after that</td>
</tr>
<tr>
<td>59-sub, 13</td>
<td>The 5th second after the first measurement, then every 10 seconds after that</td>
</tr>
<tr>
<td>1004</td>
<td>Every second</td>
</tr>
<tr>
<td>1006</td>
<td>Every 10 seconds</td>
</tr>
<tr>
<td>1008</td>
<td>Every 10 seconds</td>
</tr>
<tr>
<td>1013</td>
<td>Every 300 seconds</td>
</tr>
</tbody>
</table>
Troubleshooting

In this appendix:

- LED conditions
- Receiver issues
**LED conditions**

An LED that is flashing quickly indicates a condition that may require attention, and an unlit LED indicates that no operation is occurring. The following table describes some LED conditions, possible causes, and how to solve them.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The SV Tracking LED is lit solidly and the Logging/memory LED is flashing slowly.</td>
<td>The receiver is in Monitor mode, ready for new firmware to be loaded or new options to be added.</td>
<td>Turn off or turn on the receiver. Load the latest version of the firmware, which you can download from <a href="http://www.trimble.com/support">www.trimble.com/support</a></td>
</tr>
<tr>
<td>The SV Tracking LED is flashing rapidly.</td>
<td>The receiver is tracking fewer than four satellites.</td>
<td>Wait until the SV Tracking LED is flashing slowly.</td>
</tr>
</tbody>
</table>

**Receiver issues**

The following table describes some possible receiver issues, possible causes, and how to solve them.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The receiver does not turn on.</td>
<td>External power too low.</td>
<td>Check the charge on the external battery, and check the fuse if applicable. Replace the battery if necessary.</td>
</tr>
<tr>
<td></td>
<td>Internal power too low.</td>
<td>Check the charge on the internal batteries and replace if necessary. Ensure battery contacts are clean.</td>
</tr>
<tr>
<td></td>
<td>External power not properly connected.</td>
<td>Check that the Lemo connection is seated properly. Check for broken or bent pins in the connector.</td>
</tr>
<tr>
<td></td>
<td>Faulty power cable.</td>
<td>Try a different cable. Check pinouts with multimeter to ensure internal wiring is intact.</td>
</tr>
<tr>
<td>Receiver does not log data.</td>
<td>Insufficient internal memory.</td>
<td>Delete old files using the GPS Configurator or Trimble Survey Controller software, or by holding down the Power button for 30 seconds.</td>
</tr>
<tr>
<td></td>
<td>The receiver is tracking fewer than four satellites.</td>
<td>Wait until the SV Tracking LED is flashing slowly.</td>
</tr>
<tr>
<td>The receiver is not responding.</td>
<td>Receiver needs soft reset.</td>
<td>Power down the receiver and power back up.</td>
</tr>
<tr>
<td></td>
<td>Receiver needs full reset.</td>
<td>Hold down the Power button for 30 seconds. If you want to retain data files, remove the CompactFlash card first.</td>
</tr>
<tr>
<td>Issue</td>
<td>Possible cause</td>
<td>Solution</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Reference receiver is not</td>
<td>Port settings between reference receiver and radio are incorrect.</td>
<td>Using the Trimble Survey Controller software, connect directly to the</td>
</tr>
<tr>
<td>broadcasting.</td>
<td></td>
<td>radio and change the port settings. Try to connect to the radio through</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the receiver to ensure that they are communicating.</td>
</tr>
<tr>
<td></td>
<td>Faulty cable between receiver and radio.</td>
<td>Try a different cable.</td>
</tr>
<tr>
<td></td>
<td>No power to radio.</td>
<td>Examine the ports for missing pins.</td>
</tr>
<tr>
<td>Roving receiver is not</td>
<td>Reference receiver is not broadcasting.</td>
<td>If the radio has its own power supply, check the charge and connections.</td>
</tr>
<tr>
<td>receiving radio.</td>
<td>Incorrect over air baud rates between reference and rover.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incorrect port settings between roving external radio and receiver.</td>
<td>Connect to the roving receiver's radio and check to ensure it has the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>same setting as the reference receiver.</td>
</tr>
<tr>
<td></td>
<td>The cellular modem does not have hardware flow control enabled.</td>
<td>If the radio is receiving data (the Power LED is flashing) and the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>receiver is not getting radio communications, use Trimble Survey</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Controller to check that the port settings are correct.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disable flow control on the modem.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use a special cable. For more information, refer to the document</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Using Cellular and CDPD Modems for RTK, which is available from your</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trimble Reseller.</td>
</tr>
</tbody>
</table>
Symbols

. (NMEA field delimiter) 62
.cfg files 36–39
.elf files 33
* (NMEA checksum delimiter) 63
$ (NMEA start of message delimiter) 62

A

accuracy
  centimeter-level 16
  submeter-level 16
Actual Track Made Good Over and Speed Over Ground message 72
adding frequencies for internal radio 44
antenna information, default 54
Antenna record, in application file 36
antennas
  electrical interference 22
  mounting 22
application files
  applying 38
  configuring the receiver with 36
  Current (Current.cfg) 37, 53
  Default (Default.cfg) 37, 53
  deleting 28
  maximum number 37
  naming 39
  overview 36
  power up (Power_up.cfg) 38, 53
  records 36
  storing 38
applying application files 38
ASCII, output, default settings 54
Australia, notices to users 2

B

baseline, moving 62
battery
  compartments 22
  inserting in the receiver 23
  baud rate, default 54
  binary output, default settings 54
  Bluetooth wireless technology 16, 26
  bottom panel 22
  buttons 20, 28

C

cables, data/power 59
  catch, for CompactFlash/USB door 20
  cellphones 26
  cellular modems 26, 77
  centimeter-level accuracy 16
  CMR
    input 16
    output 16
  COCOM limits 17
  cold start, time required 51
  CompactFlash card, upgrading receiver firmware from 33
  CompactFlash port 22
  CompactFlash/USB door 22
  CompactFlash/USB door catch 20
  configuring
    MS Series parameters 64
    receiver in real time 36
    receiver using application files 36
  current application file 37, 53
  current receiver configuration 37

data link, using a cellular modem 26
data outputs, NMEA 64
data, logging to Trimble Survey Controller software 30
data/power cable pinouts 59
default application file 37, 53
default settings
  antenna 54
  ASCII output 54
  baud rate 54
  binary output 54
  changing 38
Index

elevation mask  54
motion  54
NMEA output  54
overriding  37
receiver  53
reference position  54
reference station  54
resetting  31
RT17 output  54
serial format  54
streamed output  54
SV enabling  54
deleing files
  application files  28
  ephemeris file  28
delimiters, NMEA
  checksum  63
  field separator  63
  start of message  62
Device Control record, in application file  36
dimensions, receiver  50
direction, NMEA field format  63
disabling flow control  77
dual-frequency RTK engine  16

E
electrical interference  22
electronic interference  16
elevation mask, default  54
enabling power output on Port  32
environmental factors, when setting up the receiver  22
ephemeris file, deleting  28
Europe, notices to users  2

F
factory defaults
  receiver  53–55
  resetting to  28, 54
features
  automatic OTF (on-the-fly) initialization  16
  centimeter accuracy  16
  CMR input and output  16
  OTF data  16
  real-time positioning  16
  receiver  16
  RTCM SC-104 input and output  16
  RTK data  16
  submeter accuracy  16
  WAAS capability  16
File Storage record, in application file  36
firmware, upgrading  33, 43
flashing LED  28
flow control
  default setting  54
  disabling on cellular modem  26, 77
  receiver  51
frequencies, for internal radio  44
front panel  20
full reset  76

G
General Controls record, in application file  36
GGA message, time, position, and fix related data  64
GPS antenna port  16
GPS Configurator software
  installing  42
  Trimble R6/R8 receiver  25, 35, 42
GSA message  65
GST message  66
GSV message  66
guidelines for setting up receiver  23

H
Heading Information message  70

I
icons, on top panel  21
indicator LEDs  20, 28
initialization
  minimum time required  51
  on-the-fly  16
  specifications  51
input
  CMR  16
  RTCM  16
Input Message record, in application file  36
installing
  GPS Configurator software  42
  WinFlash utility  43
interference
  electrical  22
  electronic  16

80 Trimble R8 GNSS and R6/5800 GPS Receivers User Guide
internal radio
   adding frequencies 44
internal radio, receiver 25

L
latitude, NMEA field format 63
LEDs
    flashing 28
    receiver 20, 28
Lemo cables, plugging in 23
limits, imposed by COCOM 17
Local Coordinate Position Output message 69
Logging Rate record, in application file 36
logging to Trimble Survey Controller software 30
longitude, NMEA field format 63

M
maximum number of application files 37
Maxwell architecture 51
memory, full 76
message ID, in NMEA messages 63
mobile phones 26
Monitor mode 33, 76
motion, default settings 54
mounting antenna, avoiding electrical interference 22

N
naming application files 39
New Zealand, notices to users 2
NMEA
    output 16, 61–72
    output, default settings 54
NMEA messages
    common elements 62
    common message elements 63
delimiters 63
enabling and disabling 62
GGA 64
GSA 65
GST 66
GSV 66
ID 63
PTNLGGK 67
PTNLGGK_SYNC 68
PTNLPJK 69
PTNLPJT 69
PTNLCV 70
PTNLCVHD 70
summary 62
values 63
VTG 72
ZDA 72
notices to users
   Australia and New Zealand 2
   Europe 2

O
on-the-fly (OTF) initialization 16
operating controls 20
operating temperature 50
output formats
    CMR 16
    NMEA 16, 61
    RT17 51, 54
    RTCM 16
    Trimble R6/R8 receiver 51
Output Message record, in application file 36
overriding default settings 37

P
physical specifications 50
pinout information, receiver 57
pins
    data/power cable 59
    serial ports 58
pole-mounted setup, receiver 23
Port 1
    default baud rate 54
    default serial format 54
    flow control 54
    icon 21
    pinout diagram 58
    power output 32
Port 2
    default baud rate 54
    default serial format 54
    icon 21
    pinout diagram 58
Port 3
    flow control 54
    power output 32
port settings, checking 77
ports, receiver pinout diagram 58
Position Error Statistics message 66

Trimble R8 GNSS and R6/5800 GPS Receivers User Guide 81
Index

Power button 28
power cable, pinouts 59
power output
  enabling on Port 3 32
  on Port 1 32
power supply 31
power up application file
  overriding factory defaults with 53
  Trimble R6/R8 receiver 38
Power_Up.cfg See power up application file 53
problems, troubleshooting 75–??
Projection Type message 69
PTNL,GGK message 67
PTNL,GGK message, Time, Position, Position Type, DOP 67
PTNL,GGK_SYNC message 68
PTNL,PJK message 69
PTNL,PJT message 69
PTNL,VGK message 70
PTNL,VHD message 70

R
radio antenna port 16
radio noise emissions, Canada 2
RADIO port icon 21
radios
  internal 25
  Trimble R6/R8 receiver 25
  TRIMMARK 3 25
real time, configuring receiver in 36
rear panel 21
receiver
  buttons 28
  catch lock 21
  changing default settings 38
  configuring 35
  connecting to devices 57
  current configuration 37
  factory default settings 53
  inserting the internal battery 23
  internal radio 25
  LEDs 28
  maximum number of application files 37
  output formats 51
  parts of the receiver 20–22
  pole-mounted setup 23
  resetting 37
  resetting to factory defaults 28, 54
  setup 19–26
  specifications 49–51
turning on and off 28, 29
upgrading firmware 33, 43
use and care 16
receiver setup 19–26
Reference Position record, in application file 36
reference position, default 54
reference station, default settings 54
registration 13
release notes 13
reset
  full 76
  soft 76
  to factory defaults 28, 54
  Trimble R6/R8 receiver 37
RT17 output
  default settings 54
  Trimble R6/R8 receiver 51
RTCM input 16
RTCM output 16
RTK engine 16
RTK/OTF data 16

S
Satellite Information message 66
security limits 17
serial format, default setting 54
Serial Port Baud/Format record, in application file 36
serial ports pinouts 58
setup
  guidelines 22
  pole-mounted 23
  Trimble R6/R8 receiver 19–26
signal processing 51
size, receiver 50
soft reset 76
specifications
  physical 50
  receiver 49–51
  technical 51
start-up specifications 51
Static/Kinematic record, in application file 36
storage temperature 50
storing application files 38
streamed output, default settings 54
submeter-level accuracy 16
SV Enable/Disable record, in application file 36
SV enabling, default settings 54

82 Trimble R8 GNSS and R6/5800 GPS Receivers User Guide
T

technical specifications  51
temperature
  operating range  50
  storage range  50
time values in NMEA messages  63
Time, Position, and Fix Related Data message  64
Time, Position, and Fix Related Data, GGA
  message  64
Time, Position, Position Type, DOP message  67
Time, Synchronized Position, Position Type, DOP
  message  68
TNC connector  16
TNC ports  16
tracking specifications  51
Trimble Survey Controller software
  configuring the internal radio with  25
  configuring the receiver with  35
Trimble web site  13
TRIMMARK 3 radio  25
troubleshooting  75--?
turning the receiver on and off  28, 29

U

U.S. Department of Commerce  17
Universal Time Coordinated (UTC)  See UTC
upgrading receiver firmware  33, 43
USB port  22
use and care of the receiver  16
UTC Day, Month, and Year, and Local Time Zone
  Offset message  72
UTC, NMEA time values  63

V

Vector Information message  70
VTG message  72

W

WAAS, receiver  16
warm start, time required  51
website  13
weight, receiver  50
WinFlash utility
  installing  43
  receiver  25, 43
  upgrading receiver firmware with  43

Z

ZDA message  72