# 5700 GPS Receiver

## User Guide


Trimble™

# 5700 GPS Receiver

## User Guide

Version 1.00
Part Number 43952-00-ENG
Revision A
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Trimble™

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# About This Manual

Welcome to the *5700 GPS Receiver User Guide*. This manual describes how to install, set up, and use the Trimble™ 5700 GPS receiver.

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 this product.

If you are not familiar with GPS, visit our web site for an interactive look at Trimble and GPS at:

- www.trimble.com

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

# Related Information

As well as being supplied in hardcopy, this manual is also available in portable document format (PDF) on the 5700 GPS Receiver CD-ROM. Use Adobe Acrobat 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 Acrobat Reader to view the contents of the release notes.
- Registration – register your receiver to automatically receive e-mail notifications of 5700 receiver firmware upgrades and new functionality. To register, do one of the following:
  - Run the 5700 GPS Receiver CD-ROM.
  - Print the registration form (Register.doc) that is on the 5700 GPS Receiver CD-ROM, 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.
- ftp.trimble.com – use the Trimble FTP site to send files or to receive files such as software patches, utilities, service bulletins, and FAQs. Alternatively, access the FTP site from the Trimble web site at www.trimble.com/support/support.htm.
- Trimble training courses – consider a training course to help you use your GPS system to its fullest potential. For more information, visit the Trimble web site at www.trimble.com/support/training.htm

## Technical Assistance

If you have a problem and cannot find the information you need in the product documentation, *contact your local Distributor.* Alternatively, request technical support using the Trimble web site at:

- www.trimble.com/support/support.htm

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- Send an e-mail to ReaderFeedback@trimble.com.
- Complete the Reader Comment Form at the back of this manual and mail it according to the instructions at the bottom of the form.

If the Reader Comment Form is not available, send comments and suggestions to the address in the front of this manual. Please mark the information *Attention: Technical Publications Group*.

# Document Conventions

The document conventions are as follows:

| Convention | Definition |
|---|---|
| *Italics* | Identifies software menus, menu commands, dialog boxes, and the dialog box fields. |
| Helvetica Narrow | Represents messages printed on the screen. |
| **Helvetica Bold** | Identifies a software command button, or represents information that you must type in a software screen or window. |
|  | Is an example of a hardware key (hard key) that you must press on the 5700 receiver. The operation of these buttons is explained in Button Functions, page 37. |
| "Select *Italics* / *Italics*" | Identifies the sequence of menus, commands, or dialog boxes that you must choose in order to reach a given screen. |
| [Ctrl] | Is an example of a hardware function key that you must press on a personal computer (PC). If you must press more than one of these at the same time, this is represented by a plus sign, for example, [Ctrl]+[C]. |

SECTION

# I

# OPERATION

CHAPTER

# 1

# Overview

**In this chapter:**

- Introduction
- Features
- Use and care
- COCOM limits

# Introduction

This chapter introduces the 5700 receiver, which is designed for GPS surveying applications. The receiver features one-touch logging for ease of use, and five LEDs that let you monitor the survey in progress and the available battery capacity.

The 5700 receiver tracks GPS satellites on both the L1 and L2 frequencies to provide precise position data for land survey applications. The receiver records GPS data on an internal CompactFlash card and makes all data available through serial or USB ports.

You can use the 5700 receiver alone, logging data internally, or as part of the GPS Total Station® 5700 system, which logs GPS data from the 5700 receiver to a TSC1™ data collector running the Trimble Survey Controller™ software.

# Features

The receiver provides the following features:

- centimeter-accuracy real-time positioning with RTK/OTF data, up to 10 Hz position updates, and around 20 ms latency
- submeter-accuracy real-time positioning using pseudorange corrections with less than 20 ms latency
- extended RTK (eRTK)
- Adaptive dual-frequency RTK engine
- WAAS capability
- automatic OTF (on-the-fly) initialization while moving
- 1PPS (One Pulse Per Second) output
- Dual event marker input
- USB port for data transfer
- Type I CompactFlash card for data storage
- internal charging of batteries (no external battery charger required)
- three RS-232 serial ports for:
  - NMEA output
  - RTCM SC-104 input and output
  - Trimble Format (CMR) input and output
- two TNC ports for:
  - connecting to a GPS antenna
  - connecting to a radio antenna

## Use and Care

The 5700 receiver is designed to withstand the rough treatment that typically occurs in the field. However, the receiver is a high-precision electronic instrument and should be treated with reasonable care.

**Warning –** Operating or storing the 5700 receiver outside the specified temperature range can damage it or limit its longevity.

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 5700 receiver operations.

For more information, see the Trimble technical note *Using Radio Communication Systems with GPS Surveying Receivers*.

## 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 5700 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.

CHAPTER

# 2

# Setting up the Receiver

**In this chapter:**

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

# Introduction

This chapter provides general setup information, connection information, and cabling diagrams for the most common uses of the 5700 receiver.

For more information on setting up a 5700 receiver for specific applications such as RTK or FastStatic surveying, see Applications, page 77.

# Parts of the Receiver

All operating controls, ports, and connectors on the 5700 receiver are located on its four main panels. This section provides a brief overview of the features of each of these panels.

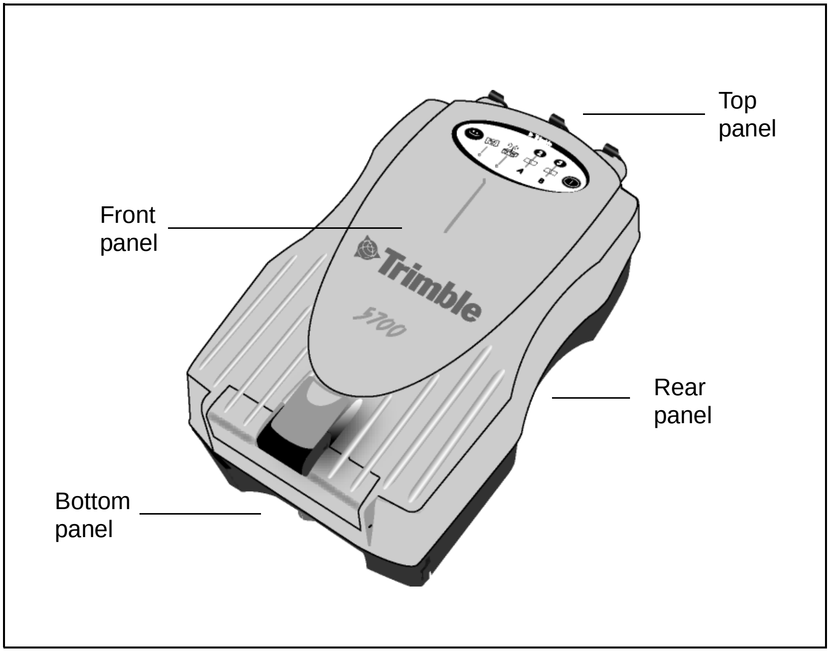



Figure 2.1 Panels on the 5700 receiver

## Front Panel

Figure 2.2 shows the front panel of the 5700 receiver. This panel contains the five indicator LEDs, the two buttons, and the catch for the CompactFlash/USB door.

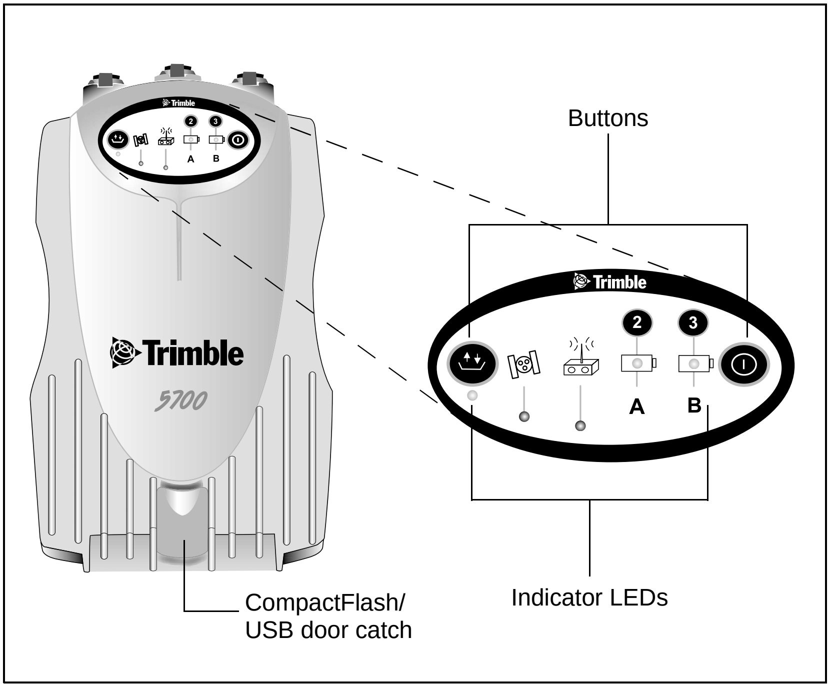



Figure 2.2 Front panel

The two buttons control data logging, data management, power, and settings. For more information, see Button Functions, page 37.

The indicator LEDs show the status of logging, power, satellite tracking, and radio reception. For more information, see LED Behavior, page 38.

## Rear Panel

Figure 2.3 shows the rear panel of the 5700 receiver. This panel contains a slot for attaching the receiver catch lock, and the catches for the two battery compartments on the bottom panel. The catch lock should already be attached to your receiver.

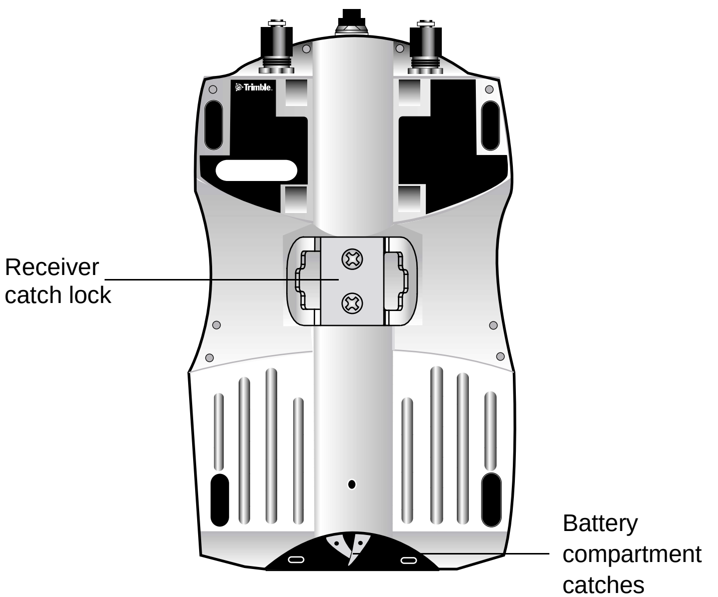



Figure 2.3 Rear panel

To mount the receiver on a pole, you need to attach the receiver bracket to the pole, and insert the catch lock into the bracket. For more information, see Pole-Mounted Setup, page 18.

## Top Panel

Figure 2.4 shows the top panel of the 5700 receiver. This panel contains the three power/serial data ports and the two GPS/radio (TNC) ports.

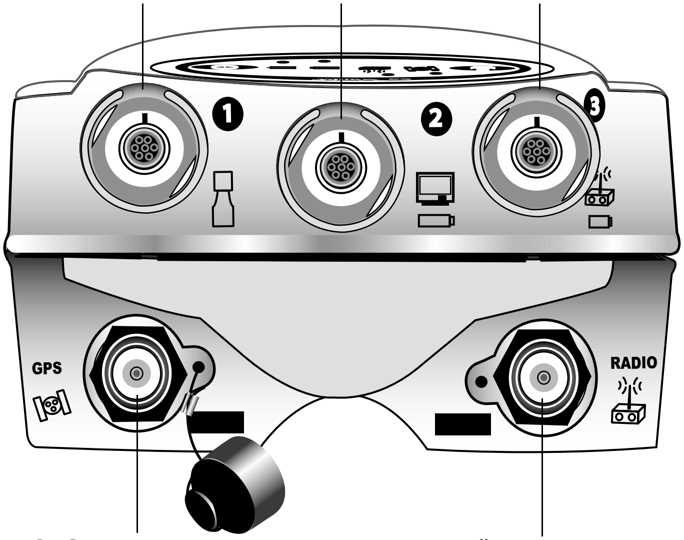
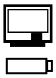
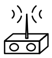



Figure 2.4 Top panel

Each port on the top panel is marked with an icon to indicate its main function.

**Table 2.1 5700 receiver ports**

| Icon | Name | Connections |
|---|---|---|
|  | Port 1 | TSC1 data collector, event marker, or computer |
|  | Port 2 | Power in, computer, 1PPS, or event marker |
|  | Port 3 | External radio, power in |
|  | ANT | GPS antenna |
|  | RADIO | Radio communications antenna |

The power/data ports are all 0-shell Lemo connectors. Both Port 2 and Port 3 can accept external power. For more information on default port settings, see Default Settings, page 111. For more information on connector pinouts, see Cables and Connectors, page 117.

The TNC port connectors are for GPS and radio antenna input. They are color-coded for easy system setup. Connect the yellow GPS antenna cable to the yellow TNC port marked ANT, and connect the blue Range Pole antenna (RPA) cable to the blue TNC connector marked RADIO. For more information on connecting the 5700 system, see the following sections in this chapter.

## Bottom Panel

Figure 2.5 shows the bottom panel of the 5700 receiver. This panel contains the USB port, the CompactFlash port, and the compartments for the two internal batteries.

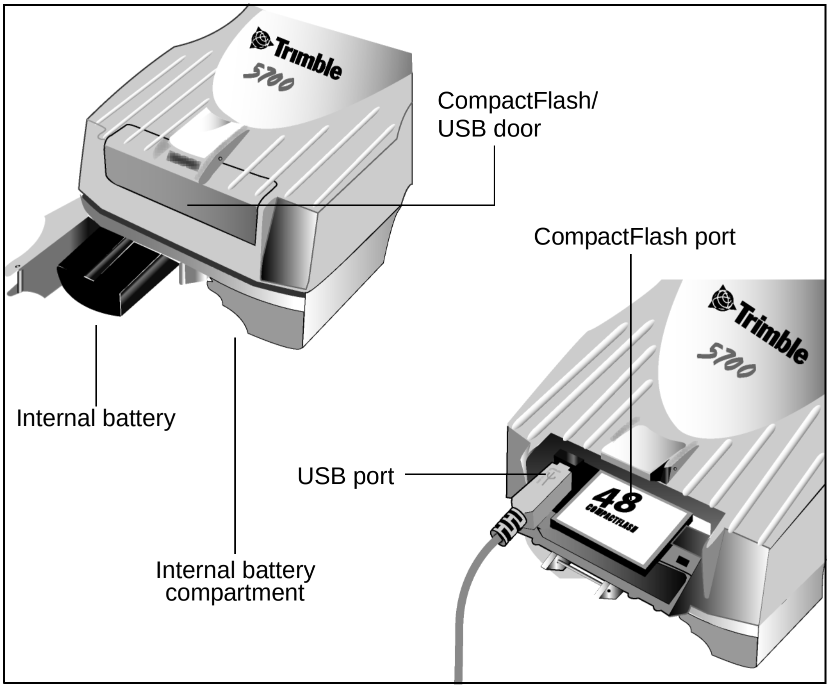



Figure 2.5 Bottom panel

The CompactFlash/USB door conceals the CompactFlash port and USB port. To open the door, push the catch on the front panel down.

**Warning –** When no USB cable is connected, or when using the receiver in a harsh environment, keep this door closed to keep moisture, dust, and dirt out of the ports. The temperature rating of the receiver applies only when all doors on the receiver are closed.

# Setup Guidelines

Consider the following guidelines when setting up the 5700 receiver.

## Environmental Conditions

Although the 5700 receiver has a waterproof housing, it should only be used in a dry location. Avoid exposure to extreme environmental conditions, including:

- Water
- Excessive heat greater than 60°C (140°F)
- Excessive cold less than –20°C (–4°F)
- Corrosive fluids and gases

Avoiding these conditions improves the 5700 receiver’s performance and long-term reliability.

## 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
- Propeller shafts
- Equipment with DC-to-AC converters
- Fluorescent lights
- Switching power supplies

## General Guidelines

The following guidelines apply whenever you set up your 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. ***Never*** use force to plug cables in, as this may damage the pins of the connectors.
- When disconnecting a Lemo cable, pull the cable connector straight out of the port. Do not turn it.
- To securely connect a TNC cable, push the connector into the port and turn it. TNC cables and the corresponding TNC ports on the 5700 receiver are color-coded to help you connect each cable to the correct port.
- Insert the internal batteries (Part Number 38403) with the terminals facing the CompactFlash/USB door. Only new-generation Lithium ion batteries with a center groove can be used.

## Postprocessed Setup

For a postprocessed survey, you only need:

- the 5700 receiver
- a Zephyr™ or Zephyr Geodetic antenna
- a GPS antenna cable

Other equipment, as described below, is optional.

To set up the 5700 receiver for a postprocessed survey:

1. Set up the tripod with the tribrach and antenna adapter over the survey mark.

   Instead of a tripod, you can use a range pole with a bipod. However, Trimble recommends that you use a tripod.

2. Mount the antenna on the tribrach adapter.
3. Use the tripod clip (Part Number 43961) to hang the 5700 receiver on the tripod.
4. Connect the yellow GPS antenna cable (Part Number 41300-10) to the Zephyr antenna.
5. Connect the other end of the GPS antenna cable to the yellow TNC port on the 5700 receiver.
6. If external power is required, connect a battery with a 0-shell Lemo connection to Port 2 or Port 3 on the receiver.

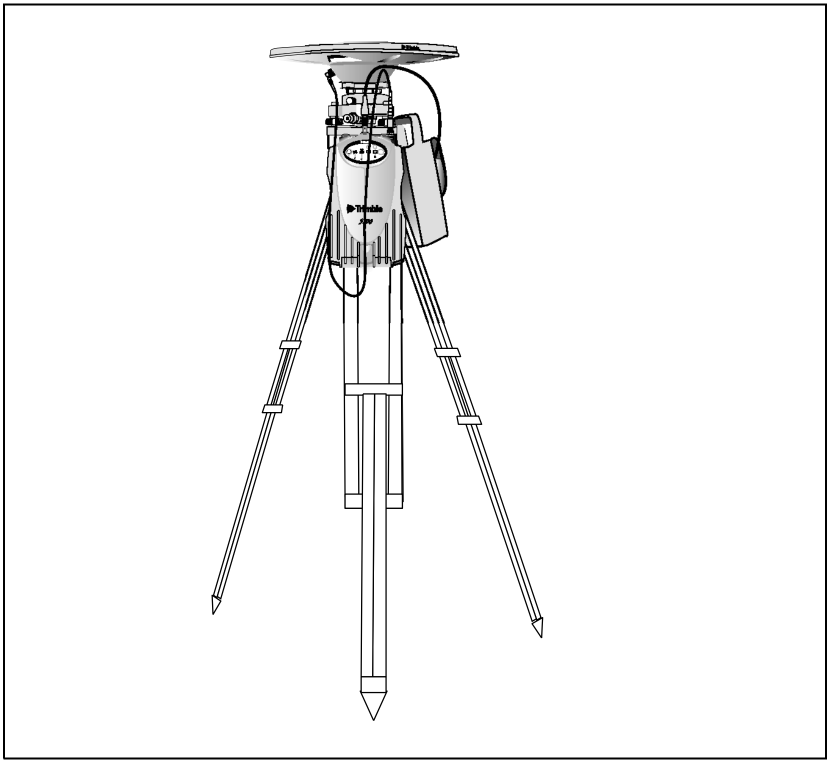


Figure 2.6 Postprocessed setup

***Note –** Instead of hanging the receiver on the tripod, you can place the receiver in its base case. Run the antenna cable out of the portal in the side of the base case to the antenna so that the case can stay closed while the receiver is running.*

# Pole-Mounted Setup

To mount the 5700 receiver on a pole, you need to do the following:

1. Mount the eRTK Range Pole antenna (RPA).
2. Mount the 5700 receiver.
3. Mount the TSC1 data collector.

This section provides detailed instructions on each of these three steps.

## Mounting the Range Pole antenna (RPA)

To mount the RPA on the pole:

1. Install the RPA bracket 7.5 cm (3") from the pole top by placing the two pieces together and securing with screws. If you are using a 1" diameter pole, place the bracket inserts inside the bracket before securing.

   ***Note –*** *You can use a quarter-wave whip ("rubber duck") antenna instead of the RPA.*

2. Connect the yellow TNC-to-TNC cable (Part Number 41300-02) and route it through the RPA bracket clips where it is labeled on the bracket. Make sure that the right angle connector is at the top.
3. Align the TNC connector on the RPA with the GPS antenna cable on the bracket, and slide the RPA onto the bracket until it clicks.

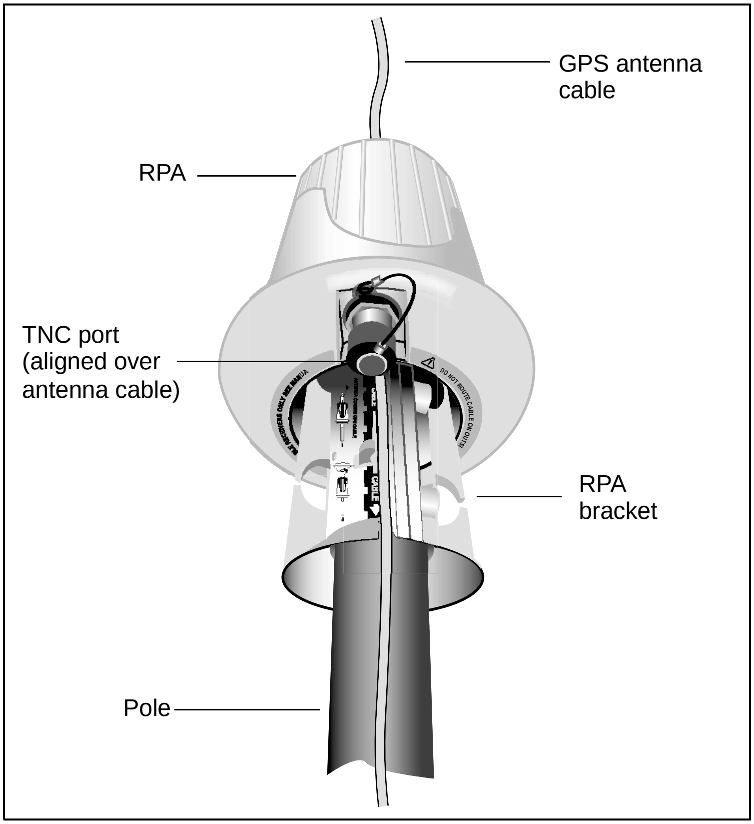



Figure 2.7 RPA and bracket

4. Mount the Zephyr antenna on the range pole.
5. Connect the GPS antenna cable. Make sure that the GPS cable is not hanging over the top of the RPA.
6. Connect the blue TNC-to-TNC cable (Part Number 41299) to the RPA.

Operation

### Mounting the 5700 receiver

To mount the 5700 receiver on the pole:

1. Attach the receiver bracket to the pole:

   a. Place the bracket against the pole, approximately 0.5 m from the ground.

   ***Note –** If you are using a 1" diameter pole, flip the black insert around inside the bracket as shown in Figure 2.8.*

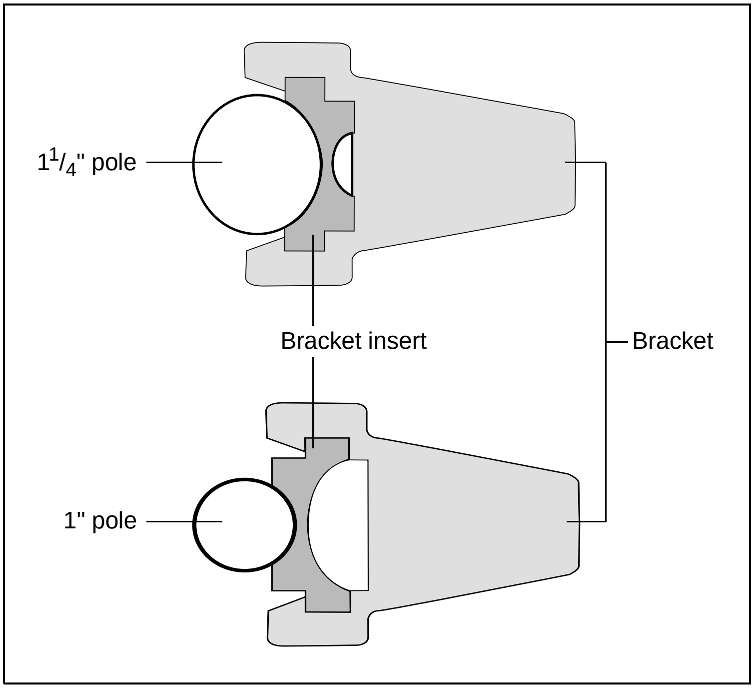



Figure 2.8 Receiver bracket insert

   b. Close the gates of the bracket around the pole.

   c. Seat the base of the clip lock in the opposite gate.

   d. Lock the clip lock down.

If the clip lock is too tight to be locked, turn it one or two turns counterclockwise and try again. If it is too loose, turn it one or two turns clockwise and try to lock it again.

2. Mount the 5700 receiver on the bracket:
   a. Pull the bracket side locks in towards the pole.
   b. Set the receiver catch lock in the bracket.
   c. Holding the receiver in the bracket, pull the side locks back to their original positions.

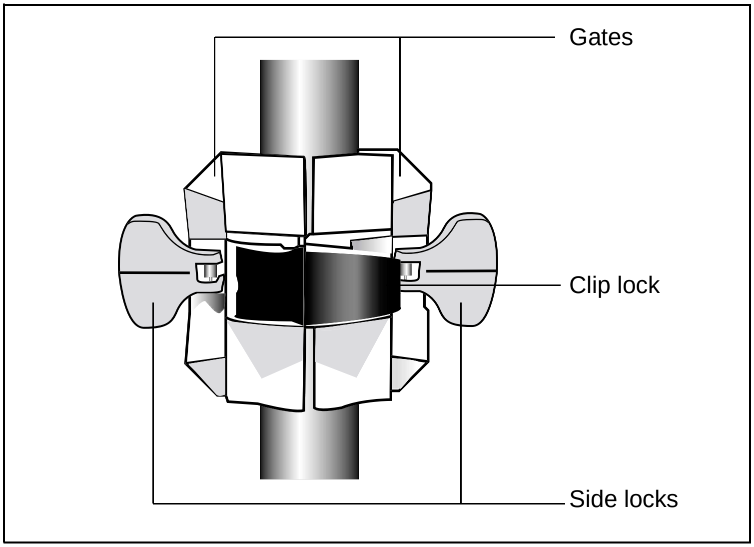



Figure 2.9 5700 receiver bracket

3. Connect the blue TNC radio communications cable to the blue TNC port on the receiver. Make sure that there is very little slack in the cable. If necessary, adjust the position of the receiver to remove slack.
4. Connect the yellow TNC GPS antenna cable to the yellow TNC port on the receiver. Make sure that there is very little slack in the cable. If necessary, adjust the position of the receiver to remove slack.

Operation

### Mounting the TSC1 data collector

To mount the TSC1 data collector on the pole:

1. Mount the handheld bracket on the pole:
   a. Place the bracket against the pole at a comfortable height.
   b. Close the gates of the bracket around the pole.
   c. Seat the base of the clip lock in the opposite gate.
   d. Lock the clip lock down.

      If the clip lock is too tight to be locked, turn it one or two turns counterclockwise and try again. If it is too loose, turn it one or two turns clockwise and try to lock it again.

      The cables running down the pole should fit into the groove so that the bracket clamps them in.

      ***Note –*** *If you are using a 1" diameter pole, flip the black insert around inside the bracket, as shown in Figure 2.8, before securing.*

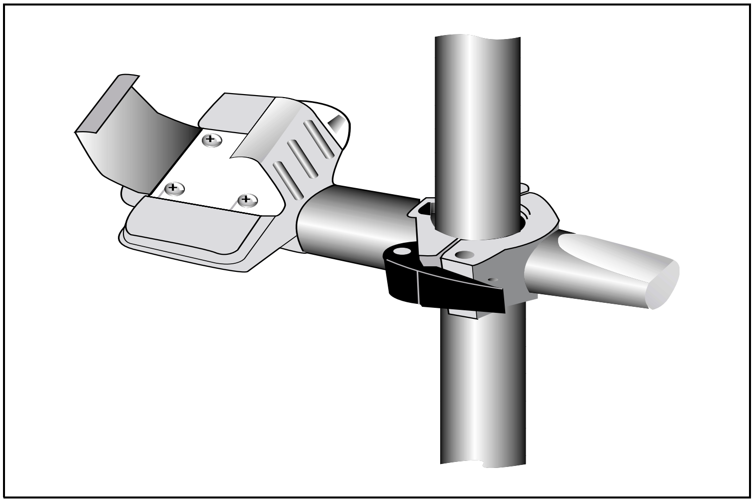


Figure 2.10 Handheld bracket

2. Insert the TSC1 data collector into the handheld bracket.
3. Connect one end of the 2 ft 0-shell to 0-shell Lemo cable (Part Number 31288-01) to the TSC1 data collector.
4. Connect the other end of the Lemo cable to Port 1 on the 5700 receiver.
5. Place the hand grip below the handheld bracket (or above it, depending on the position of the bracket), with the cables running through the groove in the grip.
6. Secure any loose cables, using the velcro cable ties.

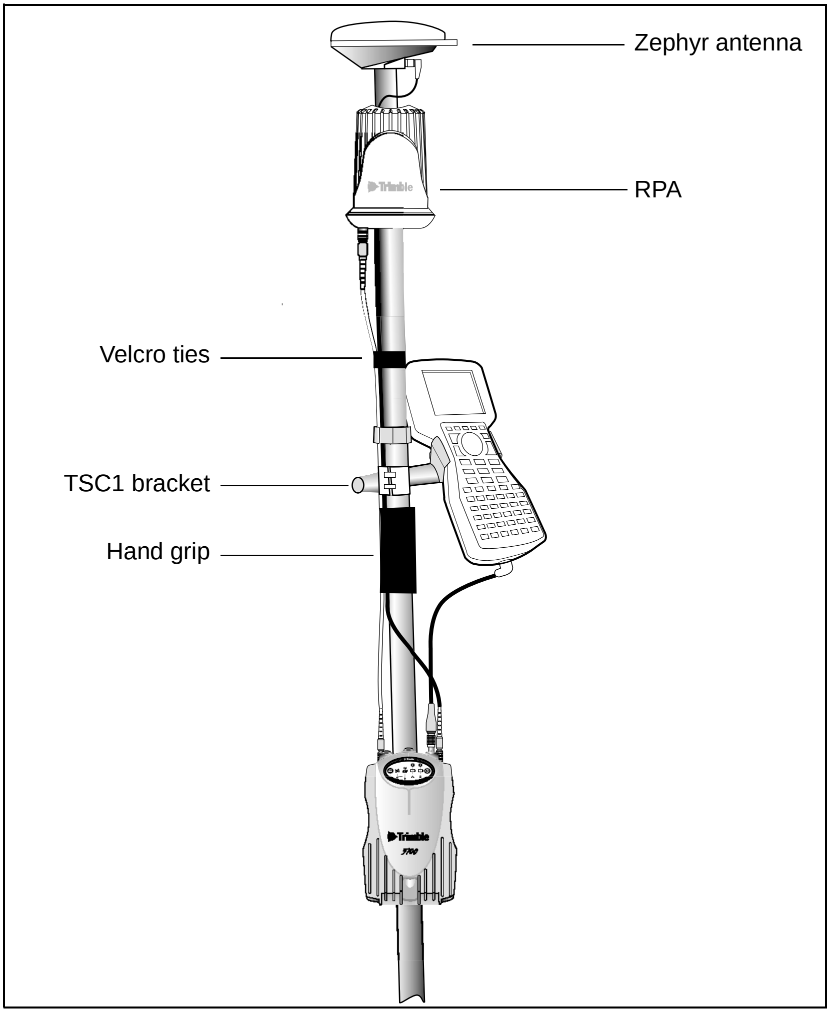



Figure 2.11 Pole-mounted setup

# Backpack Setup

You can use either the RPA or the whip antenna for this application. The RPA is installed in the same manner as for the pole-mounted setup (see Pole-Mounted Setup, page 18).

**Warning –** The RPA is tuned for operation with the GPS antenna cable running through it. Operating it from a backpack may reduce its operating range.

To set up the 5700 receiver for use in a backpack:

1. Insert the 5700 receiver into the backpack with the ports on the top panel facing upwards and the front panel facing outwards, and secure around the middle with the velcro strap.
2. Attach the Zephyr antenna to a range pole.
3. Attach the whip antenna mount to one of the fittings on the top of the backpack.
4. The backpack has a feedthrough on both sides at the top and on both sides near the bottom to allow cables to be positioned out of the way of the main zipper. Feed the radio communications cable through at the top, and connect it to the blue TNC port on the 5700.
5. Connect the straight end of the yellow GPS cable to the yellow TNC port on the receiver.
6. Feed the right angle connector on the yellow GPS cable through the top or side slot on the backpack, and connect it to the Zephyr antenna.
7. Connect one end of the 6 ft 0-shell to 0-shell cable (Part Number 31288-02) to Port 1 on the 5700 receiver.
8. Feed the 0-shell cable through the side slot of the backpack and connect it to the TSC1 data collector.

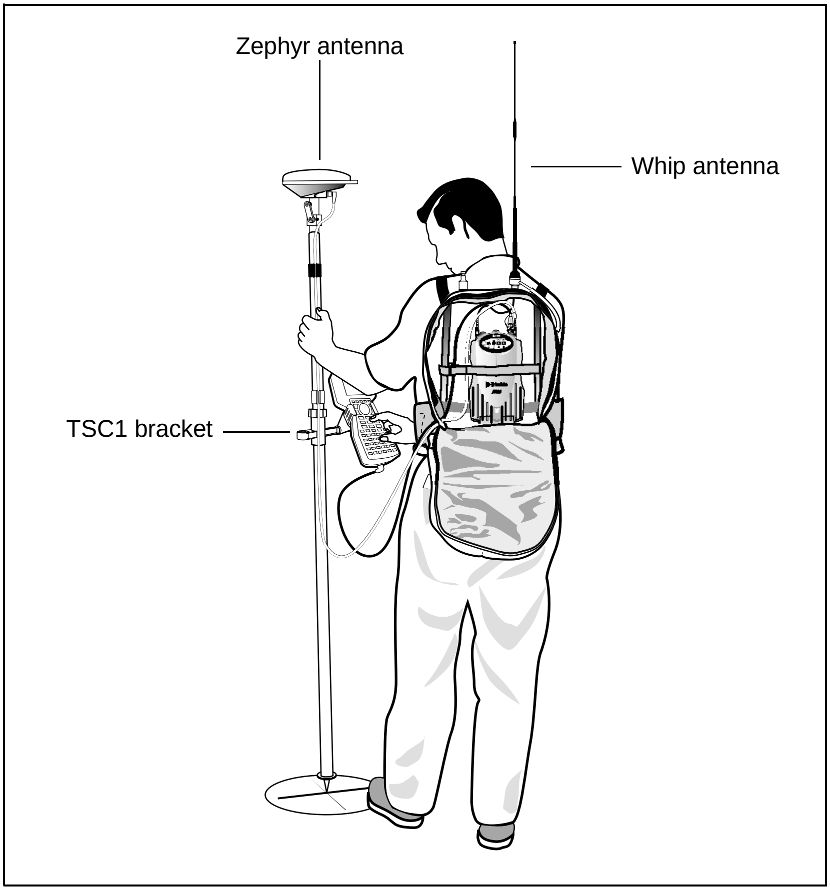



Figure 2.12 Backpack setup

# Other System Components

This section describes optional components that you can use with the 5700 receiver.

## Radios

Radios are the most common data link for Real-Time Kinematic (RTK) surveying. The 5700 receiver has an optional internal receive-only radio. You can also connect an external radio to Port 3, whether the internal radio is installed or not.

The 5700 receiver supports the following radios:

- TRIMCOMM™ 900
- TRIMMARK™ 3
- TRIMMARK™ IIe
- TRIMTALK™ 450S
- Beech
- Clarion
- Pacific Crest RFM96W
- Pacific Crest PDL
- Satel

### Internal Radio Setup

You can configure the 5700 receiver's optional internal radio using any of the following:

- the GPS Configurator™ software
- the WinFLASH™ software
- the Trimble Survey Controller software

For more information, refer to the GPS Configurator Help, the WinFLASH Help, or the *Trimble Survey Controller Reference Manual*.

By default, the internal radio has only a few frequencies installed. Use the WinFLASH software to configure additional frequencies. For more information, see Adding Frequencies for the Internal Radio, page 74.

### External Radio Setup

To use an external radio with the 5700 receiver, you need an external power source for the radio.

To set up a 5700 receiver using an external radio:

1. Connect one end of the yellow GPS antenna cable to the yellow TNC port on the 5700 receiver.
2. Connect the other end of the GPS antenna cable to a Zephyr or Zephyr Geodetic antenna.
3. Connect the external radio to Port 3 on the receiver.
4. Connect a radio antenna to the external radio.

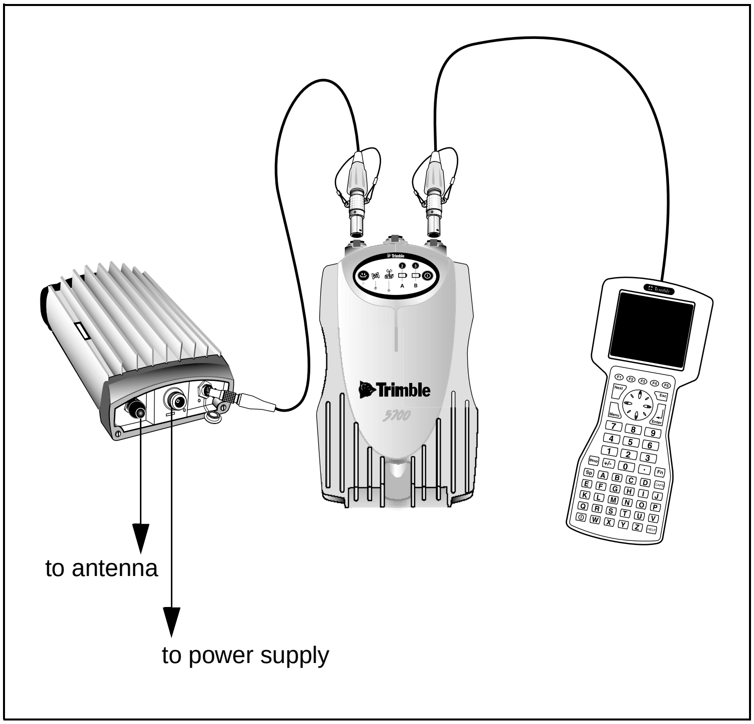



Figure 2.13 Connecting an external radio

5. Connect an external power source to Port 2 on the receiver.

   ***Note –** If you are using an external power source to power both the 5700 receiver and an external radio, you must enable power output on Port 3 and ensure that sufficient power is supplied to power both the receiver and the radio.*

   Alternatively, if the radio supports it, you can apply external power directly to the radio.

You can use a 10 Ah battery, a 6 Ah battery, or camcorder batteries. The choice of power supply depends on the application, and whether you are using the radio as a reference or rover radio. For more information about the power capabilities of the 5700 receiver, see Batteries and Power, page 43.

6. Configure the external radio using the Trimble Survey Controller software. Alternatively, you can configure a TRIMMARK 3 radio using the WinFLASH software or the configuration software supplied with the radio.

   For more information, refer to the *Trimble Survey Controller Reference Manual* or the appropriate Help.

7. Set up any other equipment as required, depending on whether you are using the radio as a reference or a rover radio.

## Cellular Modems

You can use a cellular modem instead of a radio as your data communications link. Cellular modems and other radio links can be used to extend the limits of your surveys.

To connect a cellular modem to a 5700 receiver you need the following:

- 5700 receiver
- A custom-designed cellular modem, or a cellphone that can transmit and receive data
- Serial (cellphone to DB9) cable (supplied with the cellular modem or phone)
- DB9 to 0-shell Lemo cable (Part Number 37779)

  ***Note –*** *This cable is suitable only if flow control can be disabled on the cellular modem. If the cellular modem does not support this functionality, a special cable is required. For more information, refer to the document Using Cellular and CDPD Modems for RTK, which is available from the Trimble web site.*

Figure 2.14 shows the components required to connect a cellphone to a 5700 receiver.

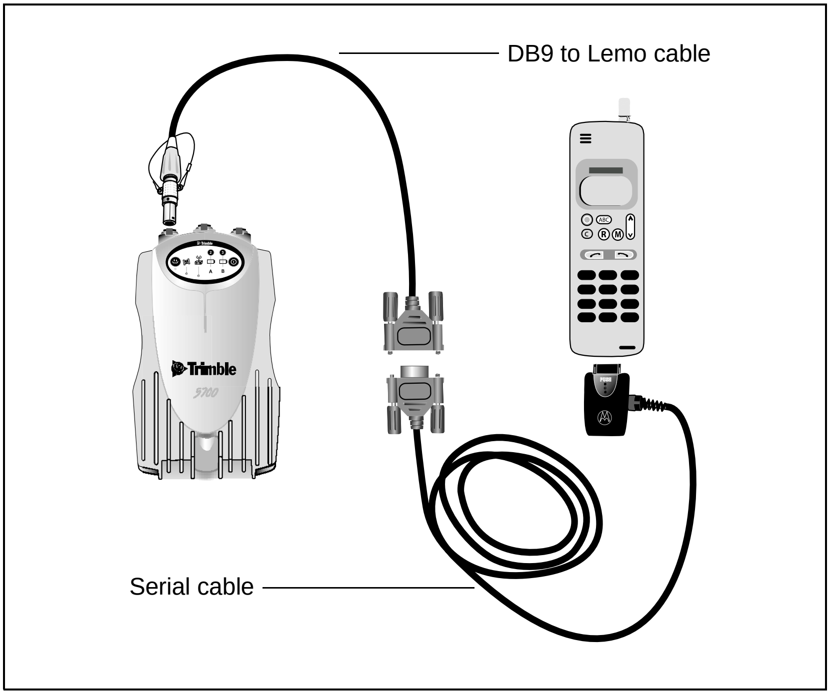



Figure 2.14 Connecting a cellphone

For more information on using a cellular modem as a data link, refer to the *Trimble Survey Controller Reference Manual*.

## Antennas

The 5700 receiver should normally be used with a Zephyr or Zephyr Geodetic antenna. These antennas have been designed specifically for use with the 5700 receiver.

Use Figure 2.15 as a guide for measuring the height of the Zephyr and Zephyr Geodetic antennas. The Zephyr antenna is designed to be measured to the top of the notch. The Zephyr Geodetic (shown) has been designed to be measured to the bottom of the notch.

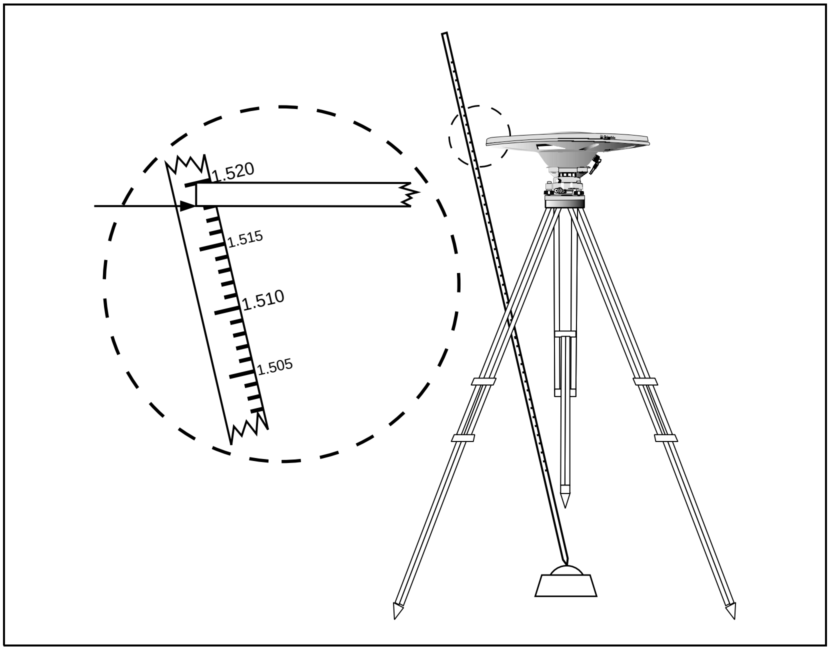



Figure 2.15 Measuring antenna height

Older model antennas, such as Choke Ring or Micro-centered L1/L2 antennas, need more power to operate than the Zephyr models. If you want to use one of these antennas with a 5700 receiver, then you need to use an antenna power adapter (Part Number 43216-00) and an external power source for the antenna.

Figure 2.16 shows the components required to connect an antenna to a 5700 receiver with an antenna power adapter. When setting up the antenna power adapter, connect all other cables before you connect the power supply.

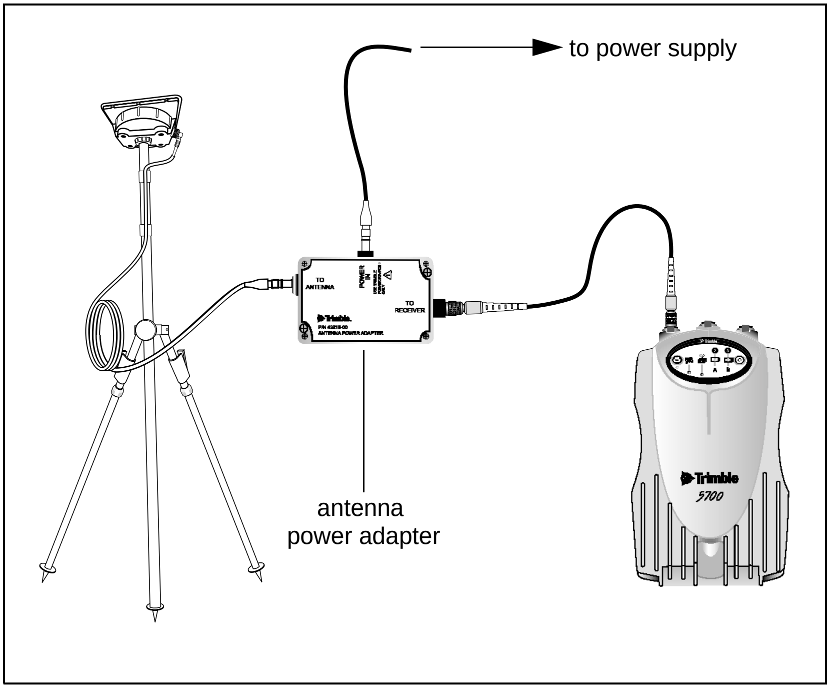



Figure 2.16 Connecting an antenna with an antenna power adapter

## CompactFlash Cards

The 5700 receiver logs data internally on CompactFlash cards. However, it only supports Type I CompactFlash cards. Trimble recommends that you use industrial-rated CompactFlash cards, as normal cards may limit the effective operating temperature of the receiver.

Before logging data to a CompactFlash card, format the card to ensure the integrity of the file system. To format the card, insert it in 5700 receiver and then hold down for 30 seconds.

***Note –*** *To enable this functionality, the card must be formatted while in the receiver. Formatting the card while it is connected to a PC will not enable this functionality.*

When inserting the card into the card slot, make sure that the card slides into the slot properly.

**Warning –** If the card does not seat into the pins correctly, ***do not use force***. Remove the card and reinsert it.

CHAPTER

3

# General Operation

**In this chapter:**

- Introduction
- Button functions
- LED behavior
- Starting and stopping the receiver
- Logging data
- Resetting to defaults
- Formatting a CompactFlash card
- Batteries and power

## Introduction

All the controls that you need for general operation of the 5700 receiver are located on the front panel.

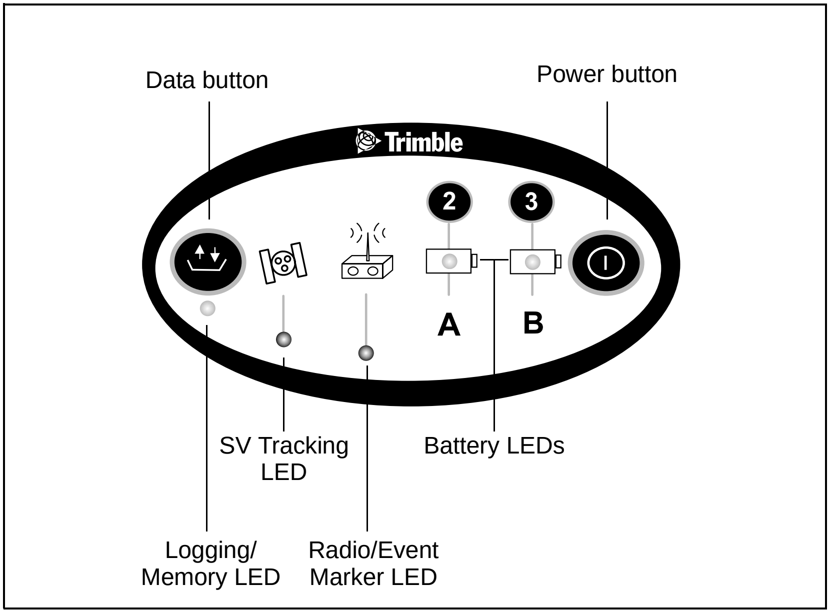



Figure 3.1 Controls on front panel of the 5700 receiver

For more information about other panels of the 5700 receiver, see Parts of the Receiver, page 8.

# Button Functions

The 5700 receiver has only two buttons: a Power button, represented in this manual by , and a Data button, represented by .

Use  to switch the receiver on or off, and to perform data management functions such as deleting files or resetting the receiver.

Use  to start or stop logging. This button is only effective when the receiver is switched on and has completed any power-up and initialization tasks.

Table 3.1 describes the main functions of the two buttons.

**Table 3.1 Button functions**

| Action | Power button | Data button |
|---|---|---|
| Turn the receiver on | Press | |
| Turn the receiver off | Hold for 2 seconds | |
| Start logging data internally | | Press |
| Stop logging data internally | | Hold for 2 seconds |
| Delete the ephemeris file | Hold for 15 seconds | |
| Reset the receiver to factory defaults | Hold for 15 seconds | |
| Delete application files | Hold for 30 seconds | |
| Format the CompactFlash card | Hold for 30 seconds | |

***Note –** The term "press" indicates that you should press the button down and release it immediately. The term "hold" indicates that you should press the button down and hold it down until the time indicated has elapsed.*

# LED Behavior

The five LEDs on the top 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.

| **The term …** | **means that the LED …** |
|---|---|
| Flash | is lit briefly every 3 seconds |
| Slow flash | alternates slowly between being lit and unlit |
| Fast flash | alternates rapidly between being lit and unlit |
| On | is lit |
| Off | is unlit |

## Logging/Memory LED

The yellow Logging/Memory LED below the button indicates the status of data logging and memory usage.

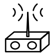
| **Behavior** | **Meaning** |
|---|---|
| On | Data is being logged |
| Slow flash | Enough FastStatic data has been logged. Alternatively, if the red SV Tracking LED is on at the same time, the receiver is in Monitor mode, and is checking for new firmware to install. |
| Fast flash | Data is being logged but memory is low |
| Flash | The receiver is in Sleep mode, and will wake up five minutes before the scheduled start time of a timed application file |
| Off | Data is not being logged, or the CompactFlash card is full |

## SV Tracking LED

The red SV Tracking LED below the SV icon  indicates the status of satellite tracking.

| Behavior | Meaning |
|---|---|
| Slow flash | Tracking four or more satellites |
| Fast flash | Tracking three or fewer satellites |
| Off | Not tracking any satellites |
| On | The receiver is in Monitor mode, and is checking for new firmware to install |

## Radio LED

The green Radio LED below the Radio icon  indicates the status of data input and output.

| Behavior | Meaning |
|---|---|
| Slow flash | A CMR packet or event marker has been received |

### Battery 1 LED and Battery 2 LED

The Battery LEDs inside the two Battery icons indicate the status of the two internal batteries, or the power sources connected on Ports 2 and 3.

By default, each battery LED indicates the status of the external power source on the corresponding port. If no external source is detected, each LED indicates the status of an internal battery. The color of the LED indicates whether the power source is currently in use (green) or is on standby (yellow).

| Color | Meaning | Behavior | Meaning |
|---|---|---|---|
| Green | Power source is in use | On | Healthy |
| | | Fast flash | Low power |
| | | Off | No power source is present |
| Yellow | Power source is on standby | On | Healthy |
| | | Fast flash | Low power |
| | | Flash | Dead |
| | | Off | No power source is present |

## Starting and Stopping the Receiver

To turn on the receiver, press .

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

# Logging Data

You can log data on the 5700 receiver, or you can use the receiver to generate GPS data, which is logged to a data collector.

## Logging Internally

The 5700 receiver can log GPS data internally on a CompactFlash card. You can then use the Trimble Data Transfer utility to transfer logged data files to your office computer. The transferred files are in Trimble DAT (.dat) format.

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

To begin internal logging, press . The Logging/Memory LED lights up.

To stop logging, hold down  for at least two seconds. The Logging/Memory LED turns off.

***Note –** When the CompactFlash card is full, the receiver stops logging data, and the Logging/Memory LED switches off. Existing data files are not overwritten.*

Approximate storage requirements for different logging rates are shown in Table 3.2. The values shown are for a one-hour logging session with six satellites visible.

**Table 3.2 Storage requirements**

| Logging rate | Memory required |
|---|---|
| 10 Hz | 2,588 KB |
| 1 Hz | 335 KB |
| 5 seconds | 87 KB |
| 15 seconds | 37 KB |

***Note –** If power is lost, or the CompactFlash card is removed while logging, the file system is designed so that a maximum of ten seconds of data will be lost, regardless of the logging rate. To ensure that this behavior occurs, use the GPS Configurator software to perform a quick format of the CompactFlash card before logging data to the card for the first time.*

### Logging to the Trimble Survey Controller Software

When the 5700 receiver is connected to a data collector running the Trimble Survey Controller software, you can log GPS data from the receiver to the data collector, or to a PC card inserted in the data collector. When you use the Trimble Survey Controller software, you do not use the receiver's controls. Instead, you use Trimble Survey Controller functions to set logging options, specify filenames, and control when logging occurs.

Data is stored in job files, which can be transferred to your office computer using Trimble's Data Transfer utility.

For more information on logging data from a receiver using the Trimble Survey Controller software, refer to the *Trimble Survey Controller Reference Manual*.

## Resetting to Defaults

To reset the 5700 receiver to its factory default settings, hold down for at least 15 seconds.

**Warning –** Make sure that you do not hold down for more than 30 seconds. After 30 seconds, any application files stored in the receiver are deleted and the CompactFlash card is reformatted.

Resetting the receiver to its factory defaults also deletes any ephemeris file in the receiver.

For more information, see Chapter 10, Default Settings.

# Formatting a CompactFlash Card

To format a CompactFlash card for use in a 5700 receiver, insert the card in the CompactFlash port, then hold down ⓘ for at least 30 seconds. After 15 seconds, the receiver is reset to its factory defaults, and any ephemeris file is deleted. After 30 seconds, any files stored on the card are deleted and the CompactFlash card is reformatted.

**Warning –** Formatting a CompactFlash card while it is in the receiver deletes all the data files on the card and all the application files in the receiver.

***Note –*** *When you use ⓘ to format the CompactFlash card, a quick format is performed. A quick format reformats the card for use with the 5700 receiver and deletes all data on the card. A full format also checks the card for errors and bad sectors. A full format is only necessary if the card is corrupted. To perform a full format, use the GPS Configurator software. For more information, see GPS Configurator Software, page 66.*

# Batteries and Power

The 5700 receiver can be powered either by its two internal batteries or by an external power source connected to Port 2 or Port 3. The charge provided by the internal batteries depends on the type of survey and operating conditions. Typically, one battery provides about 3.5 hours of power during an RTK survey using the internal radio, and about 5 hours during a survey without the internal radio.

The external power source is always used in preference to the internal batteries. When there is no external power source connected, or if the external power supply fails, the internal batteries are used. The internal batteries are drained in turn, and the receiver automatically switches to the full battery when the first battery is drained.

If there is no external power supplied and both internal batteries are drained, none of the data that you have logged is lost. When internal or external power is restored, the receiver restarts in the same state as when power was lost. For example, if the receiver was logging data, the data file is not corrupted, and when power is restored the receiver resumes logging with the same settings as before.

The power supply that is supplied with the 5700 receiver charges the receiver's internal batteries while they are still in the receiver. To do this, connect the power supply (Part Number 30413) to the data/power cable (Part Number 32345), connect the cable to Port 2 on the receiver, and connect the power supply to an AC power source.

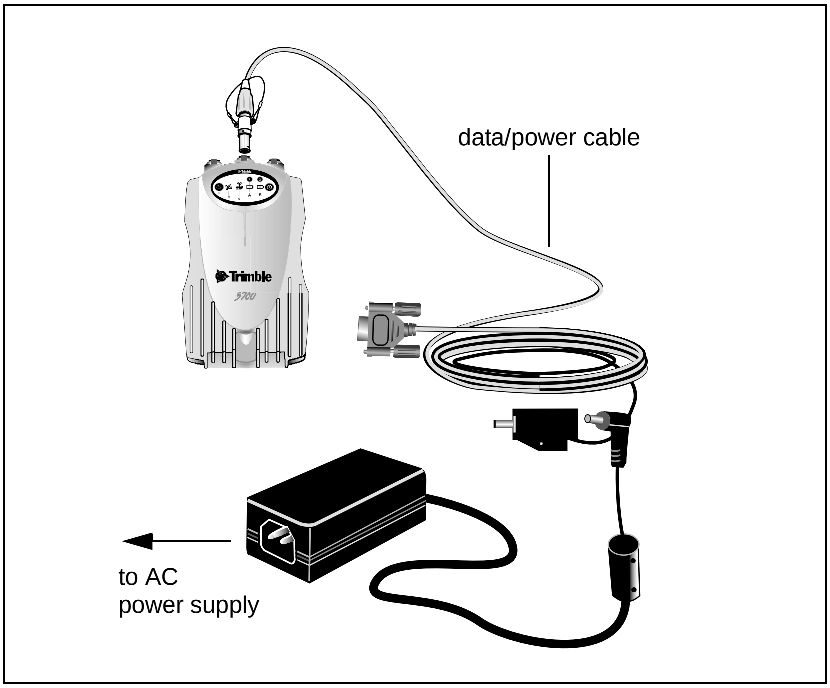



Figure 3.2 Charging the batteries

The batteries take approximately eight hours to charge fully. The batteries are charged in parallel, so one battery takes as long to charge as two batteries.

The internal batteries start charging whenever an external power supply of greater than 15 V is detected.

When using two 5700 receivers as the reference and roving receivers, you can use an external battery to power the reference receiver, and use its two internal batteries in the rover. To charge both sets of batteries, connect both receivers to power supplies as shown in Figure 3.3. If there is no reference receiver that you can use, extra batteries for the rover must be charged using the Lithium ion battery charger (Part Number 41114-10).

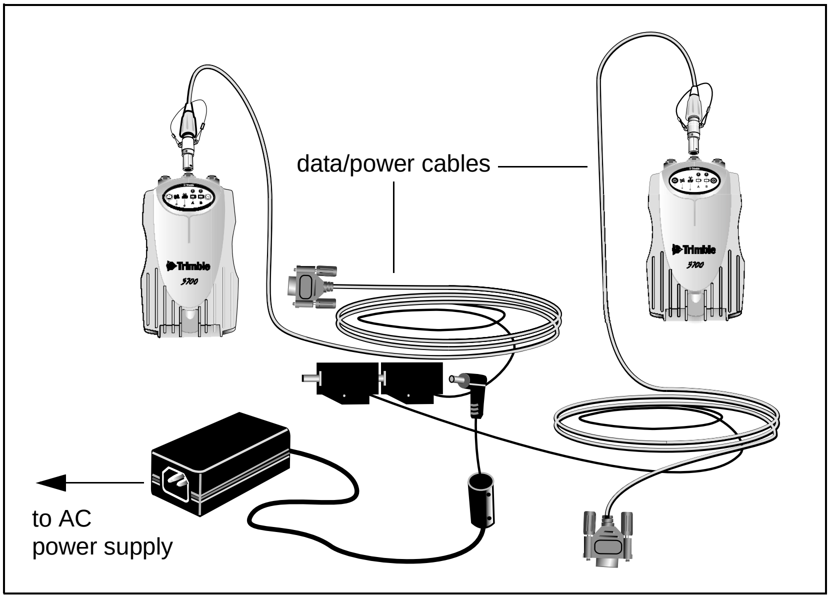



Figure 3.3 Charging rover and reference receiver batteries

## Operation with the TSC1 Data Collector

If the 5700 receiver is being powered by its internal batteries, it does not supply power to the TSC1 data collector when they are connected. However, the TSC1 batteries and the 5700 receiver batteries can be charged at the same time from the same power supply. To charge both sets of batteries, use two standard data/power cables (Part Number 32345) to connect the TSC1 data collector and the 5700 receiver to a power supply, as shown in Figure 3.4.

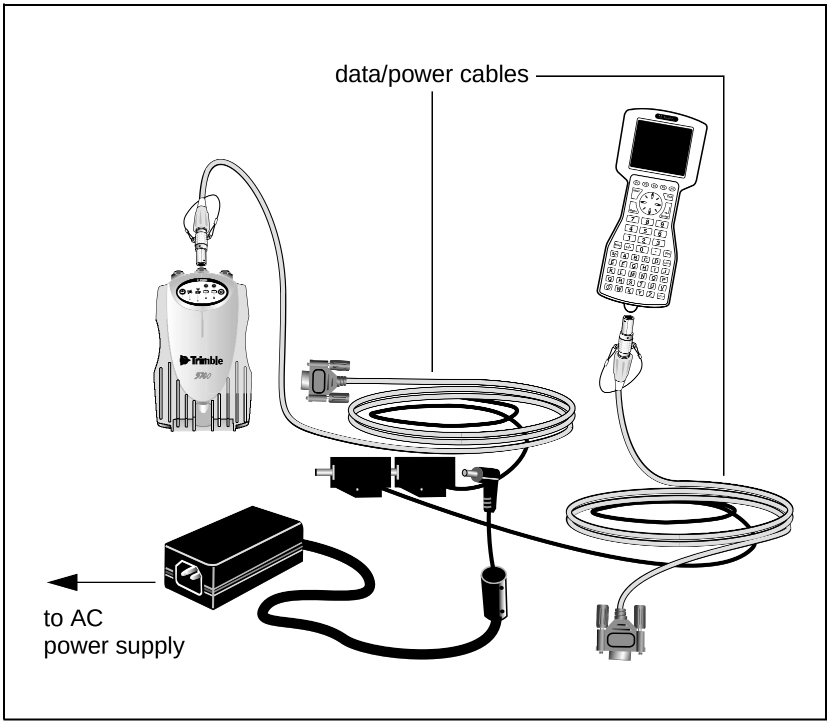



Figure 3.4 Charging receiver and TSC1 batteries

## Power Output

If the receiver is being supplied with power from an external source, power is automatically output on Port 1. The output voltage is approximately 0.5 V less than the input voltage. Port 1 outputs a maximum voltage of 20 V, even if the input voltage is higher.

You can use the GPS Configurator software or the Trimble Survey Controller software to enable power output on Port 3. Port 3 can be enabled for power output regardless of whether power is supplied internally or externally.

On Port 3, the output voltage is approximately 0.5 V less than the input voltage. For example, if power is being supplied from the internal Lithium ion batteries, the maximum battery voltage is 8.4 V, so the maximum output voltage is 7.9 V.

***Note –*** *When you start a survey using the Trimble Survey Controller software, and you are using an external radio, the software automatically enables power output on Port 3.*

## Firmware

A receiver's *firmware* is the program inside the receiver that makes the receiver run and controls the hardware. You can upgrade the firmware for the 5700 receiver in either of the following ways:

- Using the WinFLASH software
- Copying the firmware (.elf) file directly to the CompactFlash card

Trimble recommends that you use the WinFLASH software to upgrade the firmware. For more information, see WinFLASH Software, page 71.

To upgrade the receiver firmware by copying the .elf file to the CompactFlash card:

1. Connect the CompactFlash card to your desktop computer.
2. Using Windows Explorer, copy the .elf file from your computer to the CompactFlash card.
3. Disconnect the CompactFlash card from your computer and insert it into the receiver.
4. Turn the receiver off.
5. Hold down  and press .

   The receiver starts up in Monitor mode, automatically detects the newer version of the firmware, and installs it. In Monitor mode, the red SV Tracking LED is lit solidly and the yellow Logging/Memory LED flashes slowly.

   The upgrade takes about two minutes. Once the upgrade procedure is complete, the receiver restarts automatically.

**Warning –** Upgrading the firmware deletes all application files on the 5700 receiver.

CHAPTER

4

# Configuration

**In this chapter:**

- Introduction
- Configuring the receiver in real time
- Configuring the receiver using application files
- Application files

## Introduction

The 5700 receiver has no controls for changing settings. It can only be configured using external software such as the GPS Configurator software, the Configuration Toolbox™ software, or the Trimble Survey Controller software.

There are two ways to configure the 5700 receiver:

- Configuring the receiver in real time
- Applying the settings in an application file

This chapter provides a brief overview of each of these methods, and detailed information about the contents and use of application files.

## Configuring the Receiver in Real Time

The GPS Configurator software, the Configuration Toolbox software, and the Trimble Survey Controller software all support real-time configuration of the 5700 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. Use the Configuration Toolbox software to perform all these tasks.

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
- Timed Activation

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 twenty different application files in battery-backed memory on 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 5700 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  for at least 15 seconds, or by using the reset option in the GPS Configurator software.

For more information on the default receiver settings, see Default Settings, page 111.

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 optional. If a Power Up file is present, its settings are applied whenever the receiver is powered up.

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. If you want to use a Power Up application file, you need to create an application file in the Configuration Toolbox software and make sure that the *As auto power up file* option is selected in the File page. When you transfer this file to the receiver, it is transferred with the name Power_up.cfg, and becomes the new Power Up file.

The Power Up file is the only special application file that you can overwrite or delete from the receiver.

## Timed Application Files

A timed application file contains a Timed Activation record which specifies when this file is to be applied. The main use of a timed application file is to automatically start or stop logging at a predefined time.

The Timed Activation record specifies:

- the UTC date and time when the application file is to be applied for the first time
- the interval at which the file is to be reapplied

If you do not specify a repeat interval, the settings are applied only once, at the specified time. If the file specifies a repeat interval, the file's settings are reapplied at the specified interval until the file is deactivated.

### Defining timed application files

To send timed application files to a 5700 receiver, set up scheduled survey sessions in the GPS Configurator software. You can define multiple sessions, each specifying:

- basic logging parameters (data logging rate, position logging rate, and elevation mask)
- a starting time
- a duration

When you apply the current settings in the GPS Configurator software, each defined survey session is sent to the 5700 receiver as a pair of timed application files: the first includes the logging settings and start time, and the second contains settings that stop logging at the end time (which is calculated automatically from the duration you specify).

For more information on scheduled survey sessions, refer to the GPS Configurator Help.

The 5700 receiver can store up to 20 application files, so you can define a maximum of 10 scheduled survey sessions (10 pairs of start/stop timed application files).

***Note –*** *You cannot use the Configuration Toolbox software to define timed application files.*

### Sleep mode

Whenever you press to turn off the 5700 receiver, it checks for a timed application file that is due to be activated in the future. If one exists, the receiver goes into Sleep mode instead of powering down.

In Sleep mode, the yellow Logging/Memory LED flashes every three seconds. The receiver wakes up five minutes before the scheduled activation time, so that it is ready to begin logging at the scheduled time.

## 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.

***Note –*** *If the application file is a timed file, its settings do not take effect as soon as you apply the file, but at the time that the file specifies for its activation.*

## Storing Application Files

You can store application files that you create in the Configuration Toolbox software on both your receiver and computer. Each file can, for example, 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 for creating other application files with similar settings

## Naming Application Files

The filename that you use to store the application file in the computer and the name under which the file is stored in the receiver are always the same. This makes recognizing and keeping track of your application files easier. If you change the name of the file on the receiver, this changes the filename used to store the application file on your computer. Similarly, if you change the filename on the computer, the name of the file in the receiver will change.

CHAPTER

5

# Transferring Data

**In this chapter:**

- Introduction
- Connecting to the office computer
- Transferring data
- Transferring files directly from a CompactFlash card
- Deleting files in the receiver
- Supported file types

# Introduction

The 5700 receiver keeps satellite measurements and other data in files stored on a CompactFlash card. These files cannot be processed until you transfer them to your office computer.

On returning to the office after completing a survey, transfer the field data to a computer that has the Trimble Geomatics Office™ software installed. You can then process the survey data in the Trimble Geomatics Office software to produce baselines and coordinates.

## Connecting to the Office Computer

The 5700 receiver has three serial (COM) ports and one USB port for connection to your office computer. A USB connection is up to ten times faster than normal serial communications.

Use the standard data/power cable (Part Number 32345) to connect the 5700 receiver to the computer as shown in Figure 5.1.

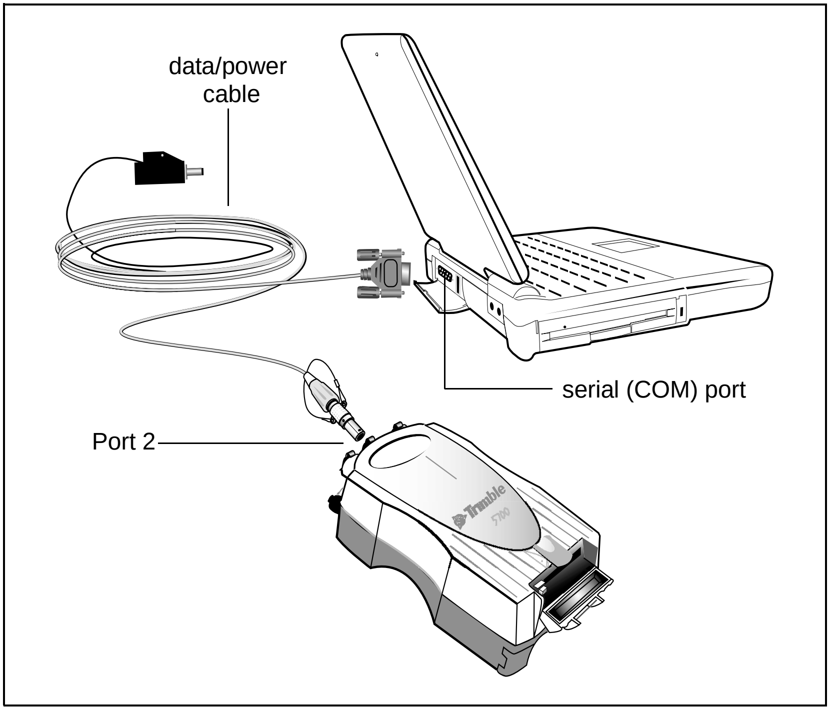



Figure 5.1 Connecting 5700 receiver to a computer for serial data transfer

Use the USB cable (Part Number 44016) to connect the 5700 receiver to the computer as shown in Figure 5.2.

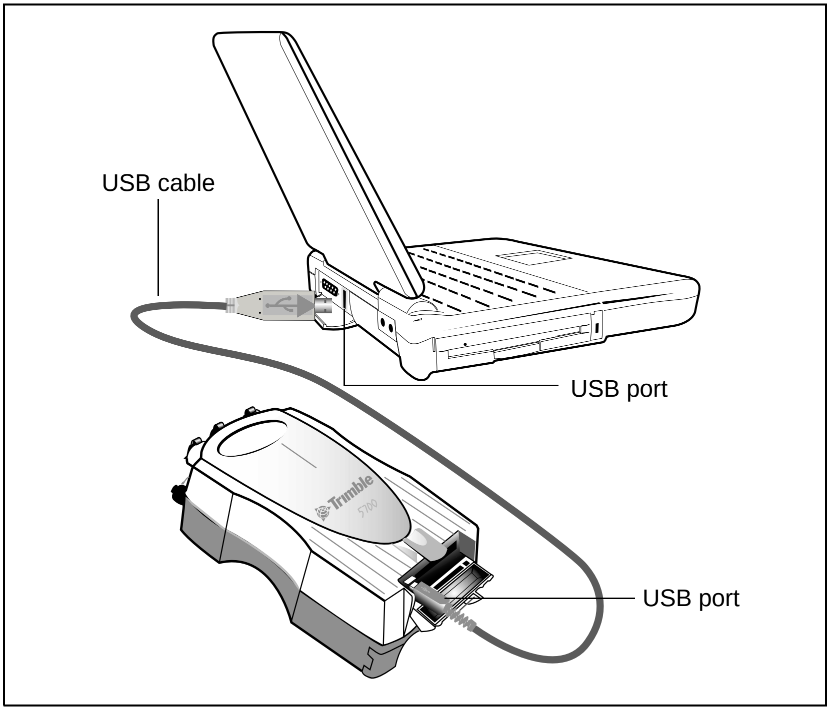



Figure 5.2 Connecting 5700 receiver to a computer for USB data transfer

***Note –** When the 5700 receiver is connected to a USB port on a computer, it is treated as a peripheral device of the computer. If the receiver is unplugged or powered down, a warning message is displayed on the computer.*

# Transferring Data

Transfer the data files to the computer using the Trimble Data Transfer utility. You can run this utility as a standalone program or from within the Trimble Geomatics Office software. For more information about the transfer process, refer to the Data Transfer Help.

***Note –*** *When you connect to a 5700 receiver in the Data Transfer utility, you must use a GPS Receiver (5000 Series) device definition. If you use a GPS Receiver (4000 Series) device definition, the Data Transfer utility will be unable to establish communication with the 5700 receiver.*

When transfer is complete, the Data Transfer utility automatically converts the file to the DAT format. If you are using Data Transfer from within the Trimble Geomatics Office software, the *Check-in* dialog appears. For more information, refer to the *Trimble Geomatics Office User Guide*.

***Note –*** *A file in DAT format is approximately six times the size of the corresponding file in the 5700 receiver's internal format. Before transferring files, make sure that there is enough space on your computer.*

# Transferring Files Directly from a CompactFlash Card

All data is stored in a 5700 receiver on an internal CompactFlash card. There are two ways to transfer files between the receiver and your office computer:

- Connect the receiver to the office computer and use the Data Transfer utility to transfer files.
- Remove the CompactFlash card from the receiver and connect it directly to your office computer, where it functions like a normal disk drive. Use Windows Explorer to transfer files.

When you use the Data Transfer utility to transfer data files from the CompactFlash card while it is still inserted in the 5700 receiver, the Data Transfer utility converts the raw receiver data (.T00) files you select into the Trimble DAT file format.

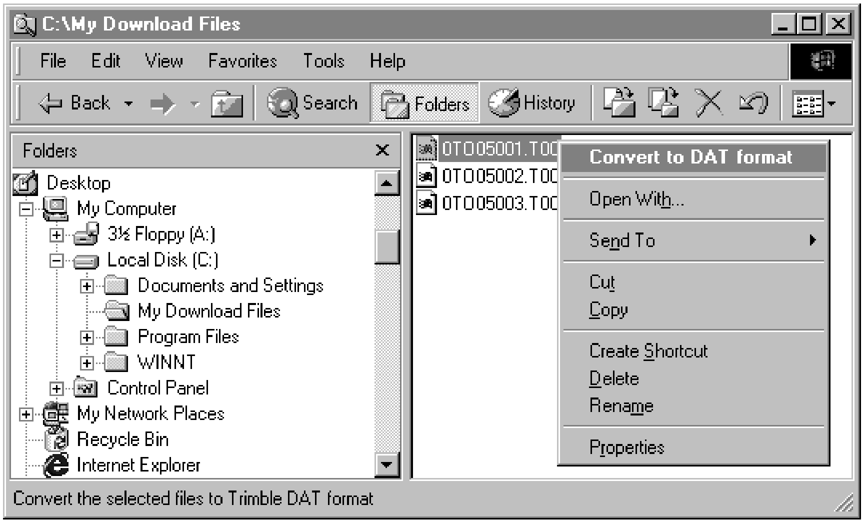
However, if you connect the CompactFlash card to your computer and then copy or move files to your computer, it treats the card like any other disk drive, and transfers the files without converting them. You need to convert these raw receiver files to DAT format files before you can use them on your office computer.

You can convert receiver data files by using a Windows Explorer extension which is installed on your computer when you install the Data Transfer utility.

***Note –*** *Although this extension is only available if you have the Data Transfer utility installed, you do not have to run the Data Transfer utility to use it.*

To convert a .T00 file on your office computer into the DAT format:

1. On your office computer, open Windows Explorer and navigate to the location of the .T00 file.
2. Right-click the file, and from the menu that appears select *Convert to DAT format*:




The *DAT File Conversion* dialog appears while the file is converted. When the dialog disappears, the file conversion is complete.

A new file with the same filename but a .dat extension appears in the same folder as the .T00 file.

# Deleting Files in the Receiver

You can delete files stored in the 5700 receiver at any time. Do one of the following:

- Use the Data Transfer utility in the Trimble Geomatics Office software.
- Use the TSC1 data collector.
- Hold down for 30 seconds after the receiver has been powered on. When you use this method, ***all*** data is deleted.
- Use the GPS Configurator software.

# Supported File Types

Table 5.1 shows the file types that you can transfer to or from a 5700 receiver and the software or utility that you must use to transfer each file type.

**Table 5.1 Supported file types**

| File Type | Extensions | Transfer from 5700 receiver? | Transfer to 5700 receiver? | Software |
|---|---|---|---|---|
| Ephemeris | .eph | Yes | No | Data Transfer |
| Raw observations | .T00, .dat | Yes | No | Data Transfer |
| Receiver firmware files | .elf | No | Yes | WinFLASH |
| Application files | .cfg | Yes | Yes | Configuration Toolbox |

CHAPTER

6

# Software Utilities

**In this chapter:**

- Introduction
- GPS Configurator software
- Configuration Toolbox software
- WinFLASH software

# Introduction

This chapter provides information on the software utilities that you can use with the 5700 receiver.

# GPS Configurator Software

The GPS Configurator software is a Windows application that you can use to configure selected Trimble GPS receivers.

The GPS Configurator software lets you:

- check current receiver settings and operation
- change receiver settings in real time

## Installing the GPS Configurator Software

A copy of the GPS Configurator software is included on the 5700 GPS Receiver CD-ROM.

To install the software:

1. Insert the CD-ROM into the CD drive on your computer.
2. Using Windows Explorer, navigate to the CD drive.
3. Double-click Setup.exe.
4. Follow the onscreen instructions.

## Configuring the 5700 Receiver

To configure a 5700 receiver using the GPS Configurator software:

1. Connect Port 1, 2, or 3 on the receiver to a serial (COM) port on the computer and apply power.
2. To start the GPS Configurator software, click 

, then select *Programs* / *Trimble* / *GPS Configurator* / *GPS Configurator.*

   The software automatically establishes a connection with the 5700 receiver.
3. Make appropriate selections for your required receiver settings.

   For more information, refer to the GPS Configurator Help.
4. Click **Apply**.

   The settings in the GPS Configurator software are applied to the receiver.

# Configuration Toolbox Software

The Configuration Toolbox software is a Windows application that provides a graphical user interface to help you configure selected Trimble GPS receivers.

The Configuration Toolbox software lets you:

- create and edit application files
- transfer application files to and from the receiver
- manage application files stored in the receiver

For more information, see Application Files, page 51.

## Installing the Configuration Toolbox Software

A copy of the Configuration Toolbox software is included on the 5700 GPS Receiver CD-ROM.

To install the software:

1. Insert the CD-ROM into the CD drive on your computer.
2. Using Windows Explorer, navigate to the CD drive.
3. Double-click Setup.exe.
4. Follow the onscreen instructions.

## Creating and Editing Application Files

You can create an application file and transfer it to the receiver in several different ways. The general workflow includes the following steps:

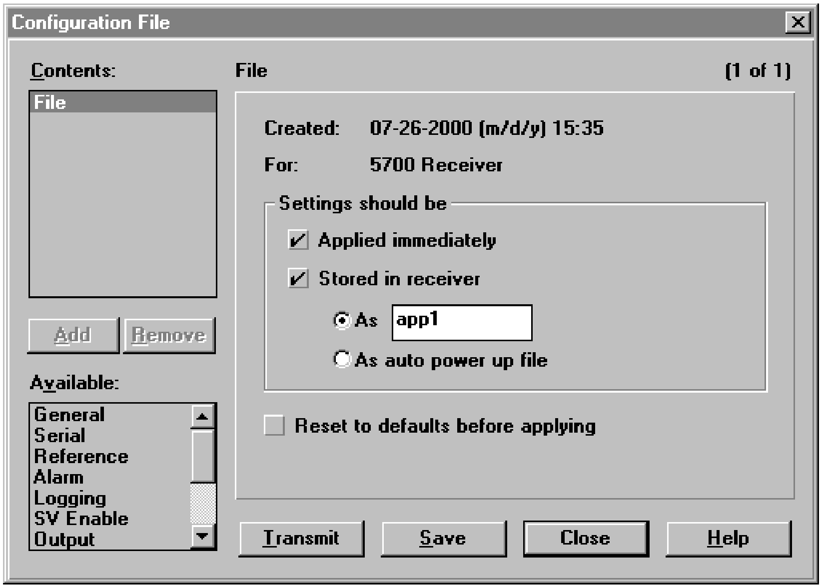
1. Create and save the application file in the Configuration Toolbox software.
2. Connect the receiver to the computer and apply power.
3. Open the desired application file in the Configuration Toolbox software.

4. Transfer this application file to the receiver.
5. Check that the receiver is using the transferred application file.

To create and save an application file to the receiver:

1. To start the Configuration Toolbox software, click 

, then select *Programs* / *Trimble* / *Configuration Toolbox* / *Configuration Toolbox*.
2. Select *File* / *New* / *5700*.
3. Specify the receiver settings (for specific information, refer to the Configuration Toolbox documentation).
4. Use *File* / *Save As* to save the application file.



To transfer the application file to the receiver:

1. Connect the data/power cable (Part Number 32345) to Port 1 on the 5700 receiver.
2. Connect the female DB9 connector on the other end of the data/power cable to a serial (COM) port on the computer.
3. Select *File* / *Open* to open the desired application file.
4. With the file open and the *Configuration File* dialog open, select *Communications* / *Transmit File*.

   A message appears informing you that the application file has been successfully transferred. If an error occurs, select *Communications* / *Transmit File* again. This overrides any incompatibility in baud rates and enables successful communication.
5. To check whether the transfer was successful, close the *Configuration File* dialog and select *Communications* / *Get File*.

   A list of all application files in the 5700 receiver appears. If you selected **Apply Immediately** in the application file, the Current application file will contain the settings in the new file.
6. To apply a different file, select the file you require from the list and then select *Communications* / *Activate File*.

# WinFLASH Software

The WinFLASH software communicates with Trimble products to perform various functions including:

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

If additional information is needed, online help is also available when using the WinFLASH software.

***Note –*** *The WinFLASH software is a 32-bit application, so the local computer's operating system must be Windows 95, 98, NT, 2000, or ME. It does not run under earlier versions of Windows.*

## Installing the WinFLASH Software

The WinFLASH software can be installed from the 5700 GPS Receiver CD-ROM, or from the Trimble FTP site. Refer to one of the following sections for the installation procedure you need.

### Installing the WinFLASH software from the 5700 receiver CD

A copy of the WinFLASH software is included on the 5700 receiver CD-ROM.

To install the WinFLASH software from a CD:

1. Insert the disk into the CD drive on your computer.
2. Using Windows Explorer, navigate to the CD drive.
3. Double-click Setup.exe.
4. Follow the onscreen instructions.

### Installing the WinFLASH software from the Internet

To install the WinFLASH software from the Trimble FTP site, connect to the following Internet address:

ftp://ftp.trimble.com/pub/survey/bin/

Locate the file called 5700v100.exe and download it to a temporary folder on your computer. The 5700v100.exe file is a compressed file which contains all the necessary files for installing the WinFLASH software and the latest version of the 5700 firmware. Once the file is on your local hard drive, you can disconnect from the Internet and proceed with the following steps:

1. Navigate to the temporary folder containing 5700v100.exe.
2. Double-click 5700v100.exe.
3. Follow the onscreen instructions to install the WinFLASH software and upgrade the receiver firmware.

## Upgrading Firmware

Your 5700 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 software guides you through the firmware upgrade process. The steps required are described below. For more information, refer to the WinFLASH Help.

To upgrade the 5700 receiver firmware:

1. Start the WinFLASH software.

   The *Device Configuration* screen appears.
2. From the *Device type* list select 5700 Receiver.
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 5700 receiver.

6. Select the latest version from the *Available Software* list and 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 the selections shown above, the *Software Upgrade* window appears and shows the status of the operation (for example, Establishing communication with the 5700. 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 the WinFLASH software.

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

## Adding Frequencies for the Internal Radio

If your 5700 receiver has the optional internal radio installed, you can use the WinFLASH software to add frequencies to the default list.

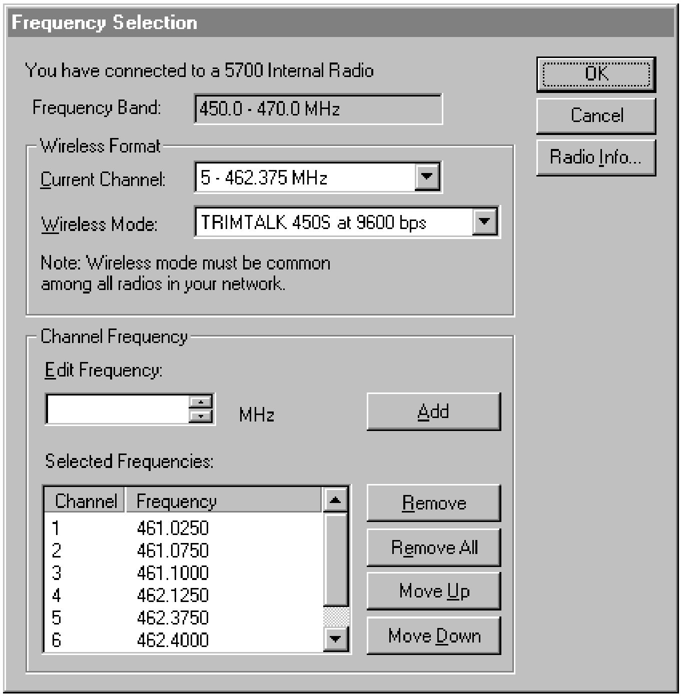
To add radio frequencies:

1. Start the WinFLASH software.

   The *Device Configuration* screen appears.
2. From the *Device type* list select 5700 Receiver.
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 click **Next**.

The *Frequency Selection* window appears:




6. In the *Wireless Format* group, select the appropriate channel and wireless mode.

   ***Note –** If the reference radio is a TRIMMARK 3 radio, select the appropriate TRIMTALK 450S option from the Wireless Mode list.*

7. In the *Edit Frequency* field, enter or select the frequency you require.

   The frequency that you select must conform to the channel spacing and minimum tuning requirements for the radio. To view this information, click **Radio Info**.

8. Press **Add**.

   The new frequency appears in the *Selected Frequencies* list.

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

   The WinFLASH software updates the 5700 receiver’s radio frequencies and then restarts the receiver.

SECTION

# II

# APPLICATIONS

CHAPTER

# 7

# Static and FastStatic Surveying

**In this chapter:**

- Introduction
- Static surveying
- FastStatic surveying
- Setting up the 5700 for a Static or FastStatic survey
- Automatically scheduling Static or FastStatic surveys

# Introduction

Static and FastStatic are two types of postprocessed surveys. The 5700 receiver can be used in Static and FastStatic surveys, as well as RTK and postprocessed kinematic surveys. The 5700 receiver can be paired with any other Trimble survey-grade receivers for this purpose.

The following items are important conditions for this application:

- To compute baselines, at least one other receiver must be logging data simultaneously and at the same epoch rate.
- For every baseline, all receivers on the baseline must be tracking *at least* four satellites in common.
- Each receiver must be a survey-grade receiver, capable of logging both C/A code and at least L1 carrier phase observables.
- The 5700 receiver is a dual-frequency receiver—to achieve dual-frequency baseline results, the receiver must be used with another dual-frequency receiver.

# Static Surveying

Static surveying is the most precise GPS surveying technique, but it requires long occupation times at each station. Like all GPS surveys, the Static survey requires the use of at least two receivers (one receiver at each point defining the baseline), and each receiver must be logging observations simultaneously from at least four common satellites. Observations must be logged for an extended period of time (usually about 45 to 60 minutes).

Although a large amount of data is collected during this period, this allows the processing software to resolve more problems in the data set than might otherwise be resolved in shorter observation periods. The additional data typically leads to greater precision in the baseline solution.

The information associated with a Static occupation is stored in a separate, unique data file. There is only one occupation per file. If the receiver is turned off in the middle of an occupation, a second file can be opened and the survey can continue. In this case, there is more than one file per occupation, but still only one occupation per file.

Static surveys can be performed with either single- or dual-frequency receivers. The 5700 receiver is a dual-frequency receiver.

The occupation time required for a Static survey depends on many factors. Trimble recommends an occupation time of at least 45 minutes when five or more satellites are available, or 60 minutes during times when only four satellites are available. The Trimble Geomatics Office software includes the QuickPlan™ utility, which you can use to determine satellite availability at a specified site and time.

Static surveying techniques are generally used for projects where the highest precision is required. At least two receivers are required, but multiple receivers can increase productivity. The sequence of observations should be dictated by the network design.

# FastStatic Surveying

Like Static surveying, FastStatic surveying requires simultaneous observations of 4 or more satellites for a period of 8 or more minutes. FastStatic surveying yields baseline components with a precision of ±0.5 mm + 1 ppm.

FastStatic surveying is similar to Static surveying in that data is logged only while the receiver is stationary and occupying a point. As the receiver moves from each point to another point in the survey, no data is logged, because the 5700 receiver is turned off during this period. The manner in which the data is treated by the baseline processor is also similar.

FastStatic surveying differs from Static surveying in the fact that less data is collected. The occupation time is shorter, resulting in fewer measurements for the baseline processor to use. Therefore, the expected baseline precision is not as high for FastStatic as it is for Static surveying. A less important distinction between FastStatic and Static surveying is the potential for logging more than one occupation within a single data file.

FastStatic surveying requires at least two receivers logging common data from two different locations. The length of time the receivers log data depends on:

- the number of satellites being tracked
- the geometry of the satellites being tracked (PDOP)
- the quality of the data being logged

Items affecting the quality of data are:

- cycle slips
- multipath
- radio frequency (RF) interference

Cycle slips are interruptions of data logging on one or more satellites. Multipath is the reflection of the satellite signal off nearby surfaces, such as the roof of a car.

In general, occupation times for FastStatic surveys (on baselines of up to 20 km) range from about 8 minutes, when data is logged from at least 6 satellites, to about 20 minutes with data from 4 satellites.

## FastStatic Using a TSC1 Data Collector

To perform a FastStatic survey with multiple occupations in a single data file, the 5700 receiver requires a TSC1 data collector. In this application, the data file remains open while the receiver moves between occupations, but no data is logged. The advantage in this case is efficiency in the field. When not using a TSC1 handheld, each of the FastStatic occupations is logged in the 5700 receiver as a unique data file with one occupation per file.

For more information on TSC1 handheld operation, refer to the Trimble Survey Controller documentation.

# Setting up the 5700 for a Static or FastStatic Survey

To set up the 5700 for a Static or FastStatic survey:

1. Set up the hardware according to the instructions in Postprocessed Setup, page 16.

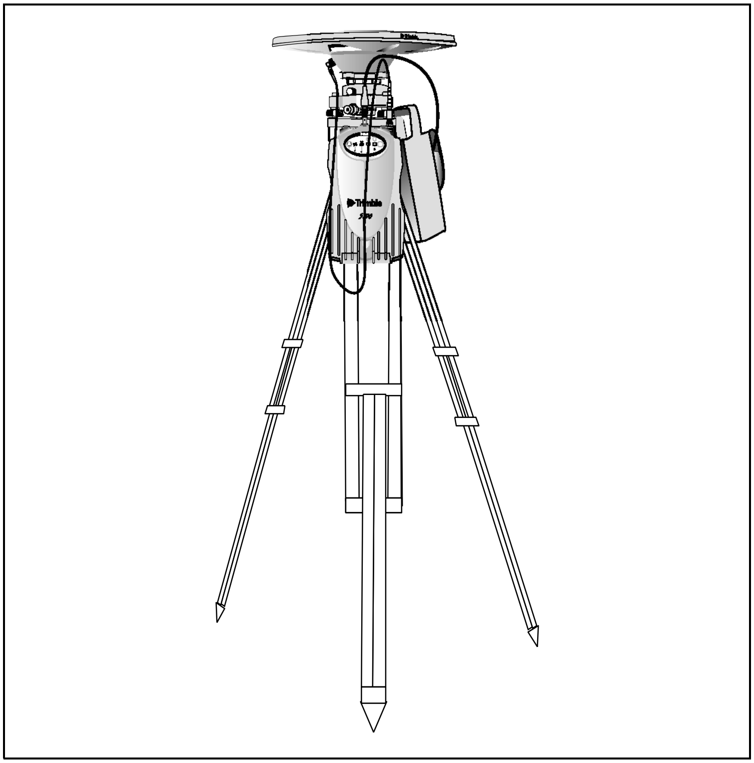


Figure 7.1 Static or FastStatic setup

2. Make sure that there is a CompactFlash card inserted in the receiver.

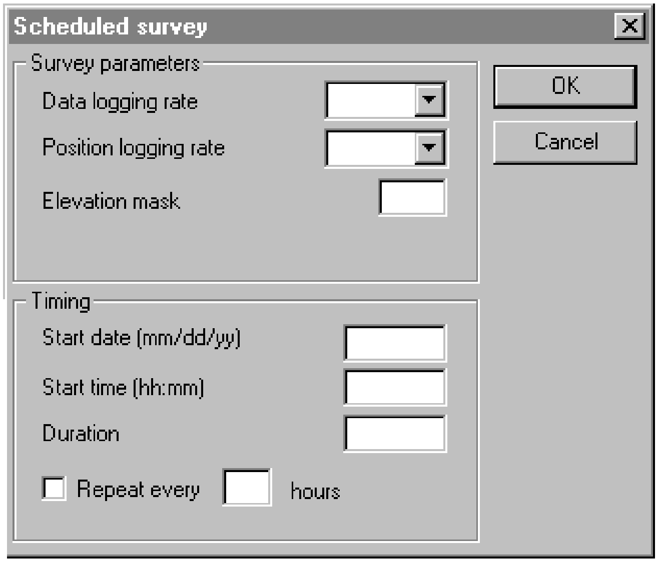
3. Do one of the following:
   - If the Trimble Survey Controller software is being used to start the survey, follow the guidelines in the *Trimble Survey Controller Reference Manual*.
   - Press on the 5700 receiver and wait until the red SV Tracking LED starts flashing slowly.
4. On the 5700 receiver, press .
5. Logging begins, and the Logging/Memory LED lights up.
6. In a FastStatic survey, the Logging/Memory LED starts flashing slowly when enough data has been collected.
7. When you have collected enough data for your application, hold down for 2 seconds to stop logging.
8. Hold down for 2 seconds to turn the receiver off.

# Automatically Scheduling Static or FastStatic Surveys

The 5700 receiver can be set up to automatically start surveying at a specific date and time and to continue for a specified duration. To do this, use timed application files. For more information, see Timed Application Files, page 54.

To set up a scheduled survey session:

1. To start the GPS Configurator software, click  , then select *Programs* / *Trimble* / *GPS Configurator* / *GPS Configurator.*
2. Select the *Connection* tab and click **Connect now** to connect to the receiver.
3. Select the *Log to receiver* tab and in the *Session schedule* group click **New**. The following dialog appears:




4. In the *Survey parameters* group, enter the data logging rate, position logging rate, and elevation mask that you want to use for this session.

5. In the *Timing* group, enter a start date and time, and a duration in hours.
6. If you want to run this session repeatedly, select the *Repeat every* check box and enter the repeat interval in the *hours* field.
7. Click **OK** to close the *Scheduled survey* dialog. The session details appear in the session table.
8. Click **Apply**.

   The GPS Configurator software sends the session details to the receiver as two timed application files (one file to start logging, and the other to stop logging).
9. Click **OK** to close the GPS Configurator software.
10. If you do not need to use the 5700 receiver before the scheduled survey, press ⏻.

    The receiver goes into Sleep mode, indicated by the yellow Logging/Memory LED flashing every three seconds. The receiver wakes up again five minutes before the scheduled start time.

CHAPTER

8

# Real-Time Kinematic (RTK) Surveying

**In this chapter:**

- Introduction
- Real-Time Kinematic positioning
- Extended RTK (eRTK)
- WAAS
- Setting up the RTK reference station
- Setting up the RTK rover

# Introduction

The 5700 receiver is designed for high-precision navigation and location. It uses Real-Time Kinematic (RTK) techniques to achieve centimeter-level positioning accuracy. This chapter introduces RTK concepts and terminology, and provides instructions for setting up the 5700 receiver as a reference or rover receiver for RTK surveying.

# Real-Time Kinematic Positioning



Real-Time Kinematic (RTK) positioning is based on at least two GPS receivers—a reference receiver and one or more rover receivers. The reference receiver takes measurements from satellites in view and then broadcasts them, with its location, to the rover receiver(s). The rover receiver also collects measurements to the satellites in view and processes them with the reference station data. The rover then estimates its location relative to the reference. Typically, reference and rover receivers take measurements at regular 1-second epochs (events in time) and produce position solutions at the same rate.

## Carrier Phase Initialization

The key to achieving centimeter-level positioning accuracy with RTK is the use of the GPS carrier phase signals. Carrier phase measurements are like precise tape measures from the reference and rover antennas to the satellites. Although carrier phase measurements are very precise, they contain an unknown bias, termed the integer cycle ambiguity, or phase ambiguity. The 5700 receiver rover has to resolve, or *initialize*, the carrier phase ambiguities at power-up and every time the satellite signals are interrupted.

The 5700 receiver can automatically initialize the carrier phase ambiguities provided that at least five common satellites are being tracked at the reference and rover sites. *Automatic initialization* is sometimes termed *on-the-fly (OTF)*, to reflect the fact that no restriction is placed on the motion of the rover receiver throughout the initialization process.

The 5700 receiver uses L1 and L2 carrier measurements, plus precise code range measurements to the satellites, to automatically initialize the ambiguities. The initialization process takes between 10 seconds and a few minutes. While the receiver is initializing the ambiguities, it generates a *float* solution with meter-level accuracy. When the initialization process is complete, the solution mode switches from *float* to *fixed*, and the precision changes from meter-level to centimeter-level accuracy.

Provided that at least four common satellites are continuously tracked after a successful initialization, the ambiguity initialization process does not have to be repeated.

***Note –*** *Initialization time is determined by baseline length, multipath, and prevailing atmospheric errors. Minimize reflective objects close to the antennas, and keep baseline lengths and differences in elevation between the reference and rover sites as small as possible.*

**Warning –** Although initialization in the 5700 receiver is very reliable, incorrect initializations can occur. A bad initialization can result in position errors of one to three meters. Generally, a bad initialization is followed by an increasing solution RMS (Root Mean Square). The receiver automatically detects initialization failures, and reports and fixes the problem. Bad initialization detection may take between one and four minutes, depending on the number of satellites being tracked.

## Update Rate and Latency

The number of position fixes delivered by an RTK system per second is called the *update rate*. The update rate determines how closely the trajectory of the rover can be represented and the ease with which position navigation can be accomplished. For the 5700 receiver, the maximum update rate is 10 Hz.

Solution *latency* is the lag in time between when the position was valid and when it is displayed. For precise navigation, you must have prompt position estimates, not values from 2 seconds ago. Solution latency is particularly important when guiding a moving vehicle. For example, a vehicle traveling at 25 kilometers per hour moves at approximately 7 meters per second. Thus, to navigate to within 1 meter, the solution latency must be less than $^{1}/_{7}$ second (0.14 s).

Various factors contribute to latency, as shown in Figure 8.1. The latency value can vary between 0.5 and 2 seconds.

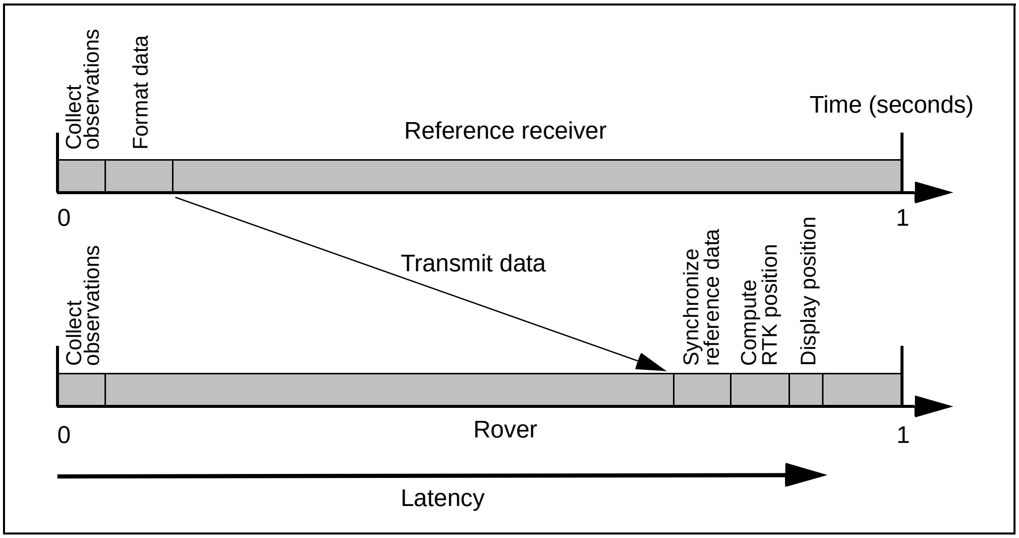



Figure 8.1 Factors contributing to RTK latency

## Data Link

The data link transfers the reference receiver's carrier phase and code measurements, and the location and description of the reference station, to the rover.

The TRIMMARK 3 reference radio modem, with the 5700 receiver's internal receive-only radio, is designed for 5700 receiver RTK operation. TRIMTALK 450 radio modems are also customized for RTK applications. You can also use third-party radio modems, cellular phones, or satellite communication links to transmit reference station data to one or more rover sites.

Factors to consider when choosing a data link include:

- Throughput capacity
- Range
- Duty cycle
- Error checking and correction
- Power consumption

The data link must support at least 2400 baud throughput. However, a throughput of 9600 baud is preferable.

### Correction message formats

In addition to selecting a data link, you need to decide in which format messages will be transmitted over the data link. The 5700 receiver supports two standards for RTK positioning: the Compact Measurement Record (CMR) format and the RTCM/RTK message format.

The Compact Measurement Record (CMR) format was designed by Trimble and is supported by all Trimble RTK products. CMR messages require at least a 2400 baud data link.

RTCM messages were designed by the Radio Technical Commission for Maritime Services (RTCM). RTK messages were included in version 2.2 of the RTCM standard. RTCM/RTK messages require at least a 4800 baud data link.

Not all RTK positioning modes are supported when you use the RTCM/RTK format. To ensure that you can use all the positioning modes supported by the 5700 receiver, Trimble recommends that you use the Compact Measurement Record format for all Trimble RTK positioning applications.

**Warning –** Use caution when trying to mix RTK systems from different manufacturers. Degraded performance nearly always results.

## RTK Positioning Modes

The 5700 receiver supports two positioning modes to support a wide variety of user applications. This section describes each mode, outlines it requirements, and highlights the differences between the modes.

### Synchronized RTK (1 Hz)

Synchronized RTK is the most widely used technique to achieve centimeter-level position estimates between a fixed reference station and a roving receiver. Typically, the update rate for Synchronized RTK is once per second (1 Hz). With Synchronized RTK, the rover receiver must wait until the reference station measurements are received before computing a baseline vector. The latency of the Synchronized position fixes is dominated by the data link delay (see Figure 8.1, page 92). Given a 4800 baud data link, the latency of the Synchronized RTK fixes is up to 0.5 seconds. The solution latency could be reduced by using a 9600 baud, or higher bandwidth data link.

The Synchronized RTK solution yields the highest precision possible and suits low dynamic applications such as human-mounted guidance. It is not as suitable for airborne applications, such as photogrammetry or aircraft landing system calibration, which require update rates in excess of 1 Hz. Data postprocessing can be used back in the office to generate corrected results, but postprocessing can cause data management problems, particularly for large data sets collected at 5 or 10 Hz.

## Low Latency RTK

Latency in Synchronized RTK processing is largely due to the formatting and transmission of the reference station data to the rover. The 5700 receiver includes a Low Latency positioning mode for applications that require centimeter-level accuracy almost instantaneously. The Low Latency positioning mode delivers 5 Hz position fixes with around 20 millisecond latency, and with a precision that is only slightly less accurate than Synchronized RTK positioning.

In the Low Latency positioning mode, accuracy is considered less important than timeliness. The Low Latency mode relies on the predictability of the reference station phase data. Given past reference station phase measurements, the 5700 receiver can accurately predict what they will be in the next few seconds.

Instead of waiting for carrier phase measurements to arrive from the reference station, the 5700 rover predicts or projects what the reference carrier phase measurements will be for the current epoch. A baseline solution is then generated using the projected reference station carrier phase measurements and the observed rover receiver carrier phase. The latency of the position solution derived from projected carrier phase is around 20 milliseconds.

An increase in the data link delay causes an increase in the projection time of the reference station phase data. This leads to an increase in the uncertainty of the RTK solution. In many applications the slight noise increase in the Low Latency solution is tolerable.

### Summary of RTK positioning modes

Table 8.1 summarizes the RTK positioning modes available in the 5700 receiver. Accuracy figures are 1 sigma and assume a 1 second data link delay.

**Table 8.1 Comparison of RTK positioning modes**

| RTK mode | Update rate (Hz) | Latency (seconds) | Minimum data link (baud) | Accuracy (RMS) |
|---|---|---|---|---|
| Synchronized | 1 | 0.5 – 2.5 | 2400 | Horizontal: 1 cm + 1 ppm<br>Vertical: 2 cm + 2 ppm |
| Low Latency | 5 | 0.02 | 2400 | Horizontal: 2 cm + 2 ppm<br>Vertical: 3 cm + 2 ppm |

## Critical Factors Affecting RTK Accuracy

The following sections present system limitations and potential problems that could be encountered during RTK operation.

### Reference receiver type

Optimal RTK performance is achieved when using 5700 receivers at reference and rover sites. However, the 5700 receiver is compatible with all other Trimble RTK systems, so you can use a 5700 receiver as the rover and a different receiver type as the reference station.

**Warning –** Trimble recommends that you only use a Trimble reference receiver with 5700 rovers. If you use a non-Trimble reference receiver, initialization reliability and RTK performance may be degraded.

### Reference station coordinate accuracy

Incorrect or inaccurate reference station coordinates degrade the rover position solution. It is estimated that every 10 meters of error in the reference station coordinates introduces one part per million error in the baseline vector. This means that if the reference station coordinates have a height error of 50 meters, and the baseline vector is 10 kilometers, then the error in the rover location is approximately five centimeters. For optimal results, the reference station coordinates should be known to within 10 meters in the WGS-84 datum.

### Number of visible satellites

The more GPS satellites that are visible, the greater the solution quality and integrity. Even though only four satellites are needed to calculate a three-dimensional position, RTK initialization requires that at least five common satellites be tracked at the reference and rover sites. In addition, L1 and L2 carrier phase data must be tracked on the five common satellites for successful RTK initialization.

### Elevation mask

Because atmospheric errors and signal multipath are largest for low elevation satellites, the elevation mask stops the 5700 receiver from using satellites that are low on the horizon. The 5700 receiver uses a default elevation mask of 13 degrees. If a lower elevation mask is used, system performance is degraded.

### Operating range

Operating range refers to the maximum separation between reference and rover sites. Often the characteristics of the data link determine the RTK operating range.

Although a shorter baseline will improve solution reliability, the 5700 receiver can remove ionospheric and tropospheric bias to allow reliable operation on baselines beyond 10 km.

## Environmental factors

Table 8.2 lists some of the environmental factors that can affect the quality of GPS measurements.

**Table 8.2 Environmental factors affecting measurement quality**

| Environmental factor | Effect | Solution |
|---|---|---|
| Ionospheric activity | Can cause rapid changes in the GPS signal delay, even between receivers a few kilometers apart, and increase RTK initialization time. | Avoid surveying around midday when ionospheric activity is high. |
| Tropospheric activity | Causes a delay in the GPS signals which varies with height above sea level, prevailing weather conditions, and satellite elevation. | Locate the reference station at approximately the same elevation as the rover. |
| Signal obstructions | Limit the number of visible satellites and can also induce signal multipath. | Locate the reference station in a clear environment with an open view of the sky. |
| Multipath | Can cause signal reflection before reception at the GPS antenna. | Use an antenna with a ground plane. |
| Radio interference | Can cause serious degradation in signal quality or complete loss of signal tracking. | Do not locate the reference station in an area where radio transmission interference may be a problem. |

# Extended RTK (eRTK)

By using mobile and satellite communications as the RTK data link you can survey at operating ranges beyond 10 km.

However, with the increase in distance there is also a greater chance for error. As the rover moves further from the reference station, the effects of the atmosphere on the GPS signals received at each station can degrade RTK performance and initialization times. In areas where the weather systems fluctuate rapidly, initialization may take longer. The 5700 receiver firmware detects and measures biases caused by ionospheric and tropospheric interference, and corrects for significant biases. However, you should still perform independent checks on your work.

The need for independent verification increases as the baseline distance increases. You also need to choose obstruction-free environments when initializing, if possible.

You can use any of the following techniques to verify RTK results:

- Reoccupy a number of points observed earlier in the day
- Reinitialize and reobserve points
- Reobserve control points in a survey at least two hours after the initial occupation, when the multipath effects will also be different
- Perform known point initializations
- Check initializations on previously observed points

# WAAS

The 5700 receiver can use the WAAS (Wide Area Augmentation System) set up by the Federal Aviation Administration (FAA). WAAS was established for flight and approach navigation for civil aviation. WAAS improves the accuracy, integrity, and availability of the basic GPS signals over its coverage area, which includes the continental United States and outlying parts of Canada and Mexico.

WAAS can be used in surveying applications to improve single point positioning when starting a reference station, or when the RTK radio link is down. WAAS corrections should be used to obtain greater accuracy than autonomous positioning, not as an alternative to RTK positioning.

The WAAS system provides correction data for visible satellites. Corrections are computed from ground station observations and then uploaded to two geostationary satellites. This data is then broadcast on the L1 frequency, and is tracked using a channel on the 5700 receiver, exactly like a GPS satellite. For more information on WAAS, refer to the FAA home page at http://gps.faa.gov.

Use the Trimble Survey Controller software or the GPS Configurator software to enable WAAS support in the 5700 receiver. For more information, refer to the *Trimble Survey Controller Reference Manual* or the GPS Configurator Help.

At the time this manual went to print, the WAAS system was operational, but had not been enabled by the FAA for general use. To use WAAS corrections while the system is disabled, configure the 5700 receiver to ignore WAAS health messages. To do this, in the *General* tab of the GPS Configurator software, select the *Ignore WAAS correction health* check box.

## Setting up the RTK Reference Station

To set up the 5700 receiver as an RTK reference station:

1. Set up the equipment as described in Postprocessed Setup, page 16 and External Radio Setup, page 28.

   Because the internal radio is receive-only, you must use an external radio when you use the 5700 receiver as a reference station.

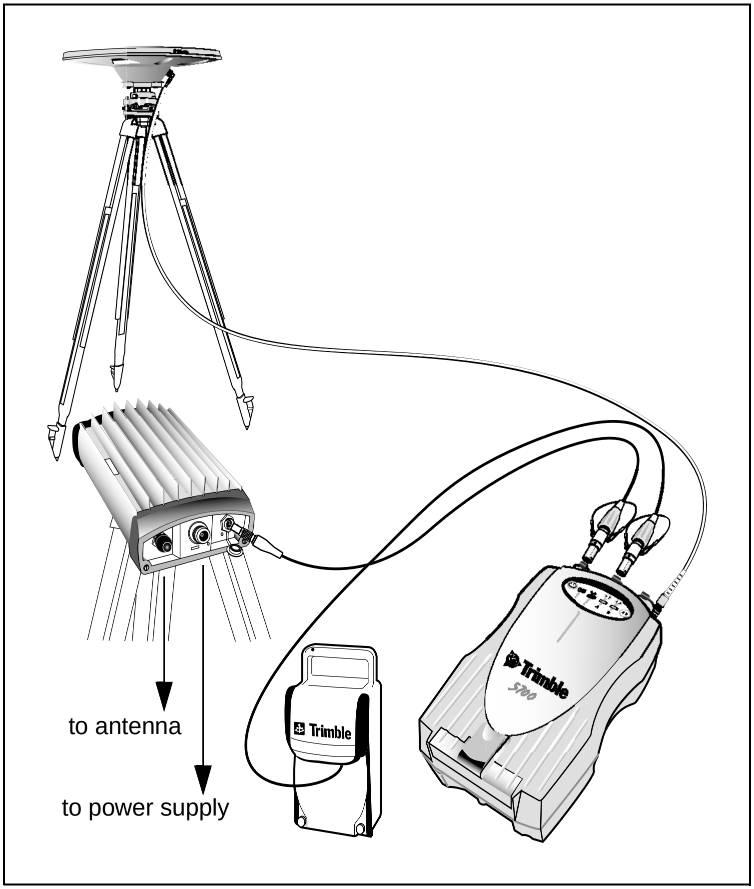



Figure 8.2 RTK reference station setup

2. Use the Trimble Survey Controller, GPS Configurator, or Configuration Toolbox software to start the reference receiver broadcasting.

   For more information, refer to the documentation for the appropriate software.

## Setting up the RTK Rover

To set up the 5700 receiver as an RTK rover:

1. Set up the equipment as described in Pole-Mounted Setup, page 18, or Backpack Setup, page 25.
2. Use the Trimble Survey Controller software to configure the RTK rover.

   For more information, refer to the *Trimble Survey Controller Reference Manual*.
3. ***Before*** leaving the reference station, check that the rover and reference receiver work together. By checking communications now, you can avoid communication problems when you start surveying that may require you to return to the reference station.
   a. Start up the rover 100 to 200 meters from the reference receiver.
   b. Check whether you are receiving the reference radio broadcasts.
   c. If you are not receiving broadcasts, check that the radio settings match on both the reference receiver and the rover and that all cables are fully plugged in. For more information, see Chapter 14, Troubleshooting.

SECTION

III

# REFERENCE

CHAPTER

9

# Specifications

**In this chapter:**

- Introduction
- Physical specifications
- Positioning specifications
- Technical specifications

# Introduction

This chapter details the specifications of the 5700 receiver.

# Physical Specifications

Table 9.1 lists physical specifications for the 5700 receiver.

**Table 9.1 Physical specifications**

| Feature | Specification |
|---|---|
| Size | 14.5 cm W x 5.1 cm H x 23.9 cm D<br>(5.7 in. W x 2.0 in. H x 9.4 in. D) |
| Weight<br>(with 2 batteries inserted) | 1.4 kg (3.0 lb) |
| Battery life<br>(at 20°C) | RTK with internal radio: 3.5 hours<br>No internal radio: 5 hours |
| Power input | 10.5–28 VDC |
| Operating temperature | –40°C to +65°C (–40°F to +150°F)[1] |
| Storage temperature | –40°C to +80°C (–40°F to +176°F) |
| Humidity | 100% condensing, unit fully sealed |
| Casing | Dust proof, shock and vibration resistant |

[1]The USB port only operates when the temperature is above 0°C (32°F). The internal batteries only charge when the temperature is in the range 0°C to 40°C (32°F to 104°F).

Reference

# Positioning Specifications

Table 9.2 lists positioning specifications for the 5700 receiver.

**Table 9.2 Positioning specifications**

| Positioning | Mode | Latency | Horizontal Accuracy (RMS) | Vertical Accuracy (RMS) |
|---|---|---|---|---|
| RTK (OTF) | Synchronized | > 100 ms | 1 cm + 1 ppm (× baseline length) | 2 cm + 2 ppm (× baseline length) |
| | Low Latency | < 20 ms | 2 cm + 2 ppm (× baseline length)[1] | 3 cm + 2 ppm (× baseline length)[1] |
| L1 C/A Code Phase | Synchronized/ Low Latency | < 20 ms | 50 cm[2] | 75 cm[2] |
| Static/ FastStatic | N/A | N/A | 5 mm + 0.5 ppm (× baseline length) | 5 mm + 1 ppm (× baseline length) |
| WAAS | N/A | N/A | Less than 5 m[3] | Less than 5 m[3] |

[1]Depends on radio link latency.

[2]One sigma figure of merit, varies with S/A errors and satellite geometry.

[3]3D RMS values depend on WAAS system performance.

Reference

# Technical Specifications

Table 9.3 lists technical specifications for the 5700 receiver.

**Table 9.3 Technical specifications**

| Feature | Specification |
|---|---|
| Tracking | 24 channels L1 C/A code, L1/L2 full cycle carrier<br>Fully operational during P-code encryption<br>WAAS satellite tracking |
| Signal processing | Maxwell architecture<br>Very low-noise C/A code processing<br>Multipath suppression |
| Start-up | Cold start: < 60 seconds from power on<br>Warm start: < 30 seconds with recent ephemeris |
| Initialization | Automatic while moving or static |
| Minimum initialization time | 10 sec + 0.5 × baseline length (km) |
| Communications | Three RS-232 serial ports (Port 1, Port 2, and Port 3)<br>Baud rates up to 115,200 bps<br>RTS/CTS flow control negotiation supported on Port 3 only<br>One USB port (download only) |
| Configuration | Via user-definable application files or the GPS Configurator software |
| Output formats | NMEA-0183: GGA; GST; GSV; PTNL,GGK; PTNL,GGK_SYNC; PTNL,PJK; PTNL,PJT; PTNL,VGK; VHD; VTG; ZDA<br>GSOF (Trimble Binary Streamed Output)<br>1PPS<br>RT17 |

CHAPTER

10

# Default Settings

**In this chapter:**

- Introduction
- Default settings
- Resetting to factory defaults
- Examples

## Introduction

All 5700 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 5700 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 about application files, see Application Files, page 51.

# Default Settings

Table 10.1 defines the default settings for the 5700 receiver, as defined in the Default application file:

**Table 10.1 Default settings**

| Function | | Factory Default |
|---|---|---|
| SV Enable | | All SVs enabled |
| General Controls: | Elevation mask | 13° |
| | SNR mask | 7 |
| | RTK positioning mode | Low Latency |
| | Motion | Kinematic |
| Power Output 3 | | Disabled |
| 1PPS time tags | | Off |
| ASCII time tags | | Off |
| Serial Port 1: | Baud rate | 38400 |
| | Format | 8-None-1 |
| | Flow control | None |
| Serial Port 2: | Baud rate | 38400 |
| | Format | 8-None-1 |
| Serial Port 3: | Baud rate | 38400 |
| | Format | 8-None-1 |
| | Flow control | None |
| Input Setup: | Station | Any |
| NMEA/ASCII (all messages) | | All Ports Off |
| Streamed output | | All Types Off<br>Offset = 00 |
| RT17/Binary | | All Ports Off |
| CMR output | | [Static] CMR: cref ID 0000 |
| RTCM output | | RTCM: Type 1 ID 0000 |

**Table 10.1 Default settings (Continued)**

| Function | | Factory Default |
|---|---|---|
| Reference position: | Latitude | 0° |
| | Longitude | 0° |
| | Altitude | 0.00 m HAE |
| Antenna: | Type | Unknown external |
| | Height (true vertical) | 0.00 m |
| | Group | All |
| | Measurement method | 255 |
| Logging rate | | 15 sec |
| Position rate | | 5 min |
| Measurement rate | | 10 Hz |

# Resetting to Factory Defaults

You can reset your 5700 receiver to its factory defaults, as defined above, in either of the following ways:

- Press and hold down  on the 5700 receiver for 15 seconds.
- In the Configuration Toolbox software, select *Communication* / *Reset receiver* and click **Reset**.

# Examples

The following examples show how the 5700 receiver uses the default settings and special application files in various situations.

## 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.

| When you turn the receiver on and … | then logging settings are … | and logging … |
|---|---|---|
| it is the first time that the receiver has been used | the factory defaults | does not begin automatically |
| you have reset the receiver to its factory defaults | the factory defaults, or those in the Power Up file[1] | does not begin automatically |
| you have performed a full reset | the factory defaults, because resetting deletes any Power Up file | does not begin automatically |

[1]A factory default setting is only used if the setting is not defined in the Power Up file.

## Power up Settings

When you turn the receiver off, 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.

| When you use to turn the receiver off then on again and … | then logging settings are … | and all other settings are … |
|---|---|---|
| you changed the receiver settings by applying an application file | the factory defaults | the last settings used |
| you changed the receiver settings using configuration software | the factory defaults | the last settings used |
| there is a Power Up application file in the receiver | the factory defaults, or those in the Power Up file[1] | the last settings used, or those in the Power Up file[1] |

[1]A factory default setting is only used if the setting is not defined in the Power Up file.

## Logging after Power Loss

If the 5700 loses power unexpectedly, when power is restored the receiver tries to return to the state it was in immediately before the power loss. The receiver does not reset itself to defaults or apply any Power Up settings. If the receiver was logging when power was lost unexpectedly, it resumes logging when power is restored.

However, when you switch the 5700 receiver off using , the receiver behaves as if you pressed to stop logging before you pressed . In this case, when power is restored normally, logging does not begin until you start it manually.

| When the receiver is logging data and then loses power … | then when power is restored, data logging … | and logging settings are … | and all other settings are … |
|---|---|---|---|
| unexpectedly | resumes automatically | the last settings used | the last settings used |
| when you press | does not resume | the factory defaults | the last settings used |

## Disabling Logging

You can disable logging by setting the receiver's data logging and position logging rates to Off. However, if you press while logging is disabled, the receiver will still log data, using the default logging settings.

| When you have disabled logging … | then if you press to start logging, logging settings are … |
|---|---|
| using the Trimble Survey Controller or GPS Configurator software | the factory defaults |
| in the Power Up application file | the factory defaults |

## Application Files

You can use application files to change the settings in the receiver. Sending an application file to the receiver does not necessarily apply the file's settings; you can apply a file's settings at any time after sending it to the receiver. You can also define timed application files. A timed application file contains receiver settings, but also includes a date and time when it is automatically activated.

If there is a timed application file on the 5700 receiver, the receiver automatically applies the file's settings and begins logging (if logging settings are included in the file) at the specified time. If the 5700 is in Sleep mode, it wakes up five minutes before the start time of the timed application file, and then begins logging, if required, at the specified start time.

| When you send an application file to the receiver and … | then the receiver settings are changed … |
|---|---|
| you apply the file's settings immediately | as soon as you send the file to the receiver |
| you apply the file later | as soon as you apply the file |
| it is a timed application file | at the specified activation time |

CHAPTER

# 11

# Cables and Connectors

**In this chapter:**

- Introduction
- Port 1, 2, and 3 connectors
- Data/Power cable
- Event/PPS cable
- GPS antennas and cables

# Introduction

This chapter provides pinout information for the 5700 receiver standard and optional cables. This information can be used to prepare special cables for connecting the 5700 receiver to devices and instruments not supported by the standard and optional cables.

# Port 1, 2, and 3 Connectors

Figure 11.1 shows the location of the 5700 serial ports.

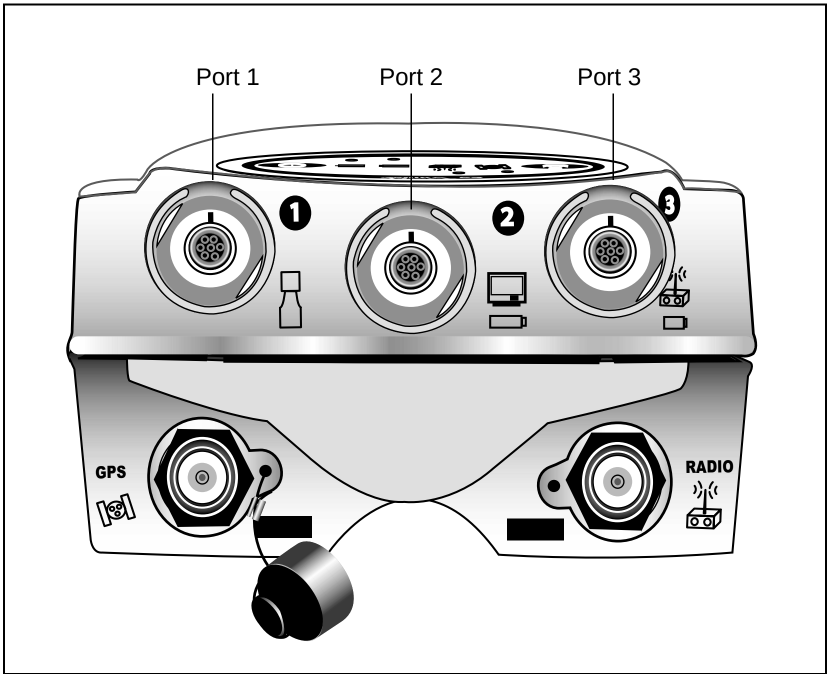



Figure 11.1 5700 serial ports

Figure 11.2 gives pinout requirements for the connector labeled Port 1. The pin locations for the Port 2 and Port 3 connectors are identical.

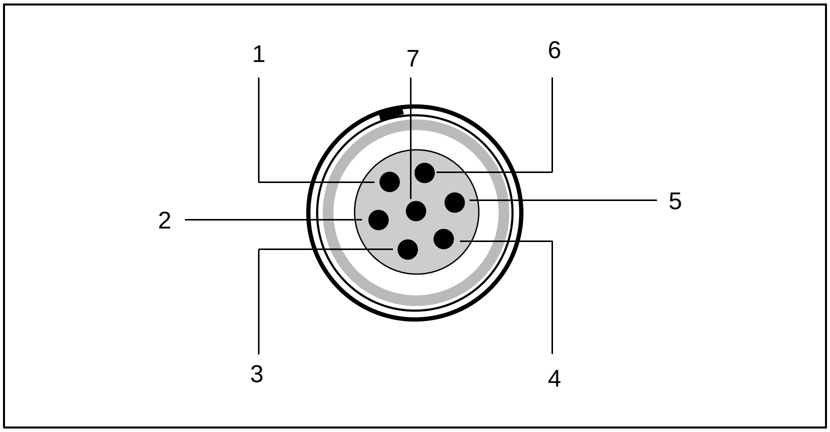



Figure 11.2 Pinout connector diagram

Table 11.1 describes the pinout functionality.

**Table 11.1 5700 port pinouts**

| Pin | Pinout function | | |
|---|---|---|---|
| | **Port 1 (TSC1 data collector, event, or computer)** | **Port 2 (Power in, computer, PPS, or event)** | **Port 3 (External radio or power in)** |
| 1 | Signal GND | Signal GND | Signal GND |
| 2 | GND | GND | GND |
| 3 | TX data out (TXD1) | TX data out (TXD2) | TX data out (TXD3) |
| 4 | RTS1 | 1PPS | RTS3 |
| 5 | CTS1/Event 2 | Event 1 | CTS3 |
| 6 | Power Out (+) | Power In (+) | Power In/Out (+) |
| 7 | Serial data in (RXD1) | Serial data in (RXD2) | Serial data in (RXD3) |

# Data/Power Cable

Table 11.2 gives pinout information for the data/power cable (Part Number 32345), which is supplied with the 5700 receiver.

**Table 11.2 Data/power cable pinouts**

| Lemo 0-shell connector 7 Pin | | Direction | DE9-F connector 7 Cond | | | Power lead 2 Cond | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Function** | | **Pin** | **Color** | **Function** | **Color** | **Function** |
| 1 | Signal ground | ↔ | 5 | Brown | Signal ground | | |
| 2 | GND | → | | | | Black | V-OUT |
| 3 | TXD | → | 2 | Orange | TXD | | |
| 4 | RTS/TXD | → | 8 | Blue | RTS | | |
| 5 | CTS/RXD | ← | 7 | Green | CTS | | |
| 6 | PWR | ← | | | | Red | Power IN (+) |
| 7 | RXD | ← | 3 | Yellow | TXD | | |

***Note –** Table 11.2 assumes that the cable is attached to the connector labeled Port 1 or Port 3.*

Reference

# Event Marker/1PPS Cable

The event marker/1PPS cable (Part Number 36451-00) shown in Figure 11.3 provides a breakout box with two BNC (female) connectors for providing 1PPS input and event marker output.

Connect a device that accepts 1PPS output pulses to the BNC connector labeled 1PPS on the breakout box. Connect a device that outputs event marker pulses to the 5700 receiver, such as a photogrammetric camera, to the BNC connector labeled Event Marker on the breakout box.

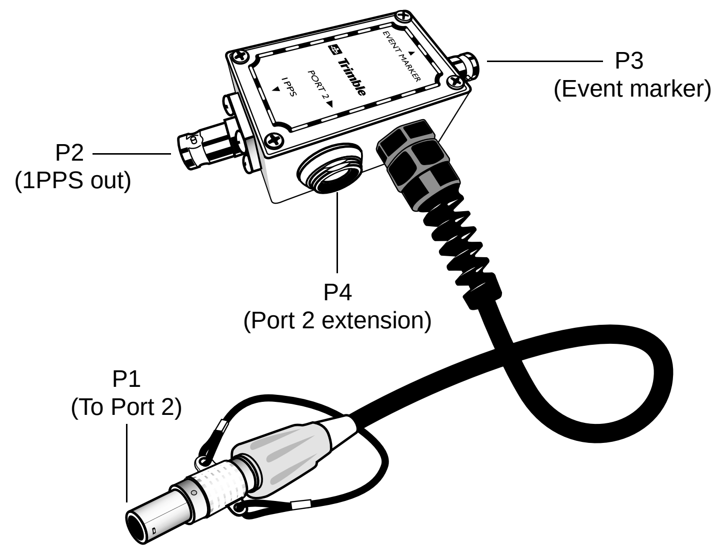



Figure 11.3 Event marker/1PPS cable

In addition, the breakout box includes a Lemo 7-pin connector to extend serial communications and/or power on Port 2. Because the BNC connectors are used to service the event marker and 1PPS features, pins 4 (1PPS) and 5 (Event Marker) are inactive on the Lemo connector.

For Port 2 pinouts, see Port 1, 2, and 3 Connectors, page 118. For more information on 1PPS input and event marker output, see Chapter 13, Event Marker Input and 1PPS Output.

Table 11.3 gives pinout information for the event marker/1PPS cable (Part Number 36451-00), which is supplied with the 5700 receiver. The event marker/1PPS cable is only used with the 5700 connectors labeled Port 1 (for event marker output) and Port 2.

**Table 11.3 Event marker/1PPS cable pinouts**

| P1: Lemo 7-Pin Port 2 5700 | | Direction | P2: BNC-F connector (1PPS) | P3: BNC-F connector (Event Marker) | P4: Lemo 7s Port 2 extension | |
|---|---|---|---|---|---|---|
| **Pin** | **5700 function** | | **Pin** | **Pin** | **Pin** | **Function** |
| 1 | Signal ground | ← | | | 1 | Signal ground |
| 2 | GND | → | GND | GND | 2 | GND |
| 3 | Serial data out (TXD2) | ← | | | 3 | Serial data in (TXD2) |
| 4 | 1PPS | ← | Center pin | | 4 | No Connect |
| 5 | Event Marker | ↔ | | Center pin | 5 | No Connect |
| 6 | Power IN (+) | → | | | 6 | Power IN (+) |
| 7 | Serial data in (RXD2) | ← | | | 7 | Serial data out (RXD2) |

# GPS Antennas and Cables

The antenna that a receiver uses to collect satellite signals is sometimes called a GPS antenna to distinguish it from a radio antenna. Radio antennas are used for communication between receivers and external networks or systems.

***Note –*** *To use older model antennas, such as Choke Ring or Micro-centered L1/L2 antennas, with a 5700 receiver, you need to use an antenna power adapter and an external power source for the antenna. For more information, see* *Antennas, page 32**.*

Connect the 5700 receiver to its GPS antenna using the yellow TNC connector. Use a coaxial cable with a right-angle TNC plug at the antenna end.

| If the antenna cable length is … | use … |
|---|---|
| up to 15 meters (45 feet) | RG-58 cable |
| up to 30 meters (100 feet) | RG-214 cable |
| over 30 meters (100 feet) | one of the following:<br>• in-line amplifier (Part Number 44033)<br>• semi-rigid coaxial cable<br>• a low-loss cable assembly |

Reference

CHAPTER

12

# NMEA-0183 Output

**In this chapter:**

- Introduction
- NMEA-0183 outputs
- Common message elements
- NMEA messages

## Introduction

This chapter describes the formats of the subset of NMEA-0183 messages that are available for output by the 5700 receiver. For a copy of the NMEA-0183 Standard, visit the National Marine Electronics Association web site at www.nmea.org.

## 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 5700 serial ports. These NMEA-0183 messages let external devices use selected data collected or computed by the 5700 receiver.

All messages conform to the NMEA-0183 Version 2.30 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.

Table 12.1 summarizes the set of NMEA messages supported by the 5700 receiver, and shows the page where detailed information about each message can be found.

**Table 12.1 NMEA message summary**

| Message | Function | Page |
|---|---|---|
| GGA | Time, position, and fix related data | 129 |
| GST | Position error statistics | 131 |
| GSV | Number of SVs in view, PRN, elevation, azimuth, and SNR | 132 |
| PTNL,GGK | Time, position, position type and DOP values | 133 |
| PTNL,GGK_SYNC | Time, synchronized position, position type and DOP values | 134 |
| PTNL,PJK | Local coordinate position output | 136 |
| PTNL,PJT | Projection type | 137 |
| PTNL,VGK | Time, locator vector, type and DOP values | 137 |
| PTNL,VHD | Heading Information | 138 |
| VTG | Actual track made good and speed over ground | 139 |
| ZDA | UTC day, month, and year, and local time zone offset | 140 |

The output of individual NMEA messages can be enabled or disabled by:

- creating an application file in the Configuration Toolbox software that contains NMEA output settings, and sending the file to the 5700 receiver
- adding NMEA outputs in the *Serial outputs* tab of the GPS Configurator software, and applying 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 that depend on message type, separated by commas
- An asterisk
- A checksum

Here is an example of a simple message with a message ID ($GPGGA), followed by 13 fields and 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 output by the 5700 receiver.

### Latitude and Longitude

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

- *dd* or *ddd* is degrees
- *mm.mmmm* 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.

## GGA Time, Position, and Fix Related Data

An example of the GGA message string is shown below. Table 12.2 describes the message fields.

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

**Table 12.2 GGA message fields**

| Field | Meaning |
|---|---|
| 1 | UTC of position fix |
| 2 | Latitude |
| 3 | Direction of latitude:<br>N: North<br>S: South |
| 4 | Longitude |
| 5 | Direction of longitude:<br>E: East<br>W: West |

**Table 12.2 GGA message fields (Continued)**

| Field | Meaning |
|---|---|
| 6 | GPS Quality indicator:<br>0: Fix not valid<br>1: GPS fix<br>2: Differential GPS fix<br>4: Real Time Kinematic, fixed integers<br>5: Real Time Kinematic, float integers |
| 7 | Number of SVs in use, range from 00 to 12 |
| 8 | HDOP |
| 9 | Orthometric height (MSL reference) |
| 10 | M: unit of measure for height is meters |
| 11 | Geoid separation |
| 12 | M: geoid separation is measured in meters |
| 13 | Age of differential GPS data record, Type 1 or Type 9. Null field when DGPS is not used. |
| 14 | Reference station ID, ranging from 0000 to 1023. A null field when any reference station ID is selected and no corrections are received. |

## GST Position Error Statistics

An example of the GST message string is shown below. Table 12.3 describes the message fields.

$GPGST,172814.0,0.006,0.023,0.020,273.6,
0.023,0.020,0.031*6A

**Table 12.3 GST message fields**

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

## 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 12.4 describes the message fields.

$GPGSV,4,1,13,02,02,213,,03,-3,000,,
11,00,121,,14,13,172,05*67

**Table 12.4 GSV message fields**

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

# PTNL,GGK

## Time, Position, Position Type, DOP

An example of the PTNL,GGK message string is shown below. Table 12.5 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 12.5 PTNL,GGK message fields**

| Field | Meaning |
|---|---|
| 1 | UTC of position fix |
| 2 | Date |
| 3 | Latitude |
| 4 | Direction of latitude:<br>N: North<br>S: South |
| 5 | Longitude |
| 6 | Direction of Longitude:<br>E: East<br>W: West |
| 7 | GPS Quality indicator:<br>0: Fix not available or invalid<br>1: Autonomous GPS fix<br>2: Differential, floating carrier phase integer-based solution, RTK(float)<br>3: Differential, fixed carrier phase integer-based solution, RTK(fixed)<br>4: Differential, code phase only solution (DGPS) |
| 8 | Number of satellites in fix |
| 9 | DOP of fix |

**Table 12.5 PTNL,GGK message fields (Continued)**

| Field | Meaning |
|---|---|
| 10 | Ellipsoidal height of fix |
| 11 | M: ellipsoidal height is measured in meters |

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

# PTNL,GGK_SYNC

## Time, Synchronized Position, Position Type, DOP

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 12.6 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 12.6 PTNL,GGK_SYNC message fields**

| Field | Meaning |
|---|---|
| 1 | UTC of position fix |
| 2 | Date |
| 3 | Latitude |
| 4 | Direction of latitude:<br>N: North<br>S: South |
| 5 | Longitude |
| 6 | Direction of Longitude:<br>E: East<br>W: West |

**Table 12.6 PTNL,GGK_SYNC message fields (Continued)**

| Field | Meaning |
|---|---|
| 7 | GPS Quality indicator:<br>0: Fix not available or invalid<br>1: Autonomous GPS fix<br>2: Differential, floating carrier phase integer-based solution, RTK(float)<br>3: Differential, fixed carrier phase integer-based solution, RTK(fixed)<br>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 12.7 describes the message fields.

$PTNL,PJK,010717.00,081796,
+732646.511,N,+1731051.091,E,
1,05,2.7,EHT-28.345,M*7C

**Table 12.7 PTNL,PJK message fields**

| Field | Meaning |
|---|---|
| 1 | UTC of position fix |
| 2 | Date |
| 3 | Northing, in meters |
| 4 | Direction of Northing will always be N (North) |
| 5 | Easting, in meters |
| 6 | Direction of Easting will always be E (East) |
| 7 | GPS Quality indicator:<br>0: Fix not available or invalid<br>1: Autonomous GPS fix<br>2: Differential, floating carrier phase integer-based solution, RTK (float)<br>3: Differential, fixed carrier integer-based solution, RTK (fixed)<br>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 12.8 describes the message fields.

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

**Table 12.8 PTNL,PJT message fields**

| Field | Meaning |
|---|---|
| 1 | Coordinate system name (can include multiple words) |
| 2 | Projection name (can include multiple coordinates) |

# PTNL,VGK

## Vector Information

An example of the PTNL,VGK message string is shown below. Table 12.9 describes the message fields.

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

**Table 12.9 PTNL,VGK message fields**

| Field | Meaning |
|---|---|
| 1 | UTC of vector in hhmmss.ss format |
| 2 | Date in mmddyy format |
| 3 | East component of vector, in meters |
| 4 | North component of vector, in meters |
| 5 | Up component of vector, in meters |

**Table 12.9 PTNL,VGK message fields (Continued)**

| Field | Meaning |
|---|---|
| 6 | GPS quality indicator:<br>0: Fix not available or invalid<br>1: Autonomous GPS fix<br>2: Differential carrier phase solution RTK(float)<br>3: Differential carrier phase solution RTK(fix)<br>4: Differential code-based solution, DGPS |
| 7 | Number of satellites if fix solution |
| 8 | DOP of fix |
| 9 | M: Vector components are in meters |

# PTNL,VHD

## Heading Information

An example of the PTNL,VHD message string is shown below. Table 12.10 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 12.10 PTNL,VHD message fields**

| Field | Meaning |
|---|---|
| 1 | UTC of position, in *hhmmss.ss,ddmmyy* format |
| 2 | Date in mmddyy format |
| 3 | Azimuth |
| 4 | ΔAzimuth/ΔTime |
| 5 | Vertical Angle |
| 6 | ΔVertical/ΔTime |
| 7 | Range |
| 8 | ΔRange/ΔTime |

**Table 12.10 PTNL,VHD message fields (Continued)**

| Field | Meaning |
|---|---|
| 9 | Quality indicator:<br>0: Fix not available or invalid<br>1: Autonomous GPS fix<br>2: Differential carrier phase solution RTK(float)<br>3: Differential carrier phase solution RTK(fix)<br>4: Differential code-based solution, DGPS |
| 10 | Number of satellites used in solution |
| 11 | PDOP |

## VTG Actual Track Made Good Over and Speed Over Ground

An example of the VTG message string is shown below. Table 12.11 describes the message fields.

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

**Table 12.11 VTG message fields**

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

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

An example of the ZDA message string is shown below. Table 12.12 describes the message fields.

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

**Table 12.12 ZDA message fields**

| Field | Meaning |
|---|---|
| 1 | UTC |
| 2 | Day, ranging between 01 and 31 |
| 3 | Month, ranging between 01 and 12 |
| 4 | Year |
| 5 | Local time zone offset from GMT, ranging from 00 to ±13 hours |
| 6 | Local time zone offset from GMT, ranging from 00 to 59 minutes |

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.

CHAPTER

13

# Event Marker Input and 1PPS Output

**In this chapter:**

- Introduction
- Event marker input
- 1PPS output
- Event Marker/1PPS cable

# Introduction

The 5700 receiver can accept event marker input on Port 1 and Port 2, and can generate 1PPS output on Port 2.

# Event Marker Input

Event marker input is used to log a precise GPS time tag whenever an externally generated pulse, such as one generated at the time of the shutter closing from a photogrammetric camera, is received.

The event is triggered when the source pulse voltage transitions between 1.0 VDC and 2.0 VDC in less than 100 nsec. Trimble recommends that you use TTL level inputs. You can configure the receiver to recognize either a positive (rising) or negative (falling) voltage as the leading edge of a pulse. The accuracy of the associated time tag recorded for an event is determined by the GPS accuracy (typically less than 1 μsec.).

The 5700 receiver records each event in the current data file. This record includes the port on which the event was received.

## Enabling and Configuring Event Marker Input

To enable or configure the event marker input function, you need either the GPS Configurator software or the Configuration Toolbox software.

### In real time

You can use the GPS Configurator software to configure a Trimble GPS receiver connected to your office computer. For more information, see GPS Configurator Software, page 66, or refer to the GPS Configurator Help.

To enable event marker input:

1. Connect the computer to the 5700 receiver.
2. Press to power on the 5700 receiver.
3. To start the GPS Configurator software, click , then select *Programs* / *Trimble* / *GPS Configurator* / *GPS Configurator.*

   The *GPS Configurator* dialog appears and the software automatically connects to the 5700 receiver.
4. In the *General* tab, select the *Event marker* check box.
5. Select the appropriate option, Positive slope or Negative slope, depending on the type of pulse the external device uses.
6. Click **Apply**.

   The GPS Configurator software sends the new configuration information to the 5700 receiver, and the receiver starts to accept event marker input.
7. Click **OK** to exit the GPS Configurator software.

   The software disconnects from the 5700 receiver.

## Using an application file

The Configuration Toolbox software lets you create an application file containing the appropriate configuration instructions for event marker input. You can then transfer that file to the 5700 to enable event marker input.

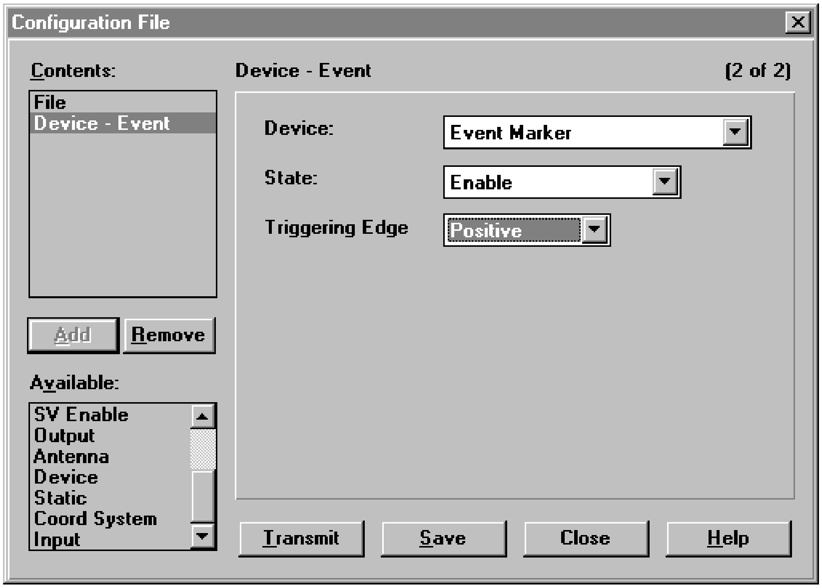
For more information, see Configuration Toolbox Software, page 68, or refer to the Configuration Toolbox Help.

To create an application file that enables event marker input:

1. Connect the computer to the 5700 receiver.
2. Press to power on the 5700 receiver.
3. To start the Configuration Toolbox software, click Start, then select *Programs* / *Trimble* / *Configuration Toolbox* / *Configuration Toolbox*.

   The main *Configuration Toolbox* window appears.
4. Select *File* / *New* / *5700* to display the *Configuration File* dialog.
5. From the *Available* list select Device, then click **Add**.

6. Complete the dialog as shown below. In the *Triggering Edge* field, select Positive or Negative, depending on which type of pulse the external device uses:




7. To save the application file to your computer, click **Save**.

8. Click **Transmit** to send the application file to the connected receiver. The message Communicating with receiver appears, followed by a message giving details of the transfer.

9. Click **Close** to exit the *Configuration File* dialog.

10. If you have not saved the application file, a message appears, prompting you to save your changes.

11. Select *File* / *Exit* to close the Configuration Toolbox software.

# 1PPS Output

The 5700 receiver can output a one pulse per second (1PPS) time strobe with an associated ASCII time tag output. The pulse is output through Port 2 of the 5700 receiver using the event marker/1PPS cable (Part Number 36451-00).

## 1PPS Pulse Definition

The leading edge of the pulse coincides with the beginning of each UTC second, as shown in Figure 13.1. The pulse is driven by an RS-422 driver between nominal levels of 0 V and 4 V. The leading edge is positive, rising from 0 V to 4 V.

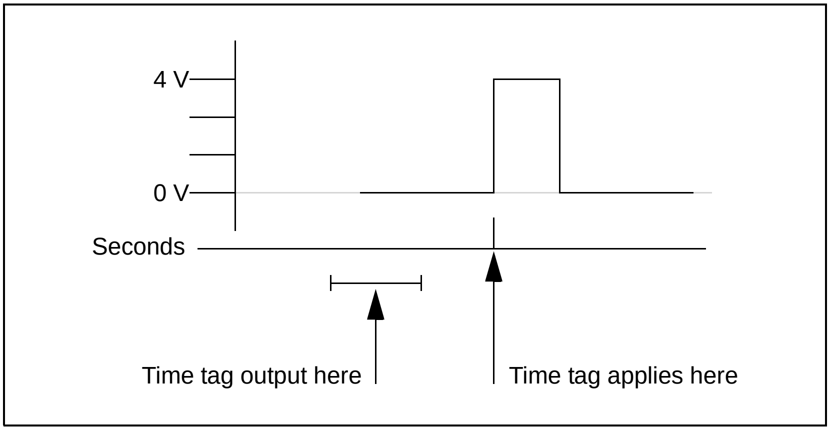



Figure 13.1 Time tag relation to 1PPS wave form

The pulse is approximately 8 μsec wide, with rise and fall times of about 100 nsec. Resolution is approximately 40 nsec, but several external factors limit accuracy to approximately ±1 μsec:

- Position errors, especially with user-entered reference. Each meter of error can result in 3 nsec of error in the 1PPS pulse.
- Selective Availability (S/A). When in effect, S/A introduces errors of up to 30 meters (100 nsec) in satellite signals, with corresponding errors in the 1PPS pulse.
- Antenna cable length. Each meter of cable adds a delay of about 2 nsec to satellite signals, and a corresponding delay in the 1PPS pulse.

## ASCII Time Tag Definition

Each time tag is output about 0.5 second before the corresponding pulse, as shown in Figure 13.1. Time tags are in ASCII format on a user-selected serial port. The format of a time tag is:

UTC yy.mm.dd hh:mm:ss ab

Where:

- *UTC* is fixed text.
- *yy.mm.dd* is the year, month, and date.
- *hh:mm:ss* is the hour (on a 24-hour clock), minute, and second. The time is in UTC, not GPS time.
- *a* is the position-fix type:

  1 = 2D Position Fix for E,N only
  2 = 3D Position Fix
  3 = Single SV Clock-only fix
  4 = Automatic Mode
  5 = Reference Station Position
  6 = Two-Dimensional with Fixed Clock
  7 = Overdetermined solution for Clock-only

- *b* is the number of satellites being tracked: 1 to 9, “:” (for 10), “;” (for 11), or “<” (for 12).
- Each time tag is terminated by a *carriage return, line feed* sequence.

A typical printout looks like this:

UTC 93.12.21 20:21:16 56
UTC 93.12.21 20:21:17 56
UTC 93.12.21 20:21:18 56

If *a* and *b* are ??, the time is based on the receiver clock because the receiver is not tracking satellites. The receiver clock is less accurate than time readings extracted from satellite signals.

## Enabling and Configuring 1PPS Output

To enable or configure the 1PPS output function, you need either the GPS Configurator software or the Configuration Toolbox software.

### In real time

You can use the GPS Configurator software to configure a Trimble GPS receiver connected to your office computer. For more information, see GPS Configurator Software, page 66, or refer to the GPS Configurator Help.

To enable 1PPS output:

1. Connect the computer to the 5700 receiver.
2. Power on the 5700 receiver.
3. To start the GPS Configurator software, click Start, then select *Programs* / *Trimble* / *GPS Configurator* / *GPS Configurator.*

   The *GPS Configurator* dialog appears and the software automatically connects to the 5700 receiver.
4. Select the *Serial outputs* tab.

5. Select the *1PPS (port 2 only)* check box.
6. If you want ASCII time tags enabled, select the check box and choose an output port.
7. Click **Apply**.

   The GPS Configurator software sends the new configuration information to the 5700 receiver, and the receiver starts to generate 1PPS output on Port 2.
8. Click **OK** to exit the GPS Configurator software.

   The software disconnects from the 5700 receiver.

### Using an application file

The Configuration Toolbox software lets you create an application file containing the appropriate configuration instructions for 1PPS output. You can then transfer that file to the 5700 to enable 1PPS output.

For more information, see Configuration Toolbox Software, page 68, or refer to the Configuration Toolbox Help.

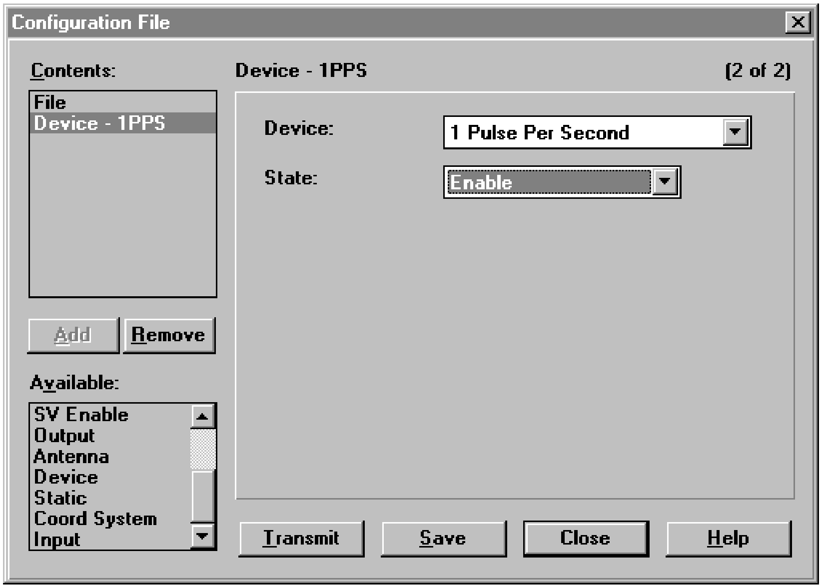
To create an application file for 1PPS output:

1. Connect the computer to the 5700 receiver.
2. Power on the 5700 receiver.
3. To start the Configuration Toolbox software, click 

, then select *Programs* / *Trimble* / *Configuration Toolbox* / *Configuration Toolbox*.

   The main *Configuration Toolbox* window appears.
4. Select *File* / *New* / *5700* to display the *Configuration File* dialog.
5. From the *Available* list, select Device, and then click **Add**.
6. From the *Device* field, select 1 Pulse Per Second.

7. From the *State* field, select Enable:




8. If you want to save the application file to your computer, click **Save**.

9. Click **Transmit** to send the application file to the connected receiver. The message Communicating with receiver appears, followed by a message box giving details of the success or failure of the transfer.

10. Click **Close** to exit the *Configuration File* dialog.

11. If you have not saved the application file, a message appears, prompting you to save your changes.

12. Select *File* / *Exit* to close the Configuration Toolbox software.

CHAPTER

14

# Troubleshooting

**In this chapter:**

- Introduction
- Troubleshooting

# Introduction

This chapter lists potential problems and describes how to solve them.

# Troubleshooting

The following table lists symptoms, the problems they indicate, and how to solve them.

**Table 14.1 Troubleshooting**

| Problem | Possible cause | Solution |
|---|---|---|
| Receiver does not power up. | External power too low. | Check the charge on the external battery, and check the fuse if applicable. Replace the battery if necessary. |
| | Internal power too low. | Check the charge on the internal batteries and replace if necessary. |
| | | Ensure battery contacts are clean. |
| | External power not properly connected. | Check that the Lemo connection is seated properly. |
| | | Check for broken or bent pins in the connector. |
| | Faulty power cable. | Try a different cable. |
| | | Check pinouts with multimeter to ensure internal wiring is intact. |

**Table 14.1 Troubleshooting (Continued)**

| Problem | Possible cause | Solution |
|---|---|---|
| Receiver does not log data. | Insufficient memory on the CompactFlash card. | Delete old files using the GPS Configurator or Trimble Survey Controller software, or by holding down for 30 seconds. |
| | No CompactFlash card is inserted. | Insert a CompactFlash card in the receiver. |
| | The CompactFlash card is not seated properly. | Remove the Compact Flash card and reinsert it, making sure that it slides into the housing easily and seats into the pins. |
| | The receiver is tracking fewer than four satellites. | Wait until the SV Tracking LED is flashing slowly. |
| | The CompactFlash card is not formatted, or is corrupted. | Format the CompactFlash card using the GPS Configurator software, or by holding down for 30 seconds. |
| | | If the problem persists, use the GPS Configurator software to perform a full format. |
| The receiver is not responding. | Receiver needs soft reset. | Power down the receiver and power back up. |
| | Receiver needs full reset. | Hold down for 30 seconds.<br>If you want to retain data files, remove the CompactFlash card first. |
| The SV Tracking LED is lit solidly and the Logging/Memory LED is flashing slowly. | The receiver is in Monitor mode, ready for new firmware to be loaded or new options to be added. | Power the receiver off or on. |
| | | Load the latest version of the firmware, which you can download from the Trimble web site at ftp://ftp.trimble.com/pub/survey/bin/ |

**Table 14.1 Troubleshooting (Continued)**

| Problem | Possible cause | Solution |
|---|---|---|
| The SV Tracking LED is not flashing. | The receiver is tracking fewer than four satellites. | Wait until the SV Tracking LED is flashing slowly. |
| | The radio antenna cable and GPS antenna cable are mixed up. | Make sure that the GPS antenna cable (with the yellow over-mould) is connected between the yellow TNC connector marked ANT and the GPS antenna. |
| Reference receiver is not broadcasting. | Port settings between reference receiver and radio are incorrect. | Using the Trimble Survey Controller software, connect to the reference radio through the receiver. If no connection is made, connect directly to the radio and change the port settings. Try to connect through the receiver again to ensure that they are communicating. |
| | Faulty cable between receiver and radio. | Try a different cable. |
| | | Examine the ports for missing pins. |
| | | Use a multimeter to check pinouts. |
| | No power to radio. | If the radio has its own power supply, check the charge and connections. |
| | | If power is routed through the receiver, ensure that the receiver's external power source is charged and that power output on Port 3 is enabled. |

**Table 14.1 Troubleshooting (Continued)**

| Problem | Possible cause | Solution |
|---|---|---|
| Roving receiver is not receiving radio. | Reference receiver is not broadcasting. | See above. |
| | Incorrect over air baud rates between reference and rover. | Connect to the roving receiver's radio and check to ensure it has the same setting as the reference receiver. |
| | Incorrect port settings between roving external radio and receiver. | If the radio is receiving data (the Logging/Memory LED is flashing) and the receiver is not getting radio communications, use the Trimble Survey Controller software to check that the port settings are correct. |
| | The radio antenna cable and GPS antenna cable are mixed up. | Make sure that the radio antenna cable (with the blue over-mould) is connected between the blue TNC connector marked RADIO and the radio antenna. |
| | The cellular modem does not have hardware flow control enabled. | Disable flow control on the modem. |
| | | Use a special cable. For more information, refer to the document *Using Cellular and CDPD Modems for RTK*, which is available from the Trimble web site. |

# Index

## Symbols



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# Reader Comment Form

**5700 GPS Receiver User Guide** **January 2001**
**Part Number 43952-00-ENG** **Revision A**

**We appreciate your comments and suggestions for improving this publication. Contributors of particularly helpful evaluations will receive a thank-you gift.**

I use the following Trimble product ________________________________________

for ________________________________________

**Please circle a response for each of the statements below:**

1 = Strongly Agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly Disagree

| | | | | | |
|---|---|---|---|---|---|
| The manual is well organized. | 1 | 2 | 3 | 4 | 5 |
| I can find the information I want. | 1 | 2 | 3 | 4 | 5 |
| The information in the manual is accurate. | 1 | 2 | 3 | 4 | 5 |
| I can easily understand the instructions. | 1 | 2 | 3 | 4 | 5 |
| The manual contains enough examples. | 1 | 2 | 3 | 4 | 5 |
| The examples are appropriate and helpful. | 1 | 2 | 3 | 4 | 5 |
| The layout and format are attractive and useful. | 1 | 2 | 3 | 4 | 5 |
| The illustrations are clear and helpful. | 1 | 2 | 3 | 4 | 5 |

The manual is: too long just right too short

**Please answer the following questions:**

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