WAAS G-III Reference Receiver

USER MANUAL

OM-20000137 Rev 3

WAAS G-III Reference Receiver User Manual

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Contact Information

Log a support request with NovAtel Customer Support using one of the following methods:

Log a Case and Search Knowledge:

Website: www.novatel.com/support

Log a Case, Search Knowledge and View Your Case History: (login access required)

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Telephone:

U.S. and Canada:	1-800-NOVATEL (1-800-668-2835)
International:	+1-403-295-4900

G-III Reference Receiver Firmware Updates

Firmware updates are firmware revisions to an existing model to improve basic GNSS receiver functionality. The process for obtaining firmware updates is discussed in *Chapter 6, Firmware Updates* starting on page 117.

Notices

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications to this equipment not expressly approved by NovAtel Inc. could result in violation of FCC and CE Marking rules and void the user's authority to operate this equipment.

To maintain compliance with the limits of a Class A digital device, you must use properly shielded interface cables when using the serial ports. Appropriate cables include Belden #9539, or equivalent, and Belden #8770 cable for input power source (ensuring the shield is connected to the protection ground).

CAUTION:
Double pole/neutral fusing

CAUTION:
The G-III Reference Receiver must be installed in a Restricted Access Location only.

The G-III Reference Receiver is not user-serviceable. In the event of any failure of the unit, do NOT remove any cards or covering panels from the unit. Return the unit to the factory for repair.

Lightning Protection Notice

What is the hazard?

A lightning strike into the ground causes an increase in the earth's potential which results in a high voltage potential between the center conductor and shield of the coax cable. This high voltage develops because the voltage surge induced onto the center conductor lags in time behind the voltage surge induced onto the shield.

Hazard Impact

A lightning strike causes the ground potential in the area to rise to dangerous levels resulting in harm to personnel or destruction of electronic equipment in an unprotected environment. It also conducts a portion of the strike energy down the inner conductor of the coax cable to the connected equipment.

Only qualified personnel, electricians as mandated by the governing body in the country of installation, may install lightning protection devices.

Actions to Mitigate Lightning Hazards

1. Do not install antennas or antenna coaxial cables outside the building during a lightning storm.
2. It is not possible to avoid over-voltages caused by lightning, but a lightning protection device may be used to shunt a large portion of the transient energy to the building ground reducing the over-voltage condition as quickly as possible.

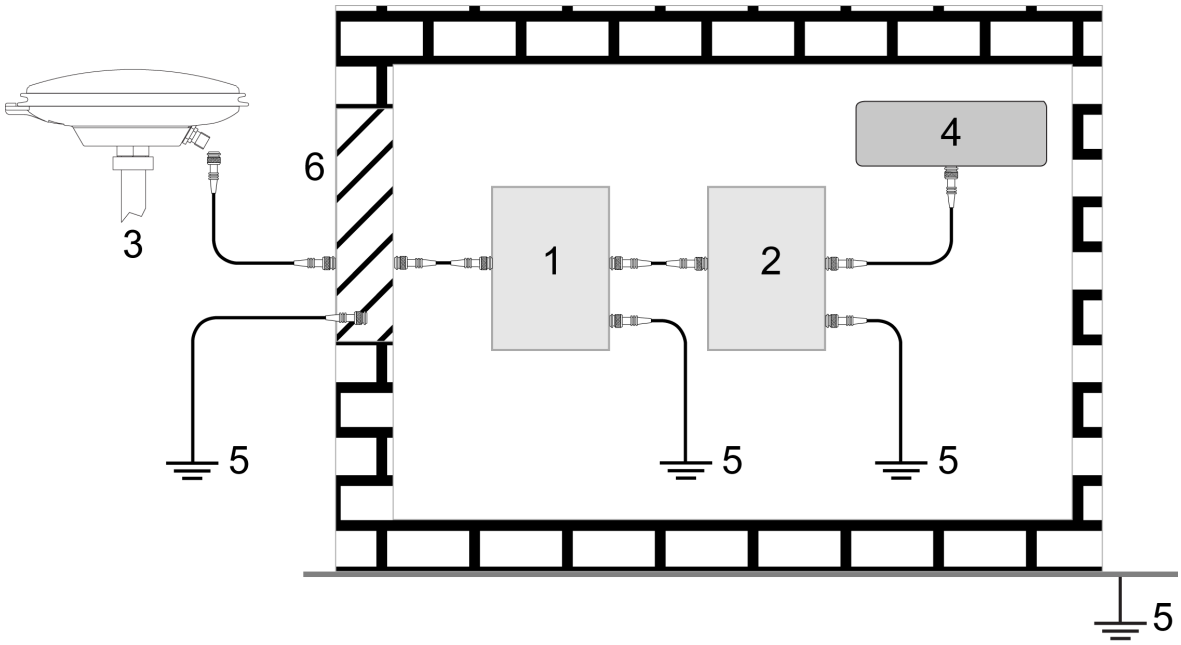
3. Primary lightning protection must be provided by the operator/customer according to local building codes as part of the extra-building installation.
4. To ensure compliance with clause 7 "Connection to Cable Distribution Systems" of EN 60950-1, Safety for Information Technology Equipment, a secondary lightning protection device must be used for in-building equipment installations with external antennas. The following device has been approved by NovAtel Inc.:

   Polyphaser - Surge Arrestor DGXZ+36NFNF-A

   If this device is not chosen as the primary lightning protection device, the device chosen must meet the following requirements:

   - UL listed, or equivalent, in country of installation (for example, TUV, VDE and so on) for lightning surge protection
   - The primary device must be capable of limiting an incoming surge to 10kV
5. The shield of the coaxial cable entering the building should be connected at a grounding plate at the building's entrance. The lightning protection devices should have their chassis grounded to the same ground near to the building's entrance.
6. The primary and secondary lightning protections should be as close to the building's entrance as possible. Where feasible they should be mounted onto the grounding plate itself. See also *Figure 1, Primary and Secondary Lightning Protection* below.

Figure 1: Primary and Secondary Lightning Protection



Reference	Description
1	Primary Lightning Protection Device
2	Secondary Lightning Protection Device
3	External Antenna
4	WAAS G-III Reference Receiver
5	To Ground
6	Grounding plate or grounding point at the building's entrance

Acceptable choices for Earth Grounds, for central buildings, are the following:

- Grounded interior metal cold water pipe within five feet (1.5 m) of the point where it enters the building
- Grounded metallic service raceway
- Grounded electrical service equipment enclosure
- Eight-foot grounding rod driven into the ground (only if bonded to the central building ground by #6, or heavier, bonding wire)

These installation instructions are the minimum requirements for receiver and antenna installations. Where applicable, follow the electrical codes for the country of installation. Examples of country codes include:

- USA National Electrical Code (NFPA 70)
- Canada Canadian Electrical Code (CSA C22)
- UK British Standards Institute (BSI 7671)

Foreword

Scope

The *WAAS G-III Reference Receiver User Manual* is written for users of the G-III Reference Receiver subsystem. The manual contains sufficient installation and operation information to allow you to effectively integrate and fully operate the unit. Additionally, each command used to configure the G-III Reference Receiver, as well as each log used to capture data, is described in detail, including the purpose, syntax, and structure of these messages. However, it is beyond the scope of this manual to provide details on service or repair. Contact NovAtel for any customer-service related inquiries. See *Customer Service* on Page 9.

For information on GNSS and other details such as acronyms and a glossary, refer to the *GNSS Book* at www.novatel.com/support/knowledge-and-learning/.

Prerequisites

The G-III Reference Receiver is a stand-alone, fully-functional GNSS and SBAS receiver. Refer to *Installation* on Page 22, for more information on installation requirements and considerations. The G-III Reference Receiver uses a comprehensive user-interface command structure. To use the full potential of the G-III Reference Receiver, you should become familiar with this manual before operating the receiver.

Conventions

The following conventions are used in this manual:

	Note that provides information to supplement or clarify the accompanying text.
	Caution that a certain action, operation or configuration may result in incorrect or improper use of the product.
	Warning that a certain action, operation or configuration may result in regulatory noncompliance, safety issues or equipment damage.

Log and command conventions include the following:

H — The letter H in the *# Bytes* or *Binary Offset* columns represents the header length for that log. The binary header is described in *Section 5.1 Log Header* on Page 87.

`0x` — A number following `0x` is a hexadecimal number.

`[ ]` — Parameters surrounded by [and] are optional in a command or are required for only some instances of the command depending on the values of other parameters.

`< >` — Text displayed between < and > indicates the entry of a keystroke in the case of the command or an automatic entry in the case of carriage return <CR> and line feed <LF> in data output.

Where bit fields are identified by bit number, the least significant bit is bit 0

In tables where no values are given, the fields are reserved for future use.

Compliance with GPS Week Rollover

The GPS week rollover issue refers to the way GNSS receivers store information regarding the current GPS week. According to the official GPS system specifications document (*ICD-GPS-200*, paragraph 20.3.3.3.1.1), "… 10 bits shall represent the number of the current GPS week…". This means the GPS week is represented by an integer number between 0 and 1023. As GPS time started on Sunday January 6, 1980 at 0:00 hours, week 1023 ended on Saturday August 21, 1999 at 23:59:59.

In accordance with the GPS system specifications document, NovAtel G-III Reference Receiver firmware resets the receiver's GPS week number back to zero. Users should be aware of this issue and keep in mind that there may be a compatibility issue when purchasing and using different makes of GNSS receivers.

Chapter 1 Introduction

The NovAtel G-III Reference Receiver is a high-performance receiver designed for installation as a core component of Satellite-Based Augmentation Systems (SBAS). This chapter provides information on the features and functionality of the G-III Reference Receiver and how it operates in the context of the SBAS system.

1.1 SBAS Overview

A Satellite-Based Augmentation System (SBAS) is a safety-critical system designed to augment the Department of Defense Global Positioning System (GPS) Standard Positioning Service (SPS). SBAS enhances GPS service by providing:

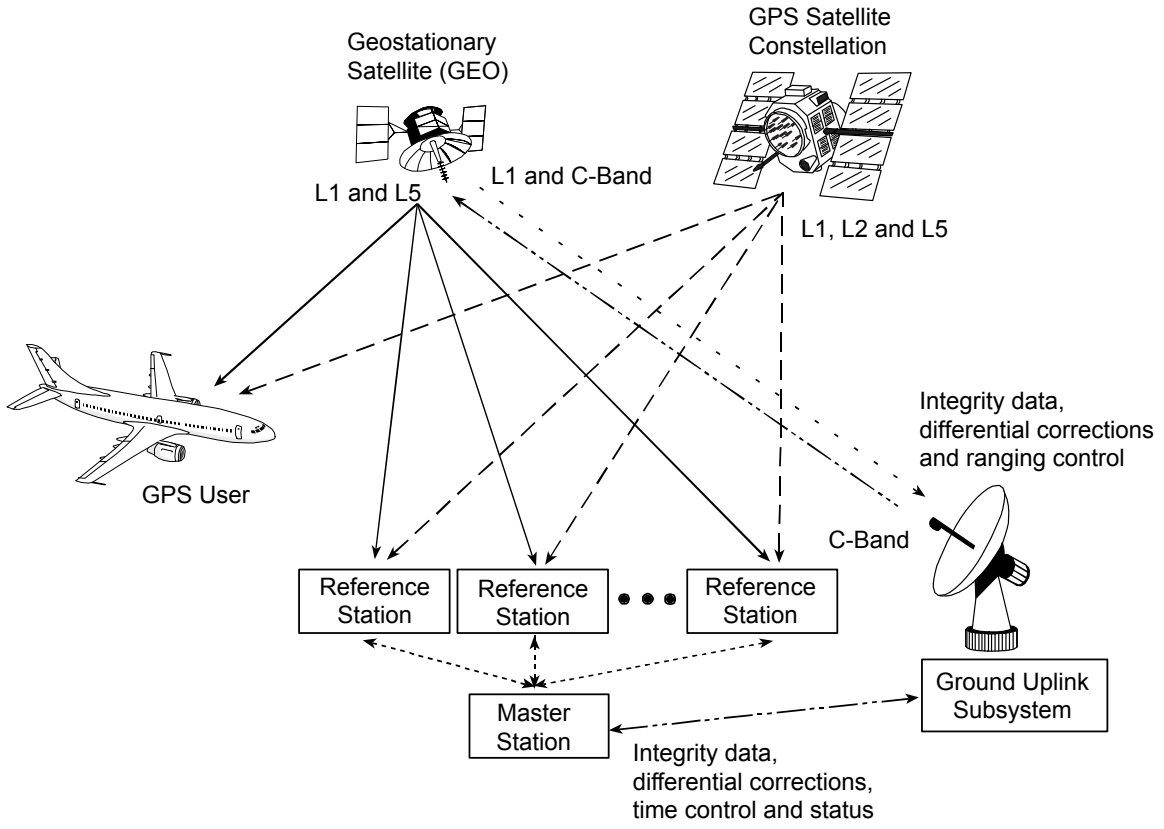
- a ranging function to the SBAS satellites to improve signal availability and reliability
- GPS signal corrections to improve accuracy
- integrity monitoring to improve safety

The primary mission of the SBAS system is to provide a means for air navigation for all phases of flight in the National Airspace System (NAS) from departure, through en route, and approach. The principal functions of SBAS include:

- determining ionospheric corrections
- determining satellite orbits
- determining satellite clock corrections
- determining satellite integrity
- independent data verification
- SBAS message broadcast and ranging
- system operations & maintenance

As shown in *Figure 2* on *Page 16*, the SBAS system consists of a series of *Reference Stations* and *Master Stations*, a *Ground Uplink Subsystem*, and *Geostationary Satellites* (*GEOs*). The *Reference Stations*, which are strategically located to provide adequate coverage, record GPS satellite data and route it to the *Master Stations*. The *Master Stations* then processes the data to determine the signal integrity, signal corrections, and residual errors for each monitored satellite. This information is sent to the *Ground Uplink Subsystem* for transmission to the *GEOs*, which then re-transmits the data on the L1 and L5 frequencies.

Figure 2: SBAS Concept



The NovAtel G-III Reference Receiver provides GPS monitoring functionality as part of the *Reference Stations* in the SBAS network.

1.2 Features

To assist the *Reference Stations* in providing data with the necessary precision, the G-III Reference Receiver has the following features:

- Support for L1, L2 and L5 GPS signal processing
- Support for L1 and L5 GEO signal processing
- GPS signal quality monitoring (SQM) functionality, see *Section 1.2.4, Signal Quality Monitoring* on *Page 17*
- Digital pulse blanking
- Cross-Correlation Check
- Time Receiver Autonomous Integrity Monitor (TRAIM)

1.2.1 GEO Processing

Specific channels in the G-III Reference Receiver have the capability to receive and process the SBAS signal provided by *GEOs*. The signals are in-band at L1 and L5 SBAS and are identified through SBAS-specific PRN (PseudoRandom Noise) numbers. The SBAS message and associated pseudorange are provided as an output.

1.2.2 Cross-Correlation Detection

Cross-correlation detection is a critical component of integrity monitoring systems such as the SBAS. Cross-correlation can happen either during acquisition or while tracking.

The receiver tracks a satellite by maximizing the correlation between the received satellite's PRN code and the locally generated code. Occasionally, this correlation is affected in the presence of another stronger satellite PRN. Subsequently, the receiver tracks the incorrect cross-correlation peak of the other satellite PRN code instead of correct main-correlation peak. In other instances, the receiver can track the minor correlation peak of the received PRN code rather than the correct main correlation peak. Both situations lead to errors in range and C/No estimates. GPS L1 C/A, SBAS L1 C/A and GPS L5 signals are particularly vulnerable to cross-correlation.

The G-III Reference Receiver technology ensures independent real-time monitoring of cross-correlation for GPS L1 C/A, SBAS L1 C/A, and GPS L5 signals. If at any point it detects the presence of cross-correlation, it terminates the tracking. The channel then attempts to re-acquire the satellite signal.

1.2.3 Bit Synchronization

Bit synchronization identifies the location of navigation bit edges with respect to the primary PRN code epochs. Bit edge detection is based on observing either the sign transition between successive accumulations that are aligned with the received PRN code epochs or by aligning to the secondary synchronization codes. The bit synchronization is verified by an additional hardware channel and software steering. This additional hardware is configured to generate a stream of accumulations until sufficient data has been collected to perform the test. The tracking channel is forced to re-acquire a signal if the results of the second test do not confirm the bit alignment selected by the tracking channel.

1.2.4 Signal Quality Monitoring

Signal Quality Monitoring (SQM) technology monitors GPS and GEO signals in space for anomalous behavior. To do this, the G-III Reference Receiver outputs accumulations at the specified correlation location values. It collects inphase and quadrature accumulation values and outputs them in a timely fashion. The G-III Reference Receiver hardware is capable of tracking the correlation function at multiple correlation locations.

1.2.5 Digital Pulse Blanking

Digital pulse blanking involves removing or attenuating pulses in the RF signal that exceed a specified level. The G-III Reference Receiver provides digital pulse blanking for the L1, L2 and L5 signal paths.

Use the *PULSEBLANKING* command to enable/disable pulse blanking or to control its sensitivity. See *Section 4.4.17, PULSEBLANKING* on *Page 68*.

1.2.6 Time Receiver Autonomous Integrity Monitor

The Time Receiver Autonomous Integrity Monitor (TRAIM) is the algorithm in the G-III Reference Receiver that computes the receiver time offset relative to the GPS time (within ± 150 nanoseconds) with a high level of integrity. The TRAIM algorithm computes the time offset, excluding unhealthy satellites, and compares the time using a minimum of 4 satellites. With good ephemeris health status from 4 or more satellites, the computed time offset should typically be within a few hundred nanoseconds. The results from TRAIM calculations are contained within the *TIMESOLUTIONB* log. For more information about this log, see *Section 5.5.19, TIMESOLUTIONB* on *Page 128*.

1.3 Product Overview

The NovAtel G-III Reference Receiver unit consists of the following:

- Standard enclosure for a 19-inch rack with built-in, forced air cooling
- Liquid crystal display (LCD) to show receiver status
- Input/output ports for power, antenna, frequency reference and general communications

Figure 3: NovAtel G-III Reference Receiver

Figure 4: G-III Reference Receiver back panel

1.3.1 Enclosure

The G-III Reference Receiver is contained in an enclosure that is designed to fit standard 19-inch EIA racks.

1.3.1.1 LCD Status Display

The LCD display on the front of the G-III Reference Receiver enclosure provides basic status information regarding the unit. See *Section 3.4, Status Display* on *Page 29* for more details.

1.3.1.2 Input/Output Ports

The G-III Reference Receiver provides a variety of ports on the rear panel of the enclosure for power, antenna input and general communications.

Table 1: Power Ports

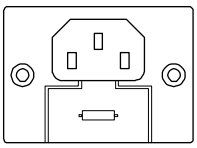
Label	Description
J01  **GND** 	J01	The power input port. Connects the G-III Reference Receiver to the 120/240 V power source.
	GND	Chassis ground. Connects the G-III Reference Receiver to the mounting hardware ground.

Table 2: Data Communication Ports

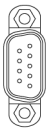
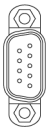
Label		Description
   	J02 DATA	Data port An Ethernet port used to configure the G-III Reference Receiver and collect data from the receiver. In a typical installation, this port connects directly to the Data Collection Processor (DCP). The port identifier is ICOM1. The interface identifier is ETHA.
	J03 MON	Monitor port An output only Ethernet port used to collect data from the G-III Reference Receiver. This Monitor port is disabled by default, but can be enabled and mapped using the *ICOMCONFIG* command. The port identifier is ICOM2. The interface identifier is ETHB.
	J04 AUX	Auxiliary port. This port is not available for use.
	J05 MAINT	Maintenance port An RS-232 port used to configure the Ethernet ports. This port operates at 115200 baud rate, no parity checking, 8 data bits and one stop bit. The Maintenance port only accepts commands related to Ethernet configuration and only when the receiver is in the Configuration state. See *Section 3.1, G-III Reference Receiver States* on *Page 28*. The port identifier is COM1.

Table 3: Ethernet Port LEDs

Label		Description
	Green (top LED)	Shows the link status and activity of the Data port (J02) and the Monitor port (J03). Off = no link On = link present Blinking = activity on the port
	Yellow (bottom LED)	Shows the duplex status and collision activity on the Data port (J02) and the Monitor port (J03). Off = half-duplex connection On = full-duplex connection Blinking = there are collisions

Table 4: Radio Frequency Ports

Label		Description
J06 10 MHz IN J07 10 MHz OUT J08 1 PPS IN J09 1 PPS OUT J10 RF1 OUT J11 RF1 IN	J06 10 MHz IN	10 MHz frequency reference input port Connects to an external 10 MHz frequency reference.
	J07 10 MHz OUT	10 MHz frequency reference output port Outputs the 10 MHz frequency reference signal.
	J08 1 PPS IN	1 Pulse Per Second (PPS) input port This port is not available for use.
	J09 1 PPS OUT	1 Pulse Per Second (PPS) output port An output port for a 1 Pulse Per Second (PPS) signal used for time synchronization.
	J10 RF1 OUT	Radio Frequency (RF) Output An RF test port that outputs the RF signal received from the GNSS antenna.
	J11 RF1 IN	Radio Frequency (RF) Input Connects to the GNSS antenna. This port can also supply DC power to the antenna. See *Section 4.4.2, ANTENNAPOWER* on *Page 47*.

Section 2.1, Typical Installation on *Page 22* provides information about connecting to the ports, while *Table 55, Port Specifications* on *Page 140* in *Appendix A* gives specifications on the connectors and signals provided at these ports.

Chapter 2 Installation

This chapter describes how to set up and prepare the G-III Reference Receiver for initial operation.

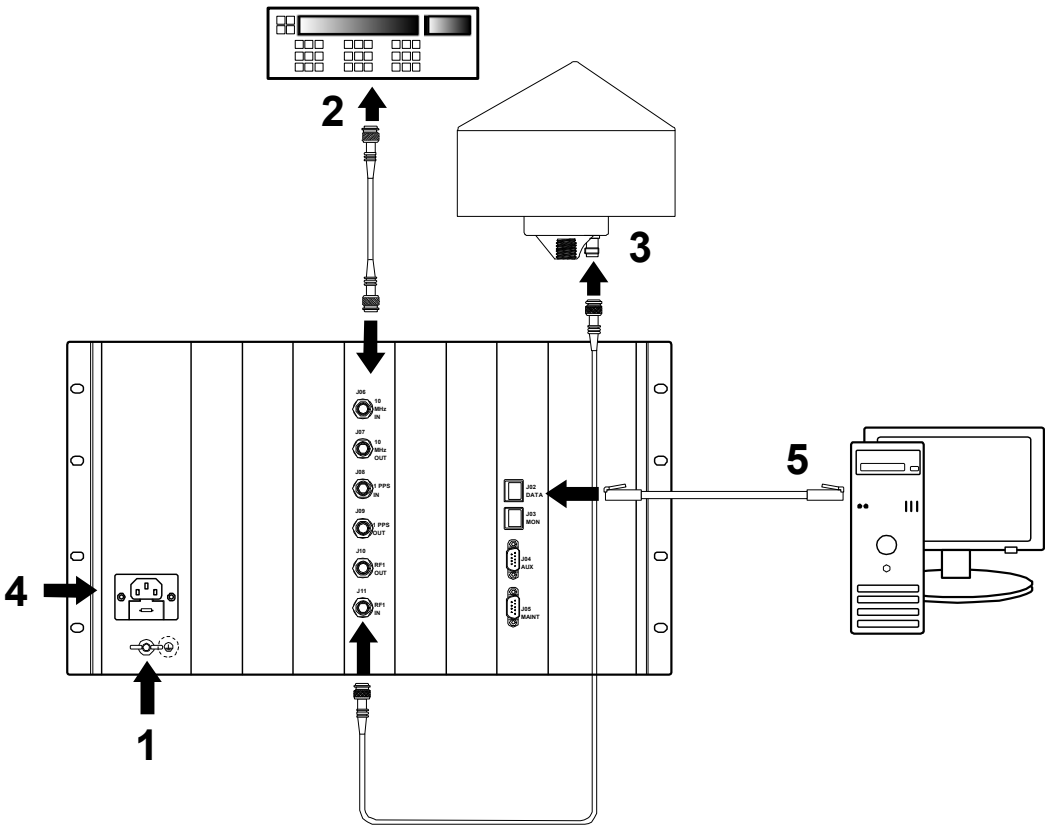
2.1 Typical Installation

For the G-III Reference Receiver to function as a complete system, you require the following equipment:

- NovAtel G-III Reference Receiver
- User-supplied standard 19-inch EIA rack with sufficient space for the G-III Reference Receiver (see *Table 53, Physical Specifications* on *Page 139* for G-III Reference Receiver dimensions)
- User-supplied L1/L2/L5 GNSS antenna and low-noise amplifier (LNA)
- Access to a 120/240 VAC 50/60 Hz power source
- User-supplied external frequency reference (10 MHz)
- User-supplied data communications equipment capable of standard RS-232 serial and Ethernet communications, such as a computer
- User-supplied data and RF cables

The typical configuration of this equipment is shown in *Figure 5*.

Figure 5: Typical Configuration



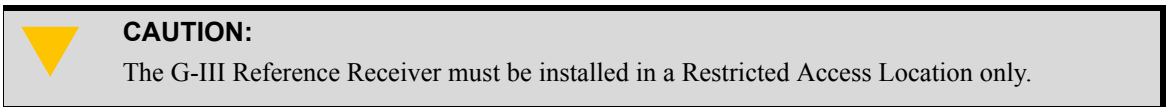
To create the typical configuration, complete the following steps.

Reference	Description
1	Install the G-III Reference Receiver in the rack and connect the chassis ground. See *Section 2.1.1, Install the G-III Reference Receiver in a Rack on Page 23*.
2	Connect the external frequency reference to the *10 MHz IN* port. See *Section 2.1.2, Connect the External Frequency Reference on Page 23*.
3	Install the GNSS antenna, including an LNA if applicable, and connect the antenna to the *RF1 IN* port. See *Section 2.1.3, Connect the GNSS Antenna on Page 24*.
4	Connect power to the G-III Reference Receiver. See *Section 2.1.4, Connect the Power Supply on Page 24*
5	Connect the Data port to the Data Collection Processor (DCP). *Section 2.1.5, Connect the Ethernet Ports on Page 24*.

The preceding steps describe the basic system configuration, which you can modify to meet your specific situation. To take advantage of G-III Reference Receiver features, your configuration may differ significantly. See *Section 2.2, Optional Installation Steps on Page 25* for additional configuration steps.

2.1.1 Install the G-III Reference Receiver in a Rack

The G-III Reference Receiver fits in a standard 19-inch EIA rack.



To install the receiver:

1. Select a location in the rack large enough for the G-III Reference Receiver.
   See *Table 53, Physical Specifications* on *Page 139* for the exact dimensions of the receiver.
2. Secure the G-III Reference Receiver in the rack.
3. Connect a ground wire from the mounting hardware ground to the chassis ground lug (GND) on the G-III Reference Receiver.

2.1.2 Connect the External Frequency Reference

The G-III Reference Receiver requires an external, user-supplied frequency reference, which is typically a high-accuracy oscillator. Refer to *Table 56, Recommended External Frequency Reference Specifications* on *Page 142* for the recommended device specifications.

Connect the frequency reference to the *10 MHz IN* (J06) TNC female connector on the rear panel of the G-III Reference Receiver. *Table 55, Port Specifications* on *Page 140* provides technical port specifications.

2.1.3 Connect the GNSS Antenna

Antenna system selection and installation is crucial to the proper operation of the G-III Reference Receiver. Before installing the antenna, select a site that meets the following conditions as closely as possible for optimal performance:

- The antenna has an unobstructed line-of-sight from horizon to horizon and at all bearings and elevation angles.
- The antenna is as far as possible from reflective objects, especially those that are above the antenna and any water bodies, which can be a strong source of multipath reflections.
- If obstructions and reflective surfaces are within 30 m, ensure the antenna is as high as possible. Otherwise, mount the antenna as low as possible.
- Ensure that the antenna is mounted on a secure, stable structure capable of withstanding relevant environmental loading forces (e.g., due to wind or ice).
- Use high-quality coaxial cables to minimize signal attenuation.
- When using active antennas, remember that you also must connect each low-noise amplifier (LNA) to a suitable power source. The gain of the LNA must be sufficient to compensate for the cable losses.
  The antenna port (J11) on the G-III Reference Receiver can provide power to the LNA. See *Table 55, Port Specifications* on *Page 140* for the port power specifications.
  If you want to use the G-III Reference Receiver to provide power to the LNA, you must enable this feature using the *ANTENNAPOWER* command. See *Section 4.4.2, ANTENNAPOWER on Page 47*.

Connect the antenna to the RF1 IN (J11) TNC female connector on the back of the G-III Reference Receiver. *Table 55, Port Specifications* on *Page 140* provides technical specifications for this port.

See also *Section 2.2.5, Access the RF Output on Page 27*.

2.1.4 Connect the Power Supply

Before applying power to the G-III Reference Receiver, ensure that all of the following conditions are met:

- The external frequency reference is properly installed, connected, powered-up and stabilized
- The GNSS antenna is properly installed and connected

Connect the power cable from the J01 port on the G-III Reference Receiver to a 120/240 VAC 50/60 Hz power source (e.g. a wall power outlet). *Table 55, Port Specifications* on *Page 140* provides technical specifications for this port.

Note that the warm-up process may take several minutes, depending on ambient temperature.

When the G-III Reference Receiver has finished starting up, it enters the Configuration state. The *State* field on LCD display changes to show the word CONFIGURATION in orange text.

2.1.5 Connect the Ethernet Ports

The default settings for the Data port are configured to be compatible with direct connection to the Data Collection Processor (DCP). To connect the G-III Reference Receiver directly to the DCP, connect an RJ-45 Ethernet crossover cable from the Data port (J02) on the G-III Reference Receiver to an Ethernet port on the DCP.

If you are using the Monitor port, connect a second RJ-45 Ethernet cable from the Monitor port (J03) on the G-III Reference Receiver to a computer or a port on the LAN switch. Refer to *Table 55, Port Specifications* on *Page 140*.

Before you connect the Monitor port to a computer or network, make sure the Ethernet settings for the Monitor port is compatible with the computer or network.

See *Section 2.2.1, Check the Ethernet settings on Page 25*.

2.2 Optional Installation Steps

In addition to the required connections discussed in the previous sections, other ports on the G-III Reference Receiver can be used to implement additional functionality.

2.2.1 Check the Ethernet settings

Before you connect the Data or Monitor port to your network, ensure the Ethernet port configuration is compatible with your network configuration.

The following tables show the default configuration for the Ethernet ports.

Table 5: Data port default settings

Setting	Value
Interface Name	ETHA
Virtual Port Identifier	ICOM1
Ethernet Speed	100 Mbit/second
Duplex	Full duplex
Port Polarity	MDI
Protocol	UDP
Endpoint	Host:3000
IP Addressing Mode	Static
IP Address	192.168.0.10
Netmask	255.255.255.0
Gateway	0.0.0.0

Table 6: Monitor port default settings

Setting	Value
Interface Name	ETHB
Virtual Port Identifier	ICOM2
Ethernet Speed	Auto
Duplex	Auto
Port Polarity	Auto
Protocol	Disabled
Endpoint	-

Table 6: Monitor port default settings

Setting	Value
IP Addressing Mode	Static
IP Address	0.0.0.0
Netmask	0.0.0.0
Gateway	0.0.0.0

If the default Ethernet settings are compatible with your network, go to *Section 2.1.5 Connect the Ethernet Ports* on page 24.

If the default Ethernet setting are not compatible with your network, go to *Section 2.2.2 Connect to the Maintenance Port* on page 26.

2.2.2 Connect to the Maintenance Port

To use the Maintenance port, the serial port settings of the computer you are using must match the following:

- RS-232C protocol
- 115200 bits per second (bps)
- No parity
- 8 data bits
- 1 stop bit
- No handshaking
- Echo off

You cannot change the port settings for the Maintenance port.

After you have configured the serial port settings on your computer, connect a serial cable with a DB9 connector from the computer to the Maintenance port (J05) on the G-III Reference Receiver. Refer to *Table 55, Port Specifications* on *Page 140*.

From the Maintenance port, you can configure the settings for the Ethernet ports. See *Section 2.2.3, Configure the Ethernet Port Settings on Page 26*.

2.2.3 Configure the Ethernet Port Settings

From the computer connected to the Maintenance port, enter the following commands to configure the Ethernet ports.

1. If you are configuring the *Data* port, skip to the next step.

   If you are configuring the *Monitor* port, use the *ICOMCONFIG* command to set the virtual COM port, UDP port and peer IP addresses.
   See *Section 4.4.12, ICOMCONFIG on Page 58* for information about using the *ICOMCONFIG* command.

2. Use the *ETHCONFIG* command to configure the port speed, duplex mode and port polarity. See *Section 4.4.10, ETHCONFIG on Page 56* for information about using the *ETHCONFIG* command.
3. Use the *IPCONFIG* command to configure the IP address, netmask and gateway for the port. See *Section 4.4.13, IPCONFIG on Page 60* for information about using the *IPCONFIG* command.

For normal operation, set the Data and Monitor ports to use 100BaseTX and full duplex.
Other configurations are only for lab or experimental use.

After you have configured the Ethernet port settings, you can connect the G-III Reference Receiver Ethernet ports to a computer or network. See *Section 2.1.5, Connect the Ethernet Ports on Page 24*.

2.2.4 Access the 1 PPS Output

The timing signal available on the *1 PPS OUT* port (J09) is generated from the 10 MHz reference frequency input. The signal specifications and electrical characteristics are described in *Table 55, Port Specifications* on *Page 140*.

2.2.5 Access the RF Output

The *RF1 OUT* port (J10) outputs the signal received from the *RF1 IN* port.

This port is isolated and the output signal is attenuated from the received RF signal by an amount set in the software adjustable attenuator. See *Section 4.4.20, RFATTEN on Page 71* for information about setting the attenuator value.

NovAtel recommends you use a 50 Ω RF terminator on the *RF1 OUT* port when it is not being used.

2.2.6 Access the 10 MHz Output

The *10MHz OUT* port (J07) outputs the signal received from the *10 MHz IN* port.

Chapter 3 Operation

Before operating the G-III Reference Receiver for the first time, ensure that you have followed the installation instructions in *Chapter 2*. From this point forward, the instructions assume you have a communications connection to the G-III Reference Receiver.

3.1 G-III Reference Receiver States

The G-III Reference Receiver is in the *Off* state when power is removed from the receiver.

The *Boot* state is initiated by powering on the receiver or after the receiver accepts a reset command. After the boot process is successfully completed, the receiver transitions without user intervention to the *Configuration* state.

The *Configuration* state allows the user to configure receiver settings such as those related to communications and signal tracking. In *Configuration* state, the user can issue a command to field load the receiver software, which causes the receiver to transition to *Maintenance* state.

After configuration is complete, a user issued command causes the receiver to transition to the *Operational* state which commences signal tracking and measurement processing operations. Channel assignments can only be accomplished in the Operational state.

3.2 G-III Reference Receiver Modes

The G-III Reference Receiver has two modes: *Normal* and *Failed*. These modes are used to track the receiver system health condition. If the receiver is determined to have failed as a result of IBIT or CBIT, the receiver goes to *Failed* mode. Limited commands are accepted when the receiver is in Failed mode. When the receiver is healthy, the receiver mode is set to *Normal*.

3.3 Communicating with the G-III Reference Receiver

The commands and logs used by the G-III Reference Receiver follow specific formats.

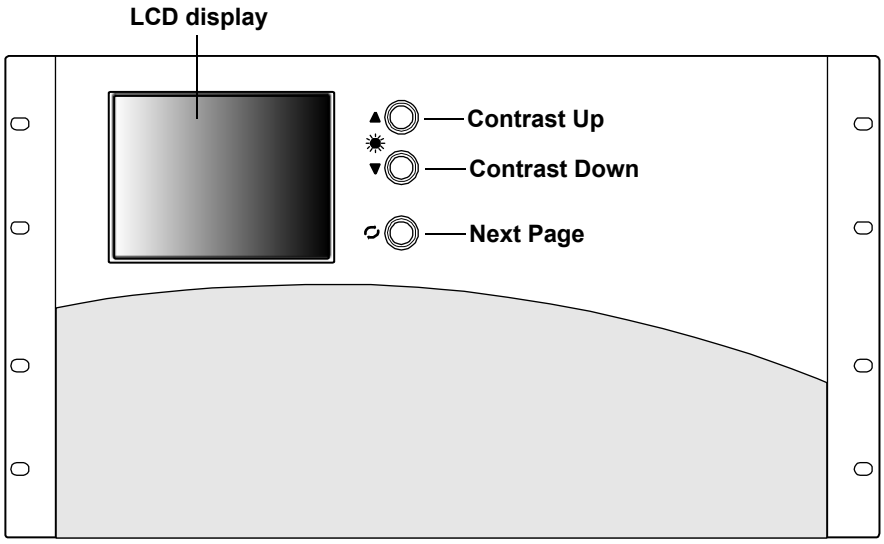
The valid commands used to control the operation and data logging of the G-III Reference Receiver are specified in *Chapter 4*.

Chapter 5 provides details on the logs that contain data from the G-III Reference Receiver.

3.4 Status Display

The G-III Reference Receiver includes a display on the front panel that shows status information for the receiver.

Figure 6: LCD Status Display



3.4.1 Adjusting the Contrast

Adjusting the contrast of the Status display can improve the readability of the display if there are changes in room lighting or viewing angle.

To change the contrast of the display, use the Contrast Up (▲) or Contrast Down (▼) buttons located to the right of the Status display.

3.4.2 Operation

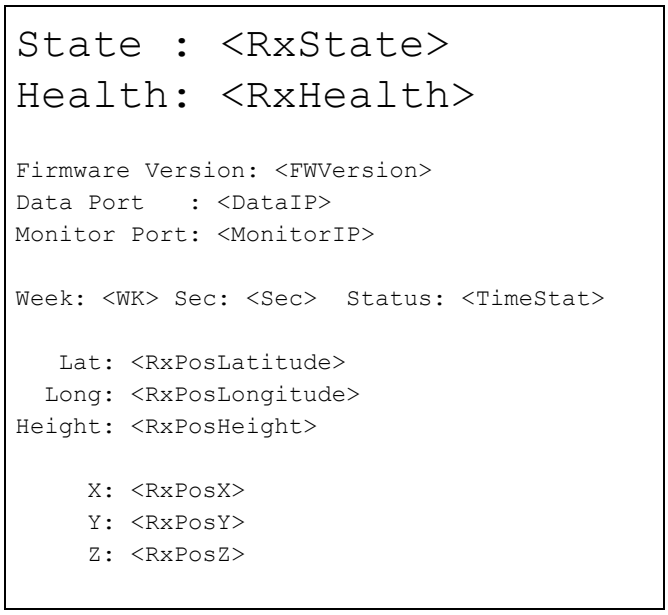
There are two pages of information available on the Status display. The layout of the information on these pages is shown in *Figure 7* and *Figure 8* on page 30.

To change between the two pages of information, press the Next Page (↻) button located to the right of the Status display.

The LCD display turns off when the buttons on the front panel have not been pressed for two minutes. To turn the display on, press any of the three front display buttons (▲ , ▼ or ↻).

Figure 7: Status Display page 1

Figure 8: Status Display page 2



The following sections describe the information available on the Status display.

3.4.2.1 RxState

The *RxState* field shows the current state of the receiver. The possible states for this field are shown in *Table 7*.

In the *RxState* field, both the text string and the text color provide information about the state of the receiver. The text string shows the state of the receiver and the text color shows the receiver mode.

Table 7: RxState field values

String Value	Condition	Text Color	Receiver Mode
CONFIGURATION	Receiver is in the *Configuration* state.	Orange	Normal
		Red	Failed
CONFIG - NoPos	Receiver is in the *Configuration* state and the receiver position has not been entered.	Orange	Normal
		Red	Failed
MAINTENANCE	Receiver is in the *Maintenance* state.	Blue	Normal
		Red	Failed
OPERATIONAL	Receiver is in the *Operational* state.	Green	Normal
		Red	Failed
OPER - NoPos	Receiver is in the *Operational* state and the receiver position has not been entered.	Green	Normal
		Red	Failed

3.4.2.2 RxHealth

The *RxHealth* field shows the overall health of the receiver. The possible values for this field are shown in *Table 8*.

Table 8: RxHealth field values

String Value	Text Color	Condition
OK	Green	No warning or error set.
WARNING	Orange	A warning bit is set.
FAILED	Red	An error bit is set. Receiver is in Failed mode.

3.4.2.3 IOMHW, RFCCHW, RFDCHW and DSPCHW

These fields show the hardware type and revision of the corresponding receiver component. For example:

- If the receiver has an RF Carrier Card with hardware revision 1.00, the RFCCHW field would be **G3RFCC13-1.00**.
- If the receiver has an IOMaster Card with hardware revision 1.02, the IOMHW field would be **G3IOM-1.02**.

If a component is not installed in the G-III Reference Receiver, the field for that component appears blank.

3.4.2.4 S

The *S* field shows the slot and module number of the corresponding receiver component. For example, if the corresponding component is in slot 6 and module 1, the S field string appears as **6-1**.

If a component is not installed in the G-III Reference Receiver, the *S* field for that component appears blank.

3.4.2.5 IOMStatus, RFCCStatus, RFDCStatus and DSPCStatus

These fields show the health of the corresponding receiver component. In cases where there is a problem with the component, a brief description of the problem appears on the display. The possible states for these fields are shown in *Table 9* through *Table 12*.

When there is more than one simultaneous problem, the description field cycles through all applicable descriptions at the highest severity level once per second.

If a component is not installed in the G-III Reference Receiver, the field for that component appears blank.

Table 9: IOMStatus field values

String Value	Status Severity	Text Color	Status
OK	Normal	Green	Normal
Software CRC	Failed	Red	Software CRC
RFCC Test	Failed	Red	RFCC
NV Memory	Warning	Orange	NVM
	Failed	Red	
Temp Sensor	Warning	Orange	Temperature Communication
	Failed	Red	
Voltage Sensor	Warning	Orange	Voltage Communication
	Failed	Red	
CPU Usage	Warning	Orange	CPU
CPU Test	Failed	Red	CPU
Internal Comm	Warning	Orange	Internal Communications
	Failed	Red	
External Comm	Warning	Orange	External Communications
	Failed	Red	
Stack Usage	Warning	Orange	Stack Usage
Temperature	Warning	Orange	Temperature
	Failed	Red	
Voltage	Warning	Orange	Voltage
	Failed	Red	
Fans	Warning	Orange	Fans
	Failed	Red	
Rx Config	Failed	Red	Receiver Configuration

Table 10: DSPCStatus field values

String Value	Status Severity	Text Color	Status
`OK`	Normal	Green	Normal
`Software CRC`	Failed	Red	Software CRC
`NV Memory`	Failed	Red	NVM
`Temp Sensor`	Warning	Orange	Temperature Communication
	Failed	Red	
`Voltage Sensor`	Warning	Orange	Voltage Communication
	Failed	Red	
`CPU Usage`	Warning	Orange	CPU
`CPU Test`	Failed	Red	CPU
`Internal Comm`	Warning	Orange	Internal Communications
	Failed	Red	
`Stack Usage`	Warning	Orange	Stack Usage
`ADC Parity`	Warning	Orange	ADC Data
`ADC Buffer`	Failed	Red	
`ADC Lock`	Failed	Red	SERDES Lock
`MINOS`	Failed	Red	MINOS
`FPGA`	Failed	Red	FPGA
`Temperature`	Warning	Orange	Temperature
	Failed	Red	
`Voltage`	Warning	Orange	Voltage
	Failed	Red	

Table 11: RFCCStatus field values

String Value	Status Severity	Text Color	Status
`OK`	Normal	Green	Normal
`PLL not locked`	Warning	Orange	PLL Not Locked
`Temp Sensor`	Warning	Orange	Temperature Communication
`Voltage Sensor`	Warning	Orange	Voltage Communication
`FPGA`	Failed	Red	FPGA
`Temperature`	Warning	Orange	Temperature
	Failed	Red	
`Voltage`	Warning	Orange	Voltage
	Failed	Red	

Table 12: RFDCStatus field values

String Value	Status Severity	Text Color	Status
`OK`	Normal	Green	Normal
`PLL not locked`	Warning	Orange	PLL Not Locked
`Temp Sensor`	Warning	Orange	Temperature Communication
`Voltage Sensor`	Warning	Orange	Voltage Communication
`Temperature`	Warning	Orange	Temperature
	Failed	Red	
`Voltage`	Warning	Orange	Voltage
	Failed	Red	

3.4.2.6 FWVersion

The *FWVersion* field shows the firmware version currently running on the G-III Reference Receiver. For example, this string may be similar to **`AW3MM0000RN0000`**.

3.4.2.7 DataIP and MonitorIP

The *DataIP* and *MonitorIP* fields show the IP address and netmask of the Data (J02) and Monitor (J03) ports. The addresses are reported in dotted decimal format with the netmask shown with slash notation. For example, **`123.45.67.89/24`**.

The *MonitorIP* field is blank if the Monitor port is not configured.

3.4.2.8 Wk

The *Wk* field shows the current GPS week.

This field is blank if the receiver time is not set.

3.4.2.9 Sec

The *Sec* field shows the number of seconds in the current GPS week.

This field is blank if the receiver time is not set.

3.4.2.10 TimeStat

The *TimeStat* field shows the status of the G-III Reference Receiver time. The possible values for this field are shown in *Table 13*.

Table 13: TimeStat field values

String Value	Text Color	Condition
`Not Set`	Red	The receiver time is not set.
`Coarse`	Orange	The receiver time is set using broadcast navigation data.
`Fine`	Green	The receiver time is set using range measurements.

3.4.2.11 RxPosLatitude and RxPosLongitude

The *RxPosLatitude* and *RxPosLongitude* fields show the latitude and longitude of the G-III Reference Receiver expressed in decimal degrees.

If the receiver position is not set, these fields are blank.

3.4.2.12 RxPosHeight

The *RxPosHeight* field shows the altitude of the G-III Reference Receiver expressed in metres.

If the receiver position is not set, this field is blank.

3.4.2.13 RxPosX, RxPosY and RxPosZ

These fields show the X, Y and Z coordinates of the G-III Reference Receiver expressed in metres.

If the receiver position is not set, these fields are blank.

Chapter 4 Commands

The G-III Reference Receiver is capable of responding to many different input commands. The commands offer a wide range of flexibility and can be used to control the following:

- Overall status of the G-III Reference Receiver
- Input and output functions
- Configuration of the G-III Reference Receiver

4.1 Entering Commands

The following rules apply when entering commands:

1. You must enter commands in ASCII format.
2. The commands are not case sensitive. The following examples work the same:

   `FIX POSITION or fix position`
3. All command strings must be followed by one of the following:
   - CR (0x0D)
   - NL (0x0A)
   - CR+NL (0x0D, 0x0A)

   If you are manually entering a command, press `<ENTER>` at end of a command or command string,
4. Commands are accepted only on the Data and Maintenance ports.
5. The Maintenance port only accepts commands related to Ethernet communications and only during the Configuration state.

4.1.1 Command Settings on Power-Up

When the G-III Reference Receiver is first powered up, all commands are at the factory default settings.

Table 14: Factory Defaults for Commands

Command	Parameters
AGCMODE	L1 auto L2 auto L5 auto
ANTENNAPOWER	off
CHANCONFIG	18GPSALL8GEO
CORRSPACING	L1geo 18 0.1 L1geo 19 0.1 L1geo 20 0.1 L1geo 21 0.1 L1geo 22 0.1 L1geo 23 0.1 L1geo 24 0.1 L1geo 25 0.1

Table 14: Factory Defaults for Commands (continued)

Command	Parameters
DLLBW	L1ca 0.2 L1geo 0.2 L1c 0.2 L2c 0.2 L2py 0.2 L5gps 0.2 L5geo 0.2
ECUTOFF	0
ETHCONFIG	Etha 100 full mdi Ethb auto auto auto
FIX	none
ICOMCONFIG	icom1 udp :3000 etha icom2 disabled
IPCONFIG	Etha static 192.168.0.10 255.255.255.0 0.0.0.0 Ethb static 0.0.0.0 0.0.0.0 0.0.0.0
LOG	icom2 agcinfob ontime 1 icom2 allsqmib onnew icom2 almanacb onnew icom2 cardstatusb ontime 1 icom2 corrdatab ontime 1 icom2 ethstatusb ontime 500 icom2 factorydatab ontime 1 icom2 measurementdatab ontime 1 icom2 rawframedatab onnew icom2 rxcommandsb ontime 600 icom2 satposb ontime 60 icom2 timesolutionb ontime 1 icom2 versionb ontime 500
PLLDYNAMIC	L1ca false 3 L1c false 3 L2c false 3 L5gps false 3 L2py false 0.2 L1geo false 3 L5geo false 3
PULSEBLANKING	L1 95 2 L2 95 2 L5 95 2
RFATTEN	30
RFIFTEMP	on

Table 14: Factory Defaults for Commands (continued)

Command	Parameters
SETSBASPREAMBLE	18 3x8 19 3x8 20 3x8 21 3x8 22 3x8 23 3x8 24 3x8 25 3x8 26 3x8 27 3x8 28 3x8 29 3x8 30 3x8 31 3x8 32 3x8 33 3x8
TRACKMODE	standard
TRACKTYPE	L5geo 26 i5 L5geo 27 i5 L5geo 28 i5 L5geo 29 i5 L5geo 30 i5 L5geo 31 i5 L5geo 32 i5 L5geo 33 i5
THRESHOLD	L1ca 36 20 36 L1c 36 20 10 L2c 36 20 10 L2py 30 10 10 L5gps 36 20 36 L1geo 36 26 36 18 L1geo 36 26 36 19 L1geo 36 26 36 20 L1geo 36 26 36 21 L1geo 36 26 36 22 L1geo 36 26 36 23 L1geo 36 26 36 24 L1geo 36 26 36 25 L5geo 36 26 36 26 L5geo 36 26 36 27 L5geo 36 26 36 28 L5geo 36 26 36 29 L5geo 36 26 36 30 L5geo 36 26 36 31 L5geo 36 26 36 32 L5geo 36 26 36 33

4.1.2 Determining the Current Command Settings

To determine the current G-III Reference Receiver command settings, request a *RXCOMMANDSB* log (described in *Section 5.5.16 RXCOMMANDSB* on *Page 124*). *RXCOMMANDSB* provides a listing of all commands and parameter settings. This log provides the most complete information on receiver configuration.

For some commands, such as *LOG*, multiple parameter sets can exist. For example, you can use the *LOG* command with one set of parameters to enable logging of the *SATPOSB* log. You can use it again with a second set of parameters to configure the G-III Reference Receiver to output the *CARDSTATUSB* log. When the *LOG* command is entered the second time, the new parameter set does not overwrite the first, it exists in addition to the first set.

4.1.3 Command Response

The G-III Reference Receiver provides a command response for both accepted and rejected commands. The response consists of a front delimiter (\r\n<) followed by the response string and an end delimiter (\r\n<). If a command is rejected, the reason for rejection is included.

For example:

```
\r\n<OK\r\n
\r\n<ERROR:Command Invalid\r\n
```

In the front delimiter, \r is a CR character (0x0D) and \n is a NL character (0x0A).

The command response is provided on the same port from which the command was executed.

Table 15 outlines the various response strings. In all cases, except for OK, the command is rejected.

Table 15: Response Messages

String	Description
OK	Command was accepted and executed.
ERROR:Command Invalid	Not a recognized command.
ERROR:Parameter x out of range	Command parameter is out of range.
ERROR:Command conflicts	Command parameters conflict with each other. The command is rejected. For example, when a signal channel specified for the signal type does not match.
ERROR:Missing parameters	Not enough parameters entered. Optional fields do not trigger this.
ERROR:Too many parameters	Command has too many parameters.
ERROR:Command rejected	Command has been rejected because the current receiver state does not accept the command or the interface on which the command was received rejects the command.
ERROR:Command not executed	Command was parsed but did not execute.
ERROR:Receiver failure	Command has been rejected due to a receiver failure.
ERROR:Exception data present	Command has been rejected because there is saved exception data in NVM.

4.1.4 Command Prompt

The G-III Reference Receiver provides a command prompt on the ports that accept commands. The command prompt consists of a front delimiter (\r\n[), port name and end delimiter (]).

For example:

```
\r\n[ICOM1]
```

In the front delimiter, \r is a CR character (0x0D) and \n is a NL character (0x0A).

4.2 Functional Listing of Commands

The following tables list the commands by function. See *Section 4.4 Command Reference* on *Page 44* for a more detailed description of each individual command.

Table 16: Communication Commands

Command	Description
ETHCONFIG	Configures the physical layer Ethernet settings.
ICOMCONFIG	Configures the virtual COM port, UDP port and peer IP address.
IPCONFIG	Configures the IP address, netmask and gateway for an Ethernet port.
LOG	Configures log collection.
UNLOG	Removes a specified log from logging control.
UNLOGALL	Removes all logs from logging control.

Table 17: Radio Frequency Control Commands

Command	Description
AGCMODE	Configures Automatic Gain Control (AGC) functionality.
ANTENNAPOWER	Enables or disables electrical power to an active antenna.
PULSEBLANKING	Sets the pulse blanking values.
RFATTEN	Changes the attenuation value on the software adjustable attenuator controlling the received RF signal.
RFIFTEMP	Enables or disables RF/IF temperature control.

Table 18: Tracking Control Commands

Command	Description
ASSIGN	Assigns a tracking channel to use to search for a satellite.
CORRSPACING	Changes the early minus late discriminator locations for the specified signal channel.
DLLBW	Changes the DLL filter bandwidth.
ECUTOFF	Sets the elevation cut-off angle for all SV channels assigned to track satellites.
NSCODE	Specifies a non-standard code to be used in signal tracking.
PLLDYNAMIC	Sets the parameters associated with dynamic PLL tracking.
SETSBASPREAMBLE	Control whether SBAS channels use the 3x8 or 6x4 distributed preamble
THRESHOLD	Sets the signal acquisition, steady-state lock signal and cross-correlation thresholds.
TRACKMODE	Changes the channel assignment method.
TRACKTYPE	Changes the type of tracking used for a specified channel.
UNASSIGN	Cancels a previously issued ASSIGN command.

Table 19: General Receiver Control Commands

Command	Description
CHANCONFIG	Changes the channel configuration of the receiver.
CHANGESTATE	Changes the state of the receiver.
CLEAREXCEPTIONDATA	Clears any previously saved exception data.
RESET	Performs a hardware reset of the receiver.
RESTORE	Restores all Ethernet configurations to their default values.
SAVEPORTS	Saves the Ethernet, IP and ICOM configuration to NVM.
SYSPROFILE	Displays the system profile information.

Table 20: Position Command

Command	Description
FIX	Sets the position parameters for the G-III Reference Receiver.

Table 21: Firmware Upgrade Commands

Command	Description
SOFTLOADCOMMIT	Saves the firmware image from the RAM buffer to flash memory.
SOFTLOADFINALIZE	Finalizes the firmware download by erasing the old firmware.
SOFTLOADRESET	Starts the firmware loading process.
SOFTLOADSREC	Sends an S-Record format data block to a RAM buffer on the G-III Reference Receiver.

4.3 Command Summary

The following table shows all of the G-III Reference Receiver commands. See *Section 4.4 Command Reference* on *Page 44* for a more detailed description of each individual command.

Table 22: Command Summary

Command Name	Description	Syntax
AGCMODE	Configures Automatic Gain Control (AGC) functionality.	`AGCMODE frequency mode [pulsewidth modulus]`
ANTENNAPOWER	Enables or disables electrical power to an active antenna.	`ANTENNAPOWER flag`
ASSIGN	Assigns a tracking channel to use to search for a satellite.	`ASSIGN svChan [state] [prn [Doppler window]]`
CHANCONFIG	Changes the channel configuration of the receiver.	`CHANCONFIG config`
CHANGESTATE	Changes the state of the receiver.	`CHANGESTATE state`

Table 22: Command Summary (continued)

Command Name	Description	Syntax
CLEAREXCEPTIONDATA	Clears any previously saved exception data.	`CLEAREXCEPTIONDATA`
CORRSPACING	Changes the early minus late discriminator locations for the specified signal channel.	`CORRSPACING signal svChan spacing`
DLLBW	Configures the DLL filter bandwidth.	`DLLBW signal bw`
ECUTOFF	Sets the elevation cut-off angle for all SV channels assigned to track satellites.	`ECUTOFF angle`
ETHCONFIG	Configures the physical layer Ethernet settings.	`ETHCONFIG interface speed duplex portpolarity`
FIX	Sets the position parameters for the G-III Reference Receiver.	`FIX type [latitude longitude height]`
ICOMCONFIG	Configures the virtual COM port, UDP port and peer IP addresses.	`ICOMCONFIG port protocol [endpoint] [BindInterface]`
IPCONFIG	Configures the IP address, netmask and gateway for an Ethernet port.	`IPCONFIG interface mode [IP address] [netmask] [gateway]`
LOG	Configures log collection.	`LOG [port] message [trigger] [period]`
NSCODE	Specifies a non-standard code to be used in signal tracking.	`NSCODE signal component prn chippingrate length nonstandard`
PLLDYNAMIC	Sets the parameters associated with dynamic PLL tracking.	`PLLDYNAMIC signal setting lowbw [highbw cno PLLerror timethreshold]`
PULSEBLANKING	Sets the pulse blanking values.	`PULSEBLANKING frequency threshold exttime`
RESET	Performs a hardware reset of the receiver.	`RESET`
RESTORE	Restores all Ethernet configurations to their default values.	`RESTORE`
RFATTEN	Changes the attenuation value on the software adjustable attenuator controlling the received RF signal.	`RFATTEN setting`
RFIFTEMP	Enables or disables RF/IF temperature control.	`RFIFTEMP setting`
SAVEPORTS	Saves the Ethernet, IP and ICOM configuration to NVM.	`SAVEPORTS`
SOFTLOADCOMMIT	Saves the firmware image from the RAM buffer to flash memory.	`SOFTLOADCOMMIT`
SOFTLOADFINALIZE	Finalizes the firmware download by erasing the old firmware.	`SOFTLOADFINALIZE`
SOFTLOADRESET	Starts the firmware loading process.	`SOFTLOADRESET`
SOFTLOADSREC	Sends an S-Record format data block to a RAM buffer on the G-III Reference Receiver.	`SOFTLOADSREC s-records`

Table 22: Command Summary (continued)

Command Name	Description	Syntax
SYSPROFILE	Displays the system profile information.	`SYSPROFILE`
THRESHOLD	Sets the signal acquisition, steady-state lock signal and cross-correlation thresholds.	`THRESHOLD signal acquisition lock crosscorr [svChan]`
TRACKMODE	Changes the channel assignment method.	`TRACKMODE mode [system]`
TRACKTYPE	Changes the type of tracking used for a specified channel.	`TRACKTYPE signal svChan type`
UNASSIGN	Cancels a previously issued ASSIGN command.	`UNASSIGN svChan`
UNLOG	Removes a specified log from logging control.	`UNLOG [port] message`
UNLOGALL	Disables all logs from logging control.	`UNLOGALL [port]`

4.4 Command Reference

All syntax strings and command examples given in this section are in the ASCII format. The tables provided show the fields necessary for all formats unless otherwise noted.

All command strings must be followed by <ENTER>.

Optional fields in a command are indicated by square brackets [ ]. If there are multiple fields within the square brackets, all of the fields must be specified.

The Format for a field specifies the type value for that field.

Format	Type of value needed
Int	The value must be a whole number.
Float	The value has a maximum of 7 significant digits.
Double	The value has a maximum of 15 significant digits.
ULong	A 32-bit unsigned integer in the range +0 to +4294967295.
N/A	The set string for this field is not case sensitive.

In the following command descriptions, the state, mode and port required to use the command are listed.

Valid States	Indicates the states the receiver must be in to use the command.
Valid Mode	Indicates mode the receiver must be in to use the command.
Acceptable Ports	Indicates the receiver port to which you must be connected to use the command.

All three of the listed requirements must be met to use the command. If any of the three requirements are not met, the command will be rejected.

4.4.1 AGCMODE

> The *AGCMODE* command can fundamentally change the way that the receiver operates. Do not alter the default settings unless you are confident that you understand the consequences.

This command controls the automatic gain control (AGC) mechanism for the receiver. The AGC controls the analog voltage of the down converted Radio Frequency (RF) signal sent to the Analog-to-Digital Converter (ADC). Precise control of the voltage of the analog signal is required to optimize receiver tracking performance. Setting this command to manual dictates the gain used to condition the input signal and may degrade or prevent the receiver from acquiring or tracking all signals on a specified frequency.

Valid States: Configuration, Operational

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
AGCMODE frequency mode [pulsewidth modulus]
```

Example:

```
AGCMODE L5 MANUAL 40 50
```

Field	Field Name	Description	Range	Precision
1	frequency	Specifies the signal type to which you want to apply the command.	L1 L2 L5	N/A
2	mode	Specifies whether to use the default or custom values for the pulse width and modulus. Select AUTO to use the default values for pulsewidth and modulus. Select MANUAL to use custom values for pulsewidth and modulus. When you select MANUAL, you must enter values for pulsewidth and modulus.	auto manual	N/A
3	pulsewidth[a]	VARF pulse width for manual mode. This number has no effect when in auto mode. [Optional]	35-262144	Ulong
4	modulus[a]	VARF modulus for manual mode. This number has no effect when in auto mode. [Optional]	35-262144	Ulong

a. The pulsewidth value must be less than or equal to the modulus value.

4.4.2 ANTENNAPOWER

This command enables or disables the supply of electrical power from the internal power source of the receiver to the low-noise amplifier (LNA) of an active antenna.

Valid States: Configuration

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
ANTENNAPOWER flag
```

Example:

```
ANTENNAPOWER on
```

Field	Field Name	Description	Range	Precision
1	flag	Enables (on) or disables (off) providing power to the antenna.	on off	N/A

4.4.3 ASSIGN

> The *ASSIGN* command can fundamentally change the way that the receiver operates. Do not alter the default settings unless you are confident that you understand the consequences.

You can use this command to assist the initial acquisition of a satellite by overriding the automatic satellite/channel assignment and reacquisition processes with manual instructions. The command specifies the tracking channel to use to search for a specified satellite, and if specified, at the provided Doppler frequency and Doppler window.

The instruction remains in effect for the specified SV channel and PRN, even if the assigned satellite sets below the horizon. If the satellite Doppler offset of the assigned SV channel exceeds that specified by the *window* parameter of the *ASSIGN* command, the satellite may never be acquired or re-acquired.
If a manually assigned channel is commanded to return to AUTO tracking and if the assigned channel is currently tracking a satellite another channel is also tracking, the assigned channel will immediately idle and be reassigned to a different satellite if one is available.

To cancel the effects of *ASSIGN*, you must issue one of the following:

- The *ASSIGN* command with the *state* set to *AUTO*
- The *UNASSIGN* command

The channels are assigned by SV channel. A single SV channel is composed of the following for GPS satellite channels:

- one L1 CA signal channel
- one L1 C signal channel
- one L2 P(Y) signal channel
- one L2 C signal channel
- one L5 signal channel

A single SBAS SV channel is composed of only one signal channel. Separate channel assignments are required to track the L1 and L5 signals for one SBAS satellite.

Changing the *ASSIGN* command state to *AUTO* returns the SV channel control to the automatic search algorithm. For SBAS channels, the SV channels are actually idled as they do not have an automatic search algorithm. The search algorithm that will be used is specified by the TRACKMODE command.

Both the *ASSIGN* and *UNASSIGN* commands are accepted only when the receiver is in the Operational state.

1. Assigning a PRN to an SV channel does not remove the PRN from the search space of the automatic search algorithm; only the SV channel is removed. This will have the side effect that if the PRN is assigned to one channel, the PRN may be reported on 2 channels since the automatic search algorithm may assign another channel to track the same PRN.
2. The *Doppler* fields are specified for the L1 frequency for all SV channels where multiple signal channels are linked to the same SV channel (i.e. GPS SV channels). The Doppler will be adjusted for the other frequencies automatically. For SV channels having only one signal channel, the *Doppler* fields are specified for that specific frequency (i.e. SBAS SV channels).
3. GPS PRNs may only be assigned to GPS SV channels, and SBAS PRNs may only be assigned to SBAS SV channels. Assigning a GPS PRN automatically dedicates channels to track all signal types for that PRN while SBAS signals must be assigned individually.

Valid States: Operational

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
ASSIGN svChan [state] [prn [Doppler window]]
```

Example:

```
ASSIGN 0 29 0 500
ASSIGN 2 idle
ASSIGN 12 auto
ASSIGN 20 120
```

Field	Field Name	Description	Range	Precision
1	svChan	SV channel	0-17 (GPS) 18-33 (SBAS)	Int
2	state	The desired SV channel state. Idle sets the SV channel to not track any satellites. Active sets the SV channel to active. Auto sets the receiver to automatically assign PRN codes to channels. If a value is not given, the default of ACTIVE is used. [Optional]	idle auto active	N/A
3	PRN	Satellite PRN [Optional] This value is required if you set the *state* field to Active. This field must be left blank if you set the *state* field to Auto or Idle.	1-63 (GPS) 120-158 (SBAS)	Int
4	Doppler[a]	Doppler (Hz) [Optional] Satellite motion, receiver antenna motion, and receiver clock frequency error must be included in the calculation of Doppler frequency.	-5000 to 5000	Int
5	window[b]	Doppler window (Hz) [Optional] This is a ± value. For example, enter 500 for ±500 Hz.	0 to 5000	Int

a. If a Doppler is not specified, the receiver uses a default of 0 Hz.

b. If a Doppler window is not specified, the receiver uses a default of 5000 Hz.

4.4.4 CHANCONFIG

This command changes the channel configuration of the receiver. This affects the number of channels tracking GPS signals and the number of channels tracking SBAS signals. This command resets the receiver, causing the receiver to enter the BOOT state. The channel configuration is saved in non-volatile memory (NVM) and is used across resets.

This command cannot be cleared, except by issuing another CHANCONFIG command.

Only one option is available for the G-III Reference Receiver. Sending this command to reconfigure to the same configuration will still result in a reset of the receiver.

Valid States: Configuration

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
CHANCONFIG config
```

Example:

```
CHANCONFIG 18GPSALL8GEO
```

Field	Field Name	Description	Range	Precision
1	config	Receiver configuration	See *Table 23*	N/A

Table 23: Channel Configuration Range

Configuration	Description
18GPSALL8GEO	18 GPS channels tracking L1 C/A, L1 C, L2 C, L2 P(Y) and L5, 8 L1 C/A SBAS and 8 L5 SBAS

4.4.5 CHANGESTATE

This command forces the G-III Reference Receiver to change receiver states. It can change the receiver state from Configuration to either Operational or Maintenance.

If the G-III Reference Receiver is in Failed mode, it will not change to the Operational state.

> Exception data must be erased for placing the receiver into the Operational state. Use the CLEAREXCEPTIONDATA command to erase the data.

Valid States: Configuration

Valid Modes: Normal, Failed

Acceptable Ports: Data

Syntax:

```
CHANGESTATE state
```

Example:

```
CHANGESTATE operational
```

Field	Field Name	Description	Range	Precision
1	state	Receiver state	operational maintenance	N/A

4.4.6 CLEAREXCEPTIONDATA

This command clears any previously saved exception data.

Exception data is information that is captured in non-volatile memory within the receiver to record information about a receiver failure. Information is captured from the first event after the exception data is cleared. The failure data can be retrieved after the receiver automatically restarts using a *LOG* command to retrieve the *EXCEPTIONDATAB* log.

If there is exception data in non-volatile memory, you must clear the data using this command before the G-III Reference Receiver can change to the Operational state.

Valid States: Configuration

Valid Modes: Normal, Failed

Acceptable Ports: Data

Syntax:

```
CLEAREXCEPTIONDATA
```

Example:

```
CLEAREXCEPTIONDATA
```

4.4.7 CORRSPACING

This command changes the early minus late discriminator locations for the specified signal channel. This command can be applied per channel as defined in the following table.

This command is valid only for L1 C/A SBAS channels. If another signal type is specified, this command is rejected.

Valid States: Configuration

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
CORRSPACING signal svChan spacing
```

Example:

```
CORRSPACING L1geo 18 0.1
CORRSPACING L1geo 20 0.3
```

Field	Field Name	Description	Range	Precision
1	signal	Signal type	L1geo	N/A
2	svChan	The SV channel the discriminator spacing is applied to.	18-25[a]	Int
3	spacing	Discriminator locations	0.1 0.3 1.0	N/A

a. This range of SV channels tracking L1GEO is for the G-III 18GPSALL8GEO configuration. This range is different for other products.

4.4.8 DLLBW

> The *DLLBW* command can fundamentally change the way that the receiver operates. Do not alter the default settings unless you are confident that you understand the consequences.

This is the noise equivalent bandwidth command for the DLL (Delay Locked Loop) filter bandwidth.

> After issuing this command, the receiver will continue to track without resetting the locktime.

Valid States: Configuration, Operational

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
DLLBW signal bw
```

Example:

```
DLLBW L1ca 0.1
DLLBW L5geo 0.2
```

Field	Field Name	Description	Range	Precision
1	signal	Signal type	L1ca L1geo L1C L2py L2C L5gps L5geo	N/A
2	bw	DLL bandwidth (Hz)	0.001-0.5	Float

4.4.9 ECUTOFF

This command sets the elevation cut-off angle for all SV channels assigned to track GNSS satellites. The receiver does not attempt to acquire a satellite until it rises above the cut-off angle (unless the TRACKMODE is set to ALL). Tracked satellites that fall below the cut-off angle are no longer tracked unless they were manually assigned using the ASSIGN command.

If the G-III Reference Receiver has not yet received an almanac, does not have a position entered or does not have time computed, the satellites below the cut-off angle may be tracked.

Valid States: Configuration

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
ECUTOFF angle
```

Example:

```
ECUTOFF 10.0
```

Field	Field Name	Description	Range	Precision
1	angle	Elevation cut-off angle relative to horizon in degrees. (decimal degrees)	0 to 90	Double

4.4.10 ETHCONFIG

This command configures the physical layer Ethernet settings.

> Commands received on the Data port (J02) are applicable only to the Monitor port (J03). Attempts to change the Data port from the Data port are rejected.

The *ETHCONFIG* command also queries the current Ethernet settings.

Valid States: Configuration, Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Data, Maintenance

Syntax:

```
ETHCONFIG interface speed duplex portpolarity
```

Example:

```
ETHCONFIG ETHB AUTO AUTO AUTO
ETHCONFIG ETHA 100 HALF MDI
```

The following alternate syntax has no effect on the receiver configuration. Instead, the command response contains the current Ethernet configuration.

Alternate Syntax:

```
ETHCONFIG interface
```

Example:

```
ETHCONFIG ETHA
<INFO:ETHCONFIG ETHA 100 FULL MDI
```

Field	Field Name	Description	Range	Precision
1	interface[a]	Name of the Ethernet interface	etha ethb	N/A
2	speed[b]	Ethernet speed (Mbits/second)	auto 10 100	N/A
3	duplex[b]	Ethernet duplex state	auto half full	N/A
4	portpolarity	Ethernet port polarity	auto mdi mdix	N/A

a. etha corresponds to the Data port.
ethb corresponds to the Monitor port.

b. If either the speed or duplex field is set to auto, both fields must be set to auto.

4.4.11 FIX

This command fixes the position parameters for the G-III Reference Receiver. The position parameters are accepted relative to the WGS-84 ellipsoid.

This command should be sent to the receiver as the receiver does not calculate its own position. If the position is not accurate, the acquisition of signals may be affected.

Valid States: Configuration

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
FIX type [latitude longitude height]
```

Example:

```
FIX position 51.4 -114.652 1000.63
FIX none
```

Field	Field Name	Description	Range	Precision
1	type	Fix type. When this field is set to **position**, the following optional fields are required.	position none	N/A
2	latitude	Latitude of the receiver position in decimal degrees. Must be accurate to 1e-10 degrees. [Optional]	-90 to +90	double
3	longitude	Longitude of the receiver position in decimal degrees. Must be accurate to 1e-10 degrees. [Optional]	-180 to +180	double
4	height	Ellipsoidal height of the receiver in metres. Must be accurate to 0.001 metres. [Optional]	-1000 to +20000000	double

When a “FIX none” command is issued, the receiver will not have a position, nor will it calculate one. Time is also not calculated. The resolution of the input parameters is required for 1 mm position accuracy.

4.4.12 ICOMCONFIG

This command configures the virtual COM port, UDP port and peer IP address.

The ICOMCONFIG command also queries the current virtual communication port configuration.

Commands received on the Data port (J02) are applicable only to the Monitor port (J03). Attempts to change the Data port from the Data port are rejected.

ICOMCONFIG configuration depends on the IPCONFIG associated with the BindInterface. Existing ICOMCONFIG configuration can be impacted by changes of the IPCONFIG associated with the BindInterface. The scenarios in the following table detail the ICOMCONFIG configuration change introduced by an IPCONFIG change.

Scenario	BindInterface	Gateway IP	Peer Host IP	ICOMCONFIG Reconfiguration
1	X	X	255.255.255.255	No change.
2	ETHA	X	0.0.0.0	No change.
3	ETHA	X	Same as BindInterface IP.	DISABLED.
4	ETHA	0.0.0.0	Not in same subnet of BindInterface IP.	DISABLED.
5	ETHA	Not 0.0.0.0	Not in same subnet of BindInterface IP.	No Change.
6	ETHB	X	Subnet broadcast IP.	With subnet broadcast IP of the new BindInterface IP subnet.
7	X	X	Not the same as BindInterface IP and in the same subnet as BindInterface IP.	No change.

Valid States: Configuration, Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Data, Maintenance

Syntax:

```
ICOMCONFIG port protocol [endpoint] [BindInterface]
```

Example:

```
ICOMCONFIG icom2 udp 255.255.255.255:3001 ETHB
ICOMCONFIG icom1 udp :3000 ETHA
ICOMCONFIG icom2 disabled
```

The following alternate syntax has no effect on the receiver configuration. Instead, the command response contains the current virtual COM port configuration.

Alternate Syntax:

```
ICOMCONFIG port
```

Example:

```
ICOMCONFIG ICOM2
<INFO:ICOMCONFIG ICOM2 UDP 255.255.255.255:3001 ETHB
```

Field	Field Name	Description	Range	Precision
1	port	The virtual port identifier.	icom1 icom2	N/A
2	protocol	The IP protocol for the connection. Select *disabled* to prevent any communications on the virtual port.	udp disabled	N/A
3	endpoint	The peer host IP address and UDP port number to communicate with in the format **Host:Port**. If the Host IP address is not provided then the receiver acts as a server. If the BindInterface is ETHB (i.e., the Monitor port), the Host must be a broadcast or subnet broadcast IP address. This field is only optional if the protocol is set to *disabled*.	Host: IPv4 address Port: 1 to 65535	N/A
4	BindInterface	The physical interface to which the ICOM port is bound. This field is only optional if protocol is set to *disabled*.	ETHA ETHB	N/A

4.4.13 IPCONFIG

This command configures the IP address, netmask and gateway for an Ethernet port.

> Commands received on the Data port (J02) are applicable only to the Monitor port (J03). Attempts to change the Data port from the Data port are rejected.
>
> An ICOMCONFIG command is required to enable the ICOM port for the Ethernet interface after changing the IP address from 0.0.0.0 to a non 0.0.0.0 address.

The IPCONFIG commands also queries the current IP configuration of the Ethernet port.

Valid States: Configuration, Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Data, Maintenance

Syntax:

```
IPCONFIG interface mode [IP address] [netmask] [gateway]
```

Example:

```
IPCONFIG ETHB STATIC 10.10.0.10 255.255.255.0
```

The following syntax has no effect on the receiver configuration. Instead, the command response contains the current IP configuration.

Alternate Syntax:

```
IPCONFIG interface
```

Example:

```
IPCONFIG ETHA
```

```
<INFO:IPCONFIG ETHA STATIC 192.168.1.101 255.255.255.0 0.0.0.0
```

Field	Field Name	Description	Range	Precision
1	interface	The name of the Ethernet interface.	etha ethb	N/A
2	mode	The IP addressing mode of the Ethernet port.	static	N/A
3	IP address	The IP address of the Ethernet port. Enter in the format: xxx.xxx.xxx.xxx [Optional] This field defaults to 0.0.0.0 if not specified.	IPv4 address[a]	N/A
4	netmask	The netmask of the Ethernet port. Enter in the format: xxx.xxx.xxx.xxx [Optional] This field defaults to 255.255.255.0 if not specified.	IPv4 netmask	N/A
5	gateway	The IP address of the gateway. Enter in the format: xxx.xxx.xxx.xxx [Optional] This field defaults to 0.0.0.0 if not specified.	IPv4 address	N/A

a. APIPA IP address block 169.254.0.0/16 not supported.

4.4.14 LOG

You can log many different types of data using several different methods of triggering the log events. See *Chapter 5, Data Logs* starting on *Page 87* for further information and a complete list of data log structures.

To remove a log use the *UNLOG* command. To remove all logs, use the *UNLOGALL* command.

The *period* parameter is only valid when the *ONTIME* trigger is being used.

Valid States: Configuration, Operational, Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Data

Syntax:

```
LOG [port] message [trigger] [period]
```

Example:

```
LOG ICOM1 measurementdatab ontime 1
LOG ICOM1 rxcommandsb
LOG versionb
LOG agcinfob once
```

Field	Field Name	Description	Range	Precision
1	port	The communication port used to output the data. [Optional]. If a port is not specified, the requested logs are output on the port from which the command was issued.	ICOM1 ICOM2	N/A
2	message	The message type.	See *Table 24 on Page 62*	N/A
3	trigger	The trigger condition. Select *once* to output the log only once. Select *onnew* to output the log immediately and each time it is updated. Select *ontime* to output the log at the rate specified in the *period* field. [Optional] If the trigger condition is not specified, a default of *once* is used.	once onnew ontime	N/A
4	period	Number of seconds between logs [Optional] If the trigger condition is *ontime*, and the *period* is not specified, a default of 1 is used.	1-1000	Int

Table 24: Message Type

Message Type	Allowed Trigger
AGCINFOB	ONCE, ONTIME
ALLSQMIB	ONNEW
ALLSQMQB	ONNEW
ALMANACB	ONCE, ONNEW
CARDSTATUSB	ONCE, ONTIME
CORRDATAB	ONCE, ONTIME
CORRLOCATIONB	ONCE, ONTIME, ONNEW
ETHSTATUSB	ONCE, ONTIME
EXCEPTIONDATAB	ONCE
FACTORYDATAB	ONCE, ONTIME
MEASUREMENTDATAB	ONCE, ONTIME
RANGEB	ONCE, ONTIME
RAWGPSSUBFRAMEWPB	ONNEW
RAWFRAMEDATAB	ONNEW
RAWWAASFRAMEWPB	ONNEW
RXCOMMANDSB	ONCE, ONTIME
SATPOSB	ONCE, ONTIME
SOFTLOADSTATUSB	ONCE, ONTIME, ONNEW
TIMESOLUTIONB	ONCE, ONTIME
VERSIONB	ONCE, ONTIME

Logs with an allowed trigger of ONNEW may also be logged with a trigger of ONCE. However, only one log will be output, regardless of the number of related logs for each tracked signal. This means that if 5 signals are tracked, only one of those signals will be reported for frame logs.

Although the LOG command is accepted in the Configuration and Maintenance states, some logs (e.g. MEASUREMENTDATAB) are only output in the Operational state. If a LOG command is provided for one of these logs in the Configuration state, the command is accepted and saved but the log will not begin to be output until the receiver is transitioned to the Operational state.

4.4.15 NSCODE

This command specifies a non-standard code to be used in signal tracking. The receiver will alternate between searching for the regular PRN and the non-standard code until the signal is acquired. The non-standard code may be specified for a specific PRN, or for a specified signal type if the PRN is specified as zero. Only one PRN specific non-standard code is accepted per signal type. Any subsequent PRN specific non-standard code overrides the earlier assignments.

The NSCODE command also queries the current NSCODE configuration.

Valid States: Configuration

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
NSCODE signal component prn chippingrate length nonstandard
```

Example:

```
nscode l1ca d 0 1.023 1023 F98366C65E2CDFC8F5310744CFD483DC31173ADD5A30AB
65CBA1F8AEDCC9048DF8C7F8814E8835F38F218FCCBB0DA00982217AF160C72FBB2D355FF
83F078CF00A50B852FB6D1BF7E1B622AE060FED11719165CBDD400501DC97C726F9EAC747
E84E2C495DF384368B310C785CB07FA543688D4C926B41CE5F3B2981F7CD9688

nscode l2c d 0 0.5115 10230 3F10FF2610F479373A319A5C3167687F8D5C40B1FE0CD
D9FFD176D100DE72CF7CD45408E169EA2BEEC4800C3A3BA752ABF598C96329698B53B56D7
08A386392DFBE0E66E4E80AAE9DBBB94BEAB3E2DE6608DA3EFBC808FA05E3C70459EDA597
9052F7E99147410990E8470CAFFDBB230AE0DC247167509B7FB38A1A6DE008E0E99C664D5
A6034B8C006A3B0AFA6B15F84BC4E522060C334F1B70FFDD754448E45B806F123F3385AE1
969A6E1A53A627982410F5EA013A2BE67111DB3D121A988DEE529405233EF76805872DEF3
3E15C95C152F409A56CE2086515677CF9EC9A84979CBFFBA25EC0818C6F2B1252B5FB6EF4
E87A5C2300B38E9E9AE2E461360B230258601E1A14825F02E3E6C3E7100CD4C9B99E0A4D9
BFF0A7929B013DB706BED9F2B765126075AC0B92B66F09347DDE5CA7151FF8A6DD1DB1B5A
04E755664C105A96D60F5097BC748B9AE90C7F15252ACE2063EFDAC36F7289A1D7B187CC4
20EB8D8D68A7BF36973D907A76A362D60CE5309838F61D9DEC2E963B1743F3EFEF26EECC1
D5CC55ED9CF4BB2F1E03A3AAB69951B0C86363E8905798E9739C10986FA81506080D308D0
DF9FCCBE2511D52EBAFE434A89290AFD7F358F7E4CC9BADFF32461E1E7D8000660463D6DC
93BDA318F2F84AB038D9E3EA5185646E202B4D789509D764802C3B20550EE8F3DADCF44D2
DEDB74DF07C6E0EB75DDBA91ACF12C3E3B1C5CDFDF0A849D75902E284762751283F78775B
ADBA62FA1F8B4BFC9139D98E694979D973255AE75B9941EF54A74E304FC8A95CC6174C52A
BB4E454B56897230D2E003BD6EDE95C177ED375B7A450B6B2EAC78333368CB582A78515AE
DE63B979A1D4F5A328552BF93D444B328D693640D55D0225AF46FBA6DC73AB000665F2DFE
B9044E6F8224853C127E27275567D4D30B1B61E756FE6B0502FEE64A2C1B353DFA16F46BE
039B8225DE5DC0AF8C827C3C1821B387328FDF6971ED7373285E07CD67905FBC34297E43F
DCA399454215EEBBA85B64A3BCE9ABC06825D70FFC16AB6F0B814EB11941B1064E833691D
B8592219CE30915F631D1B44DD7B5CAEE0AA2BB8C7E32722E7A81581FE65A7F0FA1D1F3EB
84CA775E670FF238E1E34DC51B58C1C29FA9B95A96A83129675FF33C7CDEE7395ADBF4DF1
03FD1578D709CD273D367712E7767126B915317160C52E6D57491EB1C3A5F01CF9465A414
43FD0C944433C31970D65DB5F0C01EAC24151E3E9F4673C8D15674D93D4C6D687E169A202
AE3E2B7C394E69D757956BE7FAF2612B927F4B5C203F749E946788F2AEB793F800A09AABD
B0F62DBCF0DCBAC804C8FA93A17F0683B5A50BC6CEB02359015723526B2CAF4B9826D8B38
7EF29938BB7D132560CEAE021315E83DA0205B7B8538926D81101D62B9A08284E269A21BD
7F0C3BCAFE93B48AE09AE4A1A2A10385A5DE19722D249709BB1516FE592D88B0155227AFD
3F990D428A3062A34052504C6543B2B93471509A90721020B1D26A3686B32A7DEA8EBBD59
8FA5882DA3829B88BCA9678D195D0CC97E60D70CB20BCC290C9B144FE93D351C319BE8BED
```

```
537344CF20C08AC364F69ED5CBF7EA0AB7BB9197789EA0294EE31D32AF4EBC96DF1FAE33E
6D5716B43D7DFBD92A5556BAB4422F1F35F206638F2399E85ADFA8A6282CB6F0389F82D0F
30B3DC2BDA73E763854238CF60DB3112C4ABECD18644559AEC3294C851B7CCF393824B585
30F9E49A5EFF90D6016D9D7D8B2D0218EA52F7EC0280E18EA1035F17FCC6CC25D485579C8
C0C6845B520758AA5E5AAC34E66255800

nscode l5geo d 120 10.23 10230 20A8CD10689E34425E13ED3E6634BD98E9D5AA9CD5
60D7C24DAC708D3305099F3215CC13860C00787E1FCBD002D7C9BD8A48EBCA882782C7AFC
D386B072CF2D3DC38CF7453B217C356C4ABABA3BAE8F3B66EB000B4B740A05F43CB9E6F1E
A06615BB6BFF10EDADAF8E57F77DEEEC6246FD4D0462FC8D47E9B4F097A7AAF7855610D20
1F077F6B4A87D6F684ADB80B3FF52FA9CD55FF6E371ED09356A8CD6584E91131ED940F657
4779EBBD300929F4FA946B4D166EED0F5C1AB22516B93DE3BE410D49D79506D243AE09834
95292F29C66A0EC7758C3E3ECA4BFF975A801485BF9F070A2FC55A04BC47F1A723293F508
EB04BAAD66E58E0E09D11E2F1BE72D1F16FDF931E49A5B8337BB4ABDC75FE924FFC001466
93AEFB79E6E2F42692A5F35F82143A6F2046AE2DBEEC6BE4D7B8B9EC3EC7C3A0B8EF447E3
C14E4C9FF0873E042BBCDAFE96A8555022614488120 97FF9B9E1DB90F2E250CFCF4A6C980
03B4DD3A12A78B55547465E271AADDB0C60DF1A19F11A9697FE7B228C7818E8DBC14A2E64
09399BCF9E422CE0DE9C4B25C4A7EEEA55B57B42048571723A826BE98B1E592F5CB3CD96F
CDAF063480405E13E9581B265C8670928046E965DC71417D39C62F28EACB39A29BADC2133
33A2E9B06E9891C3FA8E3741801C9D2CA8D86669A2C80ABB457BF63F0A73715A9ADD63CEF
9BF9B91B9A8AF3814DA5175720EE5253F44A94086156C0272FE5C6FFD94235D710A4B55E8
769997FE84B48CD78355CAB1F334F4B6446031682D0E48BA214C9658B299584D8085C4198
55DB1CF82037D13E065B42D3285D8B2CD6C5F6582D3698A02591FFFF77E93B38AEBA03407
5321D7746A14493500EC232AB6D7C5A2266258ED72F5FF4140EE59376964177AACBB1F7C0
67F1DB64793921C55006DDD565FE6F592CA59F3664ED6BDCF018D1F654AC4EBD31CCF3CE3
71AC8AC0631510FB370D8B26666B5D7BF804C4BA0910AD4229B45305CB415817E3000760B
7A29A39B34F00B08F5E9C0F490E93D91F97808232C699E629FF29F1F09A4A313CE27C0D6B
BBF54F6A4C0DC0A400E243200096CE4FBDD5DE66F54953263271F74B88D6B76813DACA08B
51DC0683E770F4EEF60E4394017F2AB5937EF54718A3DDA49B49DE1FB1FA34D97FF4A505E
2C0BDC82AA61A17024F1214F6F94DF2613B0C785923407D285DE85DE7C1D3F293505F191F
73C4584B615C25A40967AC9D53068C081D655DECAC334189F91124A1F3D56072215586B35
4C467C22845AED39FDE3BFD45DAF33F173AB6C43C102AAC8305CE71D0462B3E74078D3BCE
67D5F10DF79F110A3FB21BBA2C8E94FC75989295CAA943215AB94177133A60764A3374D97
0C069CE039B353F2EF694D5D16BAD7658F71E80DD2B968025E0D304DC0FCBA40CBF9EEDA9
ECE5A53C5734815CF6DBB2BD5167AD92512414197A5C68B98406516544CCAEBC6FE7516FA
B2091F9405DFB5C57A2B397CFFF693D4548D9CB7E87F12E1FA69776277490F4A61A7D7EA8
A947F9A2836D9C9B91190C70D7D8C983E5986B3DD4C025B045CA3C4E54B1416D35628248F
4DB5C261E9557DE65ABC5C5513DB055D005A515F94831357B11A4F8955024F0A604240E56
18A1CF9AC427292894F59A7B835BA4C26A86F6BB532E5B188185DB1BFB96EF698F399FED2
76201684B5DEA42B23510921F09BFC523291108CD8AD4E560B87CAFA6CF1D3BF4FAB33ED8
9387075C2266B9F93BEF1689E5421EB4956CF2844E4445E7AFFBC2263EC25539E31E7DC33
7C92EB72AA21A2CAD498BCB1F8EF2D9C9000
```

The following syntax has no effect on the receiver configuration. Instead, the command response contains the current NSCODE configuration of the specified signal type component.

Alternate Syntax:

```
NSCODE signal component
```

Example:

```
NSCODE L2C P

<INFO: NSCODE L2C P 20 0.5115 BEEFBEE0
```

Field	Field Name	Description	Range	Precision
1	signal	Signal type[a]	L1ca L1geo L1C L2C L5gps L5geo	N/A
2	component	Signal type component[b]	D P	N/A
3	prn	PRN to apply the non-standard code to. When 0 is specified, it applies to all PRNs for the selected signal and system types.	0 1-63 120-158	Int
4	chippingrate	Chipping Rate (MHz)	1.023 0.5115 10.23	N/A
5	length	Sequence length (bits)	27-10230	Int
6	nonstandard	The non-standard code that will be applied. This code must be entered in hex format. The specified sequence must be in multiples of 32-bits, achieved by adding 0's appended to the end of the non-standard code sequence if necessary.	N/A	String

a. The allowable parameters for each signal are in *Table 25*.

b. For L1 C/A (GPS and SBAS), set the signal component to D as there is only a data component. The commands will be rejected if the field is not set to D for L1 C/A GPS and SBAS signal types.
For L2C, the D component corresponds to L2CM and P corresponds to L2CL.
For L2CL, the command accepts a 27 bit initial state, rather than the entire sequence.
L1C overlay NSC is not supported.

Table 25: NSCODE Allowable Parameters for Signal Types

Signal Type	Signal	Component	PRN	Chipping Rate (MHz)	Sequence Length
L1 C/A GPS	L1ca	D	0-63	1.023	1023
L1 C/A SBAS	L1geo	D	0, 120-158	1.023	1023
L1CD	L1C	D	0-63	1.023	10230
L1CP	L1C	P	0-63	1.023	10230
L2CM	L2C	D	0-63	0.5115	10230
L2CL	L2C	P	0-63	0.5115	27 (initial state)
L5I GPS	L5gps	D	0-63	10.23	10230
L5Q GPS	L5gps	P	0-63	10.23	10230
L5I SBAS	L5geo	D	0, 120-158	10.23	10230
L5Q SBAS	L5geo	P	0, 120-158	10.23	10230

4.4.16 PLLDYNAMIC

> The *PLLDYNAMIC* command can fundamentally change the way that the receiver operates. Do not alter the default settings unless you are confident that you understand the consequences.

> The channels are not reassigned when this command is issued. They may continue to track when the command is applied. This is different than the G-II Reference Receiver PLLBW command, which did reassign the channels, causing them to lose lock and resetting the lock time for all tracking satellites to zero.

This command sets the low-pass filter bandwidth value. It also enables or disables the dynamic PLL tracking and sets the parameters associated with dynamic PLL tracking.

The following restrictions apply to the *PLLDYNAMIC* command:

- The *highbw* value must be larger than or equal to the *lowbw* value or the command will be rejected.
- The optional parameters are required fields when dynamic PLL is enabled (by specifying **enable** for the *setting* field).
- The locktime may not be reset to zero when the dynamic PLL is enabled through *PLLDYNAMIC* command.

Valid States: Configuration, Operational

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
PLLDYNAMIC signal setting lowbw [highbw cno PLLerror timethreshold]
```

Example:

```
PLLDYNAMIC L1ca TRUE 3 10 30 0.15 2000

PLLDYNAMIC L5geo FALSE 1
```

Field	Field Name	Description	Range	Precision
1	signal	Signal type	L1ca L1geo L1C L2py L2C L5gps L5geo	N/A
2	setting	Enter TRUE to enable dynamic PLL, Enter FALSE to disable dynamic PLL. When this field set to FALSE, the fields marked as optional are not necessary and are ignored if specified. When this field set to TRUE, all of the fields are mandatory.	TRUE FALSE	N/A

Field	Field Name	Description	Range	Precision
3	lowbw	Low PLL bandwidth (Hz)	0.5-15 0.01-1 (L2 P(Y) only)	Float
4	highbw	High PLL bandwidth (Hz) [Optional]	0.5-15 0.01-1 (L2 P(Y) only)	Float
5	cno	C/No threshold (dB-Hz) [Optional]	0-80	Int
6	pllerror	PLL error threshold (cycles) [Optional]	0-1	Float
7	timethreshold	Minimum number of milliseconds to stay on high bandwidth. If L2 P(Y) is configured for dynamic PLL with a time threshold of less than 500 ms, the command will be accepted but will have no effect on the PLL. [Optional]	20-100 000	Int

4.4.17 PULSEBLANKING

> The *PULSEBLANKING* command can fundamentally change the way that the receiver operates. Do not alter the default settings unless you are confident that you understand the consequences.

This command enables or disables digital pulse blanking. The sensitivity of the digital pulse blanking may be adjusted using the threshold field. When the pulse blanking extension time is non-zero, the receiver will continue to blank the signal for the specified extension time.

Valid States: Configuration, Operational

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
PULSEBLANKING frequency threshold exttime
```

Example:

```
PULSEBLANKING L2 0 2
PULSEBLANKING L5 120 4
```

Field	Field Name	Description	Range	Precision
1	frequency	Specifies which frequency type to apply the command to.	L1 L2 L5	N/A
2	threshold	Pulse Blanking threshold To turn off pulseblanking, set the threshold value to 0.	0-127	Int
3	exttime	Pulse blanking extension time (µs)	0-10	Int

4.4.18 RESET

This command performs a hardware reset. Following a *RESET* command, the receiver re-enters the BOOT state.

Valid States: Maintenance, Configuration, Operational

Valid Modes: Normal, Failed

Acceptable Ports: Data, Maintenance

When the receiver is in the Operational state, the RESET command can be issued only from the Data port.

Syntax:

```
RESET
```

Example:

```
RESET
```

A command response indicating that the *RESET* command was accepted successfully is output before the system resets.

4.4.19 RESTORE

This command restores the Ethernet configuration to its default values by deleting any saved Ethernet configuration from NVM. After the Ethernet configuration is erased from NVM, the receiver resets. For a list of the default Ethernet configuration values, see *Table 14 Factory Defaults for Commands on Page 36*.

Valid States: Configuration, Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Maintenance

Syntax:

```
RESTORE
```

Example:

```
RESTORE
```

4.4.20 RFATTEN

This command changes the attenuation value on the software adjustable attenuator controlling the received RF signal.

Valid States: Configuration, Operational

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
RFATTEN setting
```

Example:

```
RFATTEN 20
```

Field	Field Name	Description	Range	Precision
1	setting	RF attenuator setting (dB)	0-30	Int

4.4.21 RFIFTEMP

This command turns the RF/IF temperature control on or off.

Valid States: Configuration

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
RFIFTEMP setting
```

Example:

```
RFIFTEMP on
```

Field	Field Name	Description	Range	Precision
1	setting	Enables or disables the RF/IF temperature control.	on off	N/A

4.4.22 SAVEPORTS

This command saves the Ethernet, IP and ICOM configuration to non-volatile memory (NVM). When the receiver restarts, this saved configuration will override the receiver defaults.

To erase the saved configuration, use the *RESTORE* command (see *Section 4.4.19 RESTORE* on *Page 70*). Note that the *RESTORE* command will restart the receiver.

Valid States: Configuration, Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Maintenance

Syntax:

```
SAVEPORTS
```

Example:

```
SAVEPORTS
```

4.4.23 SETSBASPREAMBLE

This command controls whether SBAS channels use the 3x8 distributed preamble defined in RTCA/DO-229D or 6x4 distributed preamble in the proposed SBAS L5 DFMC ICD.

Valid States: Configuration

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
SETSBASPREAMBLE svchan type
```

Examples:

```
SETSBASPREAMBLE 18 6x4
```

Table 26: SETSBASPREAMBLE Command Format

Field	Field Name	Description	Range	Precision
1	svchan	SV Channel	18-33[a]	int
2	type	Preamble type	3x8/6x4	N/A

a. Channel ranges shown are for the default chanconfig.

4.4.24 SOFTLOADCOMMIT

This command verifies the uploaded firmware image and saves the image from the RAM buffer to flash memory.

Valid States: Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Data

Syntax:

```
SOFTLOADCOMMIT
```

Example:

```
SOFTLOADCOMMIT
```

4.4.25 SOFTLOADFINALIZE

This command finalizes the firmware download by erasing the old firmware.

Valid States: Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Data

Syntax:

```
SOFTLOADFINALIZE
```

Example:

```
SOFTLOADFINALIZE
```

4.4.26 SOFTLOADRESET

This command starts the firmware loading process.

Valid States: Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Data

Syntax:

```
SOFTLOADRESET
```

Example:

```
SOFTLOADRESET
```

4.4.27 SOFTLOADSREC

This command sends an S-Record format data block to a RAM buffer on the G-III Reference Receiver.

The data block can contain a single S-Record, or multiple S-Records packaged together.

All S-Records in the data block must be valid and complete.

Valid States: Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Data

Syntax:

```
SOFTLOADSREC s-records
```

Examples:

```
SOFTLOADSREC S31D00000048000000000000000000000000000000000000000000000000000
9A

SOFTLOADSREC S0~T~APPS31D0000000006E0A6E10100000028000000280008000000001C
E001001C03S31D00000018300000000582E5C009F5856AA2A5AD03501000000FEFFFFFF3C
```

Field	Field Name	Description	Range	Precision
1	s-records	S-Record Entries	String 2 to 8000 bytes	N/A

4.4.28 SYSPROFILE

The command response for this command contains the system profile information.

Valid States: Configuration, Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Maintenance

Syntax:

```
SYSPROFILE
```

Command Response Format:

```
<INFO:

SYSPROFILE:<MOP SW Identifier String >,<MOP SW Version String>,<MOP
SW Compile Date String>,<MOP SW Compile Time String>,<MOP SW Info
Tag String>,<Num Entities>

SYSPROFILE:<CARD TYPE>,<SLOT ID>,<MODULE ID>,<PSN String>,<HW
Version String>,<APP SW Version String>,<PBC SW Version String>,<SBC
SW Version String>,<FPGA Version String>,<APP SW Compile Date
String>,<APP SW Compile Time String>,<APP SW Info Tag String>,<PBC
SW Info Tag String>,<SBC SW Info Tag String>

…
```

The command response of the SYSPROFILE command contains multiple lines in ASCII format. Each line begins with the new line delimiter CR+NL (0x0D,0x0A).

The command response of the SYSPROFILE command ends with an empty line, i.e., CR+NL (0x0D,0x0A).

Example:

```
SYSPROFILE


<INFO:

SYSPROFILE:"MOPSW","AW3MM0000RN0000","May 23 2012","17:14:07","",5

SYSPROFILE:1,7,0,"DJV11100008","G3IOM-1.00","AW3IA0000RN0000",
"AG3IB0000RB0000","","","May 23 2012","00:04:12","","",""

SYSPROFILE:3,4,0,"DKF11180012","G3RFCC13-1.00","","","",
"G3RFCCFPGA-7","","","","","",""

SYSPROFILE:4,4,1,"DKE11120011","G3RFDCG3-1.00","","","","","","",
"","",""

SYSPROFILE:2,2,0,"DJJ10460006","G3DSPC-1.00","AW3DA0000RN0000",
"AG3DB0000RB0000","AG3NA0000RN0000","G3DSPCFPGA-10","May 23 2012",
"00:05:18","","",""

SYSPROFILE:2,2,1,"DJJ10460006","G3DSPC-1.00","AW3DA0000RN0000",
"AG3DB0000RB0000","AG3NA0000RN00000","G3DSPCFPGA-10","May 23 2012",
"00:05:18","","",""
```

Table 27: SYSPROFILE Command Response Field Description

Field Name	Description	Format	Comment
MOP SW Identifier String	MOPSW Identifier	String	The MOPSW string is always "MOPSW".
MOP SW Version String	Multiple Object Package version	String	Max Length = 15
MOP SW Compile Date String	Multiple Object Package file compile date	String	Max Length = 11
MOP SW Compile Time String	Multiple Object Package file compile time	String	Max Length = 11
MOP SW Info Tag String	Multiple Object Package file information tag	String	Max Length = 63
Num Entities	Number of entities include in the system profile	Integer	
CARD TYPE	Card type	Integer	1 = IOMaster 2 = DSPC 3 = RFCC 4 = RFDC
SLOT ID	Slot ID of the associated backplane slot location	Integer	
MODULE ID	Module ID of the associated sub slot entity	Integer	
PSN String	PSN	String	Max Length = 15
HW Version String	Hardware version	String	Max Length = 15
APP SW Version String	Software version	String	Max Length = 15
PBC SW Version String	Primary boot code software version	String	Max Length = 15
SBC SW Version String	Secondary boot code software version	String	Max Length = 15
FPGA Version String	FPGA version	String	Max Length = 15
APP SW Compile Date String	Firmware compile date	String	Max Length = 11
APP SW Compile Time String	Firmware compile time	String	Max Length = 11
APP SW Info Tag String	Firmware information tag	String	Max Length = 63
PBC SW Info Tag String	Primary boot code information tag	String	Max Length = 19
SBC SW Info Tag String	Secondary boot code information tag	String	Max Length = 19

4.4.29 THRESHOLD

This command controls the signal acquisition, steady-state-lock signal and cross-correlation thresholds.

> The cross-correlation threshold parameter is used only for L1 C/A GPS, L1 C/A SBAS and L5 GPS signal types.

Valid States: Configuration, Operational

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
THRESHOLD signal acquisition lock crosscorr [svChan]
```

Example:

```
THRESHOLD L1ca 35 15 25
THRESHOLD L1geo 36 26 36 18
```

Field	Field Name	Description	Range	Precision
1	signal	Signal type	L1ca L1geo L1C L2py L2C L5gps L5geo	N/A
2	acquisition	Acquisition power threshold (dBHz)	25-80	Int
3	lock	Steady-state tracking lock threshold (dBHz)	10-80	Int
4	crosscorr[a]	Cross-correlation power threshold at which cross-correlation checks are performed (dBHz)	10-80	Int
5	svChan[b]	SV channel to which the parameters are applied. This field is only accepted for the SBAS SV channels and must be specified. [Optional]	18-33	Int

a. A cross correlation value must be specified for L1C, L2 P(Y), L2C, and L5 SBAS, but this value is not used.

b. The svChan field must be specified only for SBAS channels.
For L1 C/A SBAS signal types, the range is from 18 to 25.
For L5 SBAS signal types, the range is from 26 to 33.
The threshold values must be specified per channel for SBAS signal types.

4.4.30 TRACKMODE

This command changes the channel assignment method.

Valid States: Configuration

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
TRACKMODE mode [system]
```

Example:

```
TRACKMODE standard
TRACKMODE all gps
```

Field	Field Name	Description	Range	Precision
1	mode[a]	Track mode type: STANDARD: Channels are assigned to satellites that are in the validated almanac and are above the elevation mask angle. ALL: Channels are assigned to all satellites (PRNs 1-32) regardless of elevation or presence in the almanac.	standard all	N/A
2	system[b]	The system the track mode is applied to. [Optional]	gps	N/A

a. If a validated almanac is not available, all satellites will be searched for regardless of the channel assignment method selected.

b. The only system this command applies to is GPS. If the system is not specified, it defaults to gps.

4.4.31 TRACKTYPE

This command changes the type of tracking that is used for the specified channel.

This command applies only to L5 SBAS tracking.

Valid States: Configuration

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
TRACKTYPE signal svChan type
```

Example:

```
TRACKTYPE L5geo 26 i5
TRACKTYPE L5geo 33 q5i5
```

Field	Field Name	Description	Range	Precision
1	signal	Signal type	L5geo	N/A
2	svChan	SV channel to which the tracktype is applied.	26-33[a]	Int
3	type	Type of tracking to apply. Specify **i5** to use I5 for both tracking and data demodulation. Specify **q5i5** to use Q5 for tracking and I5 for data demodulation.	i5 q5i5	N/A

a. This range of SV channels for tracking L5SBAS is for the G-III 18GPSALL8GEO configuration. This range will be different for other products.

4.4.32 UNASSIGN

This command cancels a previously issued ASSIGN command. If the assigned channel is currently tracking a satellite another channel is also tracking, the assigned channel will immediately idle and be reassigned to a different satellite if one is available.

This command has the same effect as the ASSIGN AUTO command.

Valid States: Operational

Valid Modes: Normal

Acceptable Ports: Data

Syntax:

```
UNASSIGN svChan
```

Example:

```
UNASSIGN 5
```

Field	Field Name	Description	Range	Precision
1	svChan	SV channel	0-17 (GPS), 18-33 (GEO) [a]	Int

a. For L1 C/A SBAS, the range is 18 to 25.
For L5 SBAS, the range is from 26 to 33.

4.4.33 UNLOG

This command removes a specific log request from the system.

Valid States: Configuration, Operational, Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Data

Syntax:

```
UNLOG [port] message
```

Example:

```
UNLOG rangeb
UNLOG ICOM2 cardstatusb
```

Field	Field Name	Description	Range	Precision
1	port	The communications port used to output the data. If a port is not specified, the command is applied to the port the command was received on. [Optional]	ICOM1 ICOM2	N/A
2	message	Message type	See *Table 24 Message Type on Page 62*	N/A

4.4.34 UNLOGALL

This command disables all logs on the specified port only. All other ports are unaffected.

Valid States: Configuration, Operational, Maintenance

Valid Modes: Normal, Failed

Acceptable Ports: Data

Syntax:

```
UNLOGALL [port]
```

Example:

```
UNLOGALL

UNLOGALL ICOM2
```

Field	Field Name	Description	Range	Precision
1	port	Communication port used to output the data. If a port is not specified, the command is applied to the port the command was received on. [Optional]	ICOM1 ICOM2	N/A

Chapter 5 Data Logs

The following rules apply to logs:

- The majority of logs are output in binary format only.
  The *RXCOMMANDSB* log is the only log that reports the configuration settings in ASCII format.
- Logs are generated by the receiver in response to the LOG command. For information about the LOG command, see *Section 4.4.14 LOG* on *Page 61*.
- All logs are protected with a 32-bit CRC at the end of each message. Refer to *32-Bit CRC* on page 91 for CRC polynomial and computation.
- Some logs have repeating data sets. This is represented by a double line between fields.
- All receiver logs are in little-endian format.
- Reserved fields in logs are reserved for manufacturer's use and may be non-zero.

5.1 Log Header

There are two types of logs in the G-III Reference Receiver: legacy logs and G-III logs. The legacy logs ensure backwards compatibility with the G-II Reference Receiver, while the G-III logs are updated to include new information and are expanded to allow for the new GPS signals.

The legacy logs have a header very similar to the G-II Reference Receiver logs, with some of the fields set to reserved. In the legacy log header, the reserved fields are set to zero.

The G-III log header can be uniquely identified by the four byte synchronization pattern "0xAACC4756".

Table 28: Legacy Log Header Format

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Sync	Hexadecimal 0xAA	Char	1	0
2	Sync	Hexadecimal 0x44	Char	1	1
3	Sync	Hexadecimal 0x12	Char	1	2
4	Header length	Length of the header	Uchar	1	3
5	Message id	Message ID	Ushort	2	4
6	Reserved 1	Reserved. Set to 0.	Char	1	6
7	Reserved 2	Reserved. Set to 0.	Char	1	7
8	Message length	Length of the message in bytes. This does not include the header nor the CRC	Ushort	2	8
9	Reserved 3	Reserved. Set to 0.	Ushort	2	10
10	Reserved 4	Reserved. Set to 0.	Char	1	12
11	Time status	Quality of the GPS time 20 = Unknown 100 = Coarse 160 = Fine 200 = Sattime	Enum	1	13
12	Week	GPS week number[a]	Ushort	2	14

Table 28: Legacy Log Header Format (continued)

Field	Field Name	Description	Format	# Bytes	Binary Offset
13	Milliseconds	Milliseconds from the beginning of the GPS week.	Ulong	4	16
14	Reserved 5	Reserved. Set to 0.	Ulong	4	20
15	Reserved 6	Reserved. Set to 0.	Ulong	4	24

a. The GPS week number count has been incremented by 1 every week and the field is modulo 1024 (i.e. set to 0 after 1023 weeks). The last roll-over occurred at 23:59:47 UTC on 21 August 1999. The previous rollover should be accounted for in determination of GPS week number by the user. The next roll over is expected at April 7, 2019.

Table 29: G-III Log Header Format

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Sync	Hexadecimal 0xAACC4756	Char[4]	4	0
2	Message length	Total length of the message including the header but not the CRC	Ushort	2	4
3	Messaged id	Message ID	Ushort	2	6
4	Log count	Number of logs output since receiver entered configuration state, for all G-III logs from the same port. Legacy logs are not included in this count. Resets to 0 when the maximum value (4 294 967 295) is reached.	Ulong	4	8
5	Time status	Quality of the GNSS time 0 = Unknown 1 = Coarse 2 = Fine 3 = Sattime	Enum	2	12
6	Week	GNSS week number[a]	Ushort	2	14
7	Milliseconds	Milliseconds from the beginning of the GNSS week.	Ulong	4	16
8	Reserved	Reserved.	Ulong	4	20
9	Reserved	Reserved.	Ushort	2	24
10	Reserved	Reserved.	Ushort	2	26

a. The GNSS week number count has been incremented by 1 every week and the field is modulo 1024 (i.e. set to 0 after 1023 weeks). The previous rollover should be accounted for in determination of GNSS week number by the user.

5.1.1 Log Triggers

Each log can be configured for output when a certain condition, or trigger, is met. The possible triggers are:

- ONNEW Output a new log immediately and whenever the message is updated.
- ONTIME Output a new log at a specified interval (in seconds).
- ONCE Output the current, existing message. Only a single log is generated.

5.2 Fields

The logs for the G-III Reference Receiver use a variety of field types to convey data. The following sections provide information on the types of fields used and some of the more commonly-used fields.

5.2.1 Field Types

The following table describes the field types used in logs.

Table 30: Field Types

Type	Binary Size (Bytes)	Description
Char	1	An 8-bit signed integer in the range -128 to +127. This integer value may be the ASCII code corresponding to the specified character.
UChar	1	An 8-bit unsigned integer. Values are in the range from +0 to +255.
UShort	2	A 16-bit unsigned integer in the range +0 to +65535.
Long	4	A 32-bit signed integer in the range -2147483648 to +2147483647.
ULong	4	A 32-bit unsigned integer in the range +0 to +4294967295.
Double	8	64 bits, with 1 for the sign, 11 for the exponent, and 52 for the mantissa. Its range is ±1.7E308 with at least 15 digits of precision. This is IEEE 754.
Float	4	32 bits, with 1 for the sign, 8 for the exponent, and 23 for the mantissa. Its range is ±3.4E38 with at least 7 digits of precision. This is IEEE 754.
Enum	4	A 4-byte enumerated type beginning at zero (an unsigned long).
Hex	n	A packed, fixed length (n) array of bytes.
String	n	A variable length array of bytes that is null-terminated. The maximum byte length for the field is shown in the row in the log table.

5.2.2 Commonly-Used Fields

Some of the more commonly-used fields are discussed in this section.

5.2.2.1 Message Time Stamps

All NovAtel format messages generated by the G-III Reference Receiver have a GNSS time stamp in the header. GNSS time is referenced to UTC with the zero point defined as midnight on the night of January 6, 1980 at 0:00 hours. The time stamp consists of the number of weeks since that zero point (0 to 1023) and the number of seconds since the last week number change (0 to 603,799). GNSS time differs from UTC time since leap seconds are occasionally inserted into UTC but GNSS time is continuous. In addition, a small error (less than 1 microsecond) can exist in synchronization between UTC and GNSS time.

The data in synchronous logs, like the *RANGEB* log, are based on a periodic measurement of satellite pseudoranges. The time stamp on these logs is the receiver estimate of GNSS time at the time of the measurement. When setting time in external equipment, a small synchronous log will be accurate to a fraction of a second. A synchronous log with trigger `ONTIME 1` can be used in conjunction with the 1 PPS signal to provide relative accuracy better than 250 ns.

Other log types (asynchronous and polled) are triggered by an external event and the time in the header may not be synchronized to the current GNSS time. Logs that contain satellite broadcast data have the transmit time of their last subframe in the header. The header of a polled log, like *VERSIONB*, gives the approximate GNSS time when its data was generated.

5.2.2.2 Locktime

The maximum allowable satellite locktime is 65,535 seconds. GEO satellites are stationary and therefore, the possibility exists for a locktime longer than the maximum.

If the locktime is larger than 65,535 s, the GEO locktime rolls back to 32,768 s.

Locktime is reported in the *RANGEB* (see *Section 5.5.12* on *Page 117*) and *MEASUREMENTDATAB* (see *Section 5.5.11* on *Page 114*) logs.

5.2.2.3 GNSS Time Status

All reported receiver times are subject to a qualifying time status. This status gives you an indication of how well a time is known, as shown in *Table 31*.

Table 31: GNSS Time Status

GNSS Time Status	Description
UNKNOWN	Time validity is unknown.
COARSE	This time is valid to coarse precision.
FINE	Time has fine precision.
SATTIME	Time from satellite. This is only used in logs containing satellite data such as ephemeris and almanac.

There are several distinct states that the receiver will go through:

1. UNKNOWN
2. COARSE
3. FINE

On start up, and before any satellites are being tracked, the receiver cannot know the current time. As a result, the receiver time starts counting at GNSS week 0 and second 0.0. The time status flag is set to *UNKNOWN*.

After the first ephemeris is decoded, the receiver time is set to a resolution of ±10 milliseconds. This state is qualified by the *COARSE* time status flag.

When the receiver knows its position and range biases are being calculated, the internal clock model will begin modelling the position range biases and the receiver clock offset.

Modelling continues until the model is a good estimation of the actual receiver clock behavior. At this time, the receiver time will again be adjusted, this time to an accuracy of ±1 microsecond. This state is qualified by the *FINE* time status flag.

The time status flag will never improve on *FINE*. The time will only be adjusted again to within ±1 microsecond if the range bias gets larger than ±250 milliseconds.

5.2.2.4 32-Bit CRC

All logs contain a 32-bit Cyclic Redundancy Check (CRC) for data verification. This allows you to ensure that the data received (or transmitted) is valid with a high level of certainty. This CRC can be generated using the following C algorithm:

```
#define CRC32_POLYNOMIAL   0xEDB88320L

/* --------------------------------------------------------------------------
Calculate a CRC value to be used by CRC calculation functions.
-------------------------------------------------------------------------- */
unsigned long CRC32Value(int i)
{
   int j;
   unsigned long ulCRC;

   ulCRC = i;
   for ( j = 8 ; j > 0; j-- )
   {
      if ( ulCRC & 1 )
         ulCRC = ( ulCRC >> 1 ) ^ CRC32_POLYNOMIAL;
      else
         ulCRC >>= 1;
   }
   return ulCRC;
}

/* --------------------------------------------------------------------------
Calculates the CRC-32 of a block of data all at once
-------------------------------------------------------------------------- */
unsigned long CalculateBlockCRC32(
   unsigned long ulCount,     /* Number of bytes in the data block */
   unsigned char *ucBuffer ) /* Data block */
{
   unsigned long ulTemp1;
   unsigned long ulTemp2;
   unsigned long ulCRC = 0;

   while ( ulCount-- != 0 )
   {
      ulTemp1 = ( ulCRC >> 8 ) & 0x00FFFFFFL;
      ulTemp2 = CRC32Value( ((int) ulCRC ^ *ucBuffer++ ) & 0xff );
      ulCRC = ulTemp1 ^ ulTemp2;
   }
   return( ulCRC );
}
```

5.3 Functional Listing of Logs

The following tables list the logs by function.

Table 32: Measurement Data Logs

Log	Description
ALLSQMIB	Contains SQM data for I correlators. Legacy Log.
ALLSQMQB	Contains SQM data for Q correlators. Legacy Log.
CORRDATAB	Contains correlator data for all signals.
CORRLOCATIONB	Contains correlator locations for all signals.
MEASUREMENTDATAB	Contains raw measurement data for all signals.
RANGEB	Contains raw measurement data for L1 C/A and L2 P(Y) signals. Legacy Log.
TIMESOLUTIONB	Shows the receiver time status.

Table 33: Satellite Data Logs

Log	Description
ALMANACB	Contains the validated almanac.
RAWFRAMEDATAB	Contains the raw navigation data for both GPS and SBAS signals. One log is output for each tracking channel.
RAWGPSSUBFRAMEWPB	Contains the raw GPS subframe navigation data. One log is output for each tracking channel. Legacy Log.
RAWWAASFRAMEWPB	Contains the raw SBAS frame navigation data. One log is output for each tracking channel. Legacy Log.
SATPOSB	Contains the satellite position and status information.

Table 34: Receiver Status Logs

Log	Description
AGCINFOB	Contains the AGC status information.
CARDSTATUSB	Contains the status information for the receiver cards.
ETHSTATUSB	Contains the Ethernet status.
EXCEPTIONDATAB	Contains the last recorded exception data from all cards.
FACTORYDATAB	Contains factory data for debug purposes.
RXCOMMANDSB	Contains the command parameters set by default or by command.
SOFTLOADSTATUSB	Shows the current status of the upgrade process.
VERSIONB	Contains the receiver version information.

5.4 Log Summary

The available logs are listed alphabetically in *Table 35*.

Table 35: Log Summary

Log Name	Message ID	Type	Description
AGCINFOB	4096	G-III Log	Contains the AGC status information.
ALLSQMIB	632	Legacy Log	Contains SQM data for I correlators.
ALLSQMQB	633	Legacy Log	Contains SQM data for Q correlators.
ALMANACB	4097	G-III Log	Contains the validated almanac.
CARDSTATUSB	4098	G-III Log	Contains the status information for the receiver cards.
CORRDATAB	4099	G-III Log	Contains correlator data for all signals.
CORRLOCATIONB	4100	G-III Log	Contains correlator locations for all signals.
ETHSTATUSB	4101	G-III Log	Contains the Ethernet status.
EXCEPTIONDATAB	4109	G-III Log	Contains the last recorded exception data from all cards.
FACTORYDATAB	4102	G-III Log	Contains factory data for debug purposes.
MEASUREMENTDATAB	4103	G-III Log	Contains raw measurement data for all signals.
RANGEB	43	Legacy Log	Contains raw measurement data for L1 C/A and L2 P(Y) signals.
RAWFRAMEDATAB	4104	G-III Log	Contains the raw navigation data for both GPS and SBAS signals. One log is output for each tracking channel.
RAWGPSSUBFRAMEWPB	570	Legacy Log	Contains the raw GPS subframe navigation data. One log is output for each tracking channel.
RAWWAASFRAMEWPB	571	Legacy Log	Contains the raw SBAS frame navigation data. One log is output for each tracking channel.
RXCOMMANDSB	4105	G-III Log	Contains the command parameters set by default or by command.
SATPOSB	4106	G-III Log	Contains the satellite position and status information.
SOFTLOADSTATUSB	4110	G-III Log	Shows the current status of the upgrade process.
TIMESOLUTIONB	4107	G-III Log	Shows the receiver time status.
VERSIONB	4108	G-III Log	Contains the receiver version information.

5.5 Log Reference

The following sections describe the logs available on the G-III Reference Receiver.

Some logs have repeating data sets. This is represented by a double line between fields.

5.5.1 AGCINFOB

This log contains information about the automatic gain control mechanism. All frequencies are reported in one log.

Some frequencies may be reported more than once in the AGCINFOB log.

Output states: Configuration, Operational, Maintenance

Valid trigger: ONTIME, ONCE

Frequency: Requested frequency

Message ID: 4096

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	#freq	Number of entries	Ulong	4	H
3	Agcword	AGC status word (See *Table 36, AGC Status Word* on *Page 96*)	Ulong	4	H+4
4	Reserved	Reserved	Ulong	4	H+8
5	Pulse width	VARF pulse width	Ulong	4	H+12
6	Modulus	VARF modulus	Ulong	4	H+16
7	Bin1	A/D bin 1 (%)	Double	8	H+20
8	Bin2	A/D bin 2 (%)	Double	8	H+28
9	Bin3	A/D bin 3 (%)	Double	8	H+36
10	Bin4	A/D bin 4 (%)	Double	8	H+44
11	Bin5	A/D bin 5 (%)	Double	8	H+52
12	Bin6	A/D bin 6 (%)	Double	8	H+60
13	Noise floor	Calculated noise floor	Double	8	H+68
14	Pulses blanked	Ratio of samples blanked over the previous second	Float	4	H+76
15	DC offset	A/D DC offset estimate (samples)	Long	4	H+80
16	Reserved	Reserved	Ulong	4	H+84
17	Reserved	Reserved	Ulong	4	H+88
18…	Next RF deck, offset = H+4+(#previous freq*88)				
Variable	32-bit CRC		Hex	4	H + 4 + (#freq*88)

Table 36: AGC Status Word

Bit	Description
0-3	Card ID
4-6	RF Type: 0 = L1 1 = L2 2 = L5
7	Active flag: 0 = Card is not controlling the AGC for this frequency 1 = Card is controlling the AGC for this frequency
8	Bin Skew: 0 = Bin Skew Not Present 1 = Bin Skew Present
9-10	AGC Calibrated: 0 = Coarse Calibration 1 = Fine Calibration
11-13	ADC Range: Indicates which 3 bits of the 8-bit ADC output are currently being used by the receiver: 0 = Bits 7, 6, 5 1 = Bits 7, 5, 4 2 = Bits 7, 4, 3 3 = Bits 7, 3, 2 4 = Bits 7, 2, 1 5 = Bits 7, 1, 0
14-16	Method of Noise Floor Calculation: 1 = AGC 2 = Post Correlation
17	Bin Count Overflow: A flag identifying when more than 1 bin was filled with 1023+ samples. 0 = Less than 2 bins completely filled 1 = 2+ bins completely filled
18	Railed Gain: A flag identifying when the VGA is railed high/low for 3+ consecutive seconds. 0 = VGA not railed 1 = VGA railed for 3+ seconds
19	Bins Not Full: A flag identifying when all the bins contain 1 or more but less than 1023 samples. 0 = One of more bins filled 1 = All bins not filled
20	Bins Empty: A flag identifying when all the bins are empty. 0 = Bins contain data 1 = All bins are empty
21-31	Reserved

5.5.2 ALLSQMIB

This log provides information about the I correlation function. The data is provided for all signals in one single message.

Output states: Operational

Valid trigger: ONNEW

Frequency: Once a second

Message ID: 632

Header Format: Legacy Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	header	Legacy log header		H	0
2	#svobs	Number of tracked satellite data sets to follow.	Ulong	4	H
3	prn	Satellite PRN tracked	Ulong	4	H+4
4	sigChan	Signal channel for the tracked satellite	Ulong	4	H+8
5	#accumulations	Number of accumulation values to follow.	Ulong	4	H+12
6	Asum	I Accumulation value	Long	4	H+16
Variable	Next channel data set, offset = H+4+#svobs(12+(4x#accumulations))				
Variable	32-bit CRC		Hex	4	Variable

5.5.3 ALLSQMQB

This log provides information about the Q correlation function. The data is provided for all signals in one single message.

Output states: Operational

Valid trigger: ONNEW

Frequency: Once a second

Message ID: 633

Header Format: Legacy Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	header	Legacy log header		H	0
2	#svobs	Number of tracked satellite data sets to follow.	Ulong	4	H
3	prn	Satellite PRN tracked	Ulong	4	H+4
4	sigChan	Signal channel for the tracked satellite	Ulong	4	H+8
5	#accumulations	Number of accumulation values to follow.	Ulong	4	H+12
6	Asum	Q Accumulation value	Long	4	H+16
Variable	Next channel data set, offset = H+4+#svobs(12+(4x#accumulations))				
Variable	32-bit CRC		Hex	4	Variable

5.5.4 ALMANACB

This log contains the complete and verified collected almanac from the L1 C/A GPS signal.

> If the # entries field is 0, the CRC will be output directly following the # entries field.

Output states: Operational

Valid trigger: ONNEW, ONCE

Frequency: When requested, when the almanac has changed

Message ID: 4097

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	System	System the almanac pertains to 0 = GPS	Enum	2	H
3	Reserved	Reserved	Ushort	2	H+2
4	SVused	PRN of the SV the almanac is from	Ushort	2	H+4
5	#valid	Number of almanacs used in validation	Ushort	2	H+6
6	# entries	Number of entries to follow	Ulong	4	H+8
7	PRN	PRN	Ulong	4	H+12
8	Week	Almanac reference week	Ulong	4	H+16
9	Seconds	Almanac reference time (s)	Double	8	H+20
10	Ecc	Eccentricity	Double	8	H+28
11	ωDot	Rate of right ascension, radians/second	Double	8	H+36
12	ω_o	Right ascension, radians	Double	8	H+44
13	ω	Argument of perigee, radians	Double	8	H+52
14	M_o	Mean anomaly of reference time, radians	Double	8	H+60
15	a_{fo}	Clock aging parameter, seconds	Double	8	H+68
16	a_{f1}	Clock aging parameter, seconds/second	Double	8	H+76
17	N	Corrected mean motion, radians/second	Double	8	H+84
18	A	Semi-major axis, metres	Double	8	H+92
19	Incl-angle	Angle of inclinations relative to 0.3π, radians	Double	8	H+100
20	SV config	Satellite configuration	Ulong	4	H+108
21	Health-prn	SV health from subframe 4 or 5	Ulong	4	H+112
22	Health-alm	SV health from almanac	Ulong	4	H+116
23	antispoof	Antispoofing flag where: 0=FALSE 1=TRUE	Enum	4	H+120
24…	Next almanac data set, offset = H + 12 + (#previous msgs x 112)				
Variable	32-bit CRC		Hex	4	H + 12 + (#entries x 112)

5.5.5 CARDSTATUSB

This log contains status information for the IOMaster, all DSPC cards, the RF Carrier Card, all RF Daughter Cards and the fans.

There are a total of three entries for the RFCC to report all the necessary information.

Output states: Configuration, Operational, Maintenance

Valid trigger: ONCE, ONTIME

Frequency: When requested

Message ID: 4098

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	State	Receiver operating state 0 = OFF 1 = CONFIGURATION 2 = OPERATIONAL 3 = MAINTENANCE 4 = BOOT	Ushort	2	H
3	Mode	Receiver operating mode 0 = NORMAL 1 = FAILED	Ushort	2	H+2
4	Atten setting	Software attenuator setting	Ulong	4	H+4
5	#hours	Total number of hours of power on since manufacture of IOMaster card.	Ulong	4	H+8
6	DSPC Error Signal	Bit-field indicating the current state of all DSPC error signals. The bit position corresponds to Card ID.	Ulong	4	H+12
7	#cards	Number of cards to follow.	Ulong	4	H+16
8	component	Component type 0 = UNKNOWN 1 = IOMASTER 2 = DSPC (Digital Signal Processing Card) 3 = RFCC (Radio Frequency Carrier Card) 4 = RFDC (Radio Frequency Daughter Card)	Enum	4	H+20
9	Slot ID	IOMaster = 7 DSPC = slot ID of DSPC RFCC 1 (first RFCC values) = 4 RFCC 2 (second RFCC values) = 4 RFCC 3 (third RFCC values) = 4 RFDC = 4	Ushort	2	H+24

Field	Field Name	Description	Format	# Bytes	Binary Offset
10	Module ID	Module ID of the card in the slot IOMaster = 0 DSPC = 0/1 RFCC 1 = 0 RFCC 2 = 0 RFCC 3 = 0 RFDC = 1/2/3	Ushort	2	H+26
11	Idle time	IOMaster = Idle time (%) DSPC = Idle time (%) RFCC 1 = Reserved (0) RFCC 2 = Reserved (0) RFCC 3 = Reserved (0) RFDC = Reserved (0)	Float	4	H+28
12	Value 1	IOMaster = Board temperature (^{O}C) DSPC = Board temperature (^{O}C) RFCC 1 = Board temperature (^{O}C) RFCC 2 = 2V5S0 (V) RFCC 3 = 3V3A (V) RFDC = IF temperature (^{O}C)	Float	4	H+32
13	Value 2	IOMaster = 5V0 Supply voltage (V) DSPC = 5V0 Supply voltage (V) RFCC 1 = 5V0 Supply voltage (V) RFCC 2 = 2V5S1 (V) RFCC 3 = 3V3CLK (V) RFDC = RF temperature (^{O}C)	Float	4	H+36
14	Value 3	IOMaster = 3V3 Supply voltage (V) DSPC = 3V3 Supply voltage (V) RFCC 1 = 3V3 Supply voltage (V) RFCC 2 = 2V5S2 (V) RFCC 3 = 2V5CLK (V) RFDC = 3V3 Supply voltage (V)	Float	4	H+40
15	Value 4	IOMaster = 2V5 Supply voltage (V) DSPC = 2V5 Supply voltage (V) RFCC 1 = 2V5 Supply voltage (V) RFCC 2 = 2V5S3 (V) RFCC 3 = Reserved (0) RFDC = 2V5 Supply voltage (V)	Float	4	H+44
16	Value 5	IOMaster = Reserved (0) DSPC = 2V5_S Supply voltage (V) RFCC 1 = OSC_VC (V) RFCC 2 = 2V5S4 (V) RFCC 3 = Reserved (0) RFDC = 4V5 Supply voltage (V)	Float	4	H+48
17	Value 6	IOMaster = 1V8 Supply voltage (V) DSPC = 1V8 Supply voltage (V) RFCC 1 = 3V0A (V) RFCC 2 = 2V5S5 (V) RFCC 3 = Reserved (0) RFDC = Reserved (0)	Float	4	H+52

Field	Field Name	Description	Format	# Bytes	Binary Offset
18	Value 7	IOMaster = 1V5 Supply voltage (V) DSPC = 1V5 Supply voltage (V) RFCC 1 = 1V5 Supply voltage (V) RFCC 2 = 2V5S6 (V) RFCC 3 = Reserved (0) RFDC = Reserved (0)	Float	4	H+56
19	Value 8	IOMaster = 1V2 Supply voltage (V) DSPC = 1V2 Supply voltage (V) RFCC 1 = 13V0RF (V) RFCC 2 = 2V5S7 (V) RFCC 3 = Reserved (0) RFDC = Reserved (0)	Float	4	H+60
20	Value 9	IOMaster = 1V05 Supply voltage (V) DSPC = 1V05 Supply voltage (V) RFCC 1 = 13V0RF_A (A) RFCC 2 = 2V5S8 (V) RFCC 3 = Reserved (0) RFDC = Reserved (0)	Float	4	H+64
21	Value 10	IOMaster = 0V75 Supply voltage (V) DSPC = 0V75 Supply voltage (V) RFCC 1 = 9V0A (V) RFCC 2 = 2V5S9 (V) RFCC 3 = Reserved (0) RFDC = Reserved (0)	Float	4	H+68
22	warning word	Warning status word For information about the warning status word, see: *Table 37, IOMaster Warning Status Word* on *Page 103* *Table 38, DSPC Warning Status Word* on *Page 104* *Table 39, RFCC Warning Status Word* on *Page 105* *Table 40, RFDC Warning Status Word* on *Page 105*	Ulong	4	H+72
23	error word	Error status word For information about the error status word, see: *Table 41, IOMaster Error Status Word* on *Page 106* *Table 42, DSPC Error Status Word* on *Page 107* *Table 43, RFCC Error Status Word* on *Page 108* *Table 44, RFDC Error Status Word* on *Page 108*	Ulong	4	H+76
	Next entry, offset = H+20 + (# previous cards * 60)				
24	#fans	Number of fans to follow.	Ulong	4	H + 20 + (#cards * 60)
25	Fan speed	Speed of fan (rpm)	Ushort	2	H+20 + (#cards * 60) +4

Field	Field Name	Description	Format	# Bytes	Binary Offset
26	Fan failed	0 = Okay 1 = Failed	Ushort	2	H+20 + (#cards * 60) +6
	Next entry, offset = H+20 + (#cards * 60) + 4 + (#previous fans * 4)				
variable	32-bit CRC		Hex	4	H+20 + (#cards * 60) + 4 + (#previous fans * 4)

Table 37: IOMaster Warning Status Word

Nibble	Bit #	Description
N_0	0	Reserved (0)
	1	Reserved (0)
	2	Reserved (0)
	3	Reserved (0)
N_1	4	Reserved (0)
	5	NVM test warning
	6	Temperature monitor communications test warning
	7	Voltage monitor communications test warning
N_2	8	CPU usage warning
	9	Internal communication warning
	10	External communication warning
	11	Stack usage warning
N_3	12	Reserved (0)
	13	Reserved (0)
	14	Reserved (0)
	15	Reserved (0)
N_4	16	Temperature warning test failed
	17	Voltage warning test failed
	18	Fans warning test failed
	19	Reserved (0)

Table 37: IOMaster Warning Status Word

Nibble	Bit #	Description
N_5	20	Reserved (0)
	21	Reserved (0)
	22	Reserved (0)
	23	Reserved (0)
N_6 - N_7	24 - 31	Reserved (0)

Table 38: DSPC Warning Status Word

Nibble	Bit #	Description
N_0	0	Reserved (0)
	1	Reserved (0)
	2	Reserved (0)
	3	Reserved (0)
N_1	4	Reserved (0)
	5	Reserved (0)
	6	Temperature monitor communications test warning
	7	Voltage monitor communications test warning
N_2	8	CPU usage warning
	9	Internal communication warning
	10	Reserved (0)
	11	Stack usage warning
N_3	12	ADC test warning
	13	Reserved (0)
	14	Reserved (0)
	15	Reserved (0)
N_4	16	Temperature warning test failed
	17	Voltage warning test failed
	18	Reserved (0)
	19	Reserved (0)
N_5 - N_7	20 -31	Reserved (0)

Table 39: RFCC Warning Status Word

Nibble	Bit #	Description
N_0	0	PLL lock test warning
	1	Reserved (0)
	2	Reserved (0)
	3	Reserved (0)
N_1	4	Reserved (0)
	5	Reserved (0)
	6	Temperature monitor communications test warning
	7	Voltage monitor communications test warning
N_2	8	Reserved (0)
	9	Reserved (0)
	10	Reserved (0)
	11	Reserved (0)
N_3	12	Reserved (0)
	13	Reserved (0)
	14	Reserved (0)
	15	Reserved (0)
N_4	16	Temperature warning test failed
	17	Voltage warning test failed
	18	Reserved (0)
	19	Reserved (0)
N_5 - N_7	20 - 31	Reserved (0)

Table 40: RFDC Warning Status Word

Nibble	Bit #	Description
N_0	0	PLL lock test warning
	1	Reserved (0)
	2	Reserved (0)
	3	Reserved (0)
N_1	4	Reserved (0)
	5	Reserved (0)
	6	Temperature monitor communications test warning
	7	Voltage monitor communications test warning

Table 40: RFDC Warning Status Word (continued)

Nibble	Bit #	Description
N_2	8-11	Reserved (0)
N_3	12-15	Reserved (0)
N_4	16	Temperature warning test failed
	17	Voltage warning test failed
	18	Reserved (0)
	19	Reserved (0)
N_5 - N_7	20-31	Reserved (0)

Table 41: IOMaster Error Status Word

Nibble	Bit #	Description
N_0	0	Reserved (0)
	1	Reserved (0)
	2	Reserved (0)
	3	Operational SW CRC integrity test failed
N_1	4	RF carrier card test failed
	5	NVM test failed
	6	Temperature monitor communications test failed
	7	Voltage monitor communications test failed
N_2	8	CPU test failed
	9	Internal communication test failed
	10	External communication test failed
	11	Reserved (0)
N_3	12	Reserved (0)
	13	Reserved (0)
	14	Reserved (0)
	15	Reserved (0)
N_4	16	Temperature error test failed
	17	Voltage error test failed
	18	Fans error test failed
	19	Receiver configuration failed
N_5 - N_7	20 - 31	Reserved (0)

Table 42: DSPC Error Status Word

Nibble	Bit #	Description
N_0	0	Reserved (0)
	1	Reserved (0)
	2	Reserved (0)
	3	Operational SW CRC integrity test failed
N_1	4	Reserved (0)
	5	NVM test failed
	6	Temperature monitor communications test failed
	7	Voltage monitor communications test failed
N_2	8	CPU test failed
	9	Internal communication test failed
	10	Reserved (0)
	11	Reserved (0)
N_3	12	ADC test failed
	13	ADC lock test failed
	14	MINOS test failed
	15	FPGA test failed
N_4	16	Temperature error test failed
	17	Voltage error test failed
	18	Reserved (0)
	19	Reserved (0)
N_5 - N_7	20 - 31	Reserved (0)

Table 43: RFCC Error Status Word

Nibble	Bit #	Description
N_0	0 - 3	Reserved (0)
N_1	4 - 7	Reserved (0)
N_2	8 - 11	Reserved (0)
N_3	12	Reserved (0)
	13	Reserved (0)
	14	Reserved (0)
	15	FPGA test failed

Table 43: RFCC Error Status Word (continued)

Nibble	Bit #	Description
N_4	16	Temperature error test failed
	17	Voltage error test failed
	18	Reserved (0)
	19	Reserved (0)
N_5 - N_7	20 - 31	Reserved (0)

Table 44: RFDC Error Status Word

Nibble	Bit #	Description
N_0	0-3	Reserved (0)
N_1	4-7	Reserved (0)
N_2	8-11	Reserved (0)
N_3	12-15	Reserved (0)
N_4	16	Temperature error test failed
	17	Voltage error test failed
	18	Reserved (0)
	19	Reserved (0)
N_5 - N_7	20-31	Reserved (0)

5.5.6 CORRDATAB

This log contains the correlator data for each corresponding correlator location.

Output states: Operational

Valid trigger: ONCE, ONTIME

Frequency: Once a second

Message ID: 4099

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	# entries	Number of entries to follow	Ulong	4	H
3	prn	PRN tracked on the HW channel	Ushort	2	H+4
4	signal type	Signal type 0 = L1 C/A GPS 1 = L2 P(Y) 2 = L1 C 3 = L2 C 4 = L5 GPS 5 = L1 C/A SBAS 6 = L5 SBAS	Ushort	2	H+6
5	sigChan	Signal channel reported	Ushort	2	H+8
6	HWchan	Hardware channel number	Ushort	2	H+10
7	MS	Milliseconds of accumulation	Ulong	4	H+12
8	#bins	Number of repeating entries to follow (an I/Q pair is one bin)	Ulong	4	H+16
9	Bin value I	Inphase correlation value	Long	4	H+20
10	Bin value Q	Quadrature correlation value	Long	4	H+24
11…	Next entry, offset = H+4+(#previous entries*(16 + # bins * 8))				
variable	32-bit CRC		Hex	4	H + 4 + (#entries * (16 + #bins * 8))

5.5.7 CORRLOCATIONB

This log contains the correlator location information for each hardware channel.

Output states: Configuration, Operational, Maintenance

Valid trigger: ONCE, ONTIME, ONNEW

Frequency: When requested

Message ID: 4100

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	# entries	Number of entries to follow	Ulong	4	H
3	sigChan	Signal channel reported	Ulong	4	H+4
4	#locations	Number of repeating entries to follow	Ulong	4	H+8
5	location	Location of correlator	Float	4	H+12
6…	Next entry, offset = H+4+(#previous entries*(8 + # locations * 4))				
variable	32-bit CRC		Hex	4	H + 4 + (#entries * (8 + # locations * 4))

5.5.8 ETHSTATUSB

This log returns the status of the G-III Reference Receiver Ethernet ports.

Output states: Configuration, Operational, Maintenance

Valid trigger: ONTIME, ONCE

Frequency: Requested frequency

Message ID: 4101

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	Num	Number of records to follow	Ulong	4	H
3	Interface	Ethernet interface 0 = ETHA 1 = ETHB	Enum	4	H+4
4	MAC	MAC address of port. Set to "xx:xx:xx:xx:xx:xx" if there is an error reading the value.	Char	18	H+8
5	Reserved	Reserved	Ushort	2	H+26
6	Details	Ethernet port connection details. 1 = Not Connected 2 = 10Mbps/Full Duplex 3 = 10Mbps/Half Duplex 4 = 100Mbps/Full Duplex 5 = 100Mbps/Half Duplex Defaults to 0 if there is an error reading the value.	Enum	4	H+28
7..	Next entry, offset = H+4+(#previous entries*28)				
variable	32-bit CRC		Hex	4	H + 4 + (#entries *28)

5.5.9 EXCEPTIONDATAB

This log contains the last recorded exception data from all cards. One log is generated for every card.

The content of the data in this log is for the manufacturer's use only, and as such, more detailed information is not provided in this document.

If there is no exception data stored in non-volatile memory, this log is not output and an error message is returned.

Output states: Configuration, Operational, Maintenance

Valid trigger: ONCE

Frequency: When requested

Message ID: 4109

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	Card ID	Card Identification The card from which the exception data in this log is taken.	Ulong	4	H
3	NumCards	Number of cards on the G-III Reference Receiver with exception data. This indicates the number of logs that will be generated.	Ulong	4	H+4
4	DataPresent	Indicates if there is exception data present in flash memory at startup. TRUE = there is exception data present FALSE = there is no exception data present	BOOL	4	H+8
5	DataDeleted	Indicates if the exception data was successfully deleted after the CLEAREXCEPTIONDATA command was called. TRUE = the exception data was successfully deleted FALSE = the exception data was not successfully deleted If the card did not have any exception data when CLEAREXCEPTIONDATA was called, then this field is set to TRUE.	BOOL	4	H+12
6	DataCorrupted	Indicates if the exception data written in flash is corrupted. TRUE = exception data is corrupted FALSE = exception data is not corrupted	BOOL	4	H+16
7	Exception Data	The exception data for this card.	Uchar[10240]	10240	H+20
8	32-bit CRC		Hex	4	H+10260

5.5.10 FACTORYDATAB

This log contains debug information for the IOMaster and all DSPC cards.

The contents of this log is manufacturer's data used for debug purposes and is for manufacturer's use only. As such, more detailed information is not provided in this document.

Output states: Configuration, Operational, Maintenance

Valid trigger: ONCE, ONTIME

Frequency: When requested

Message ID: 4102

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	# cards	Number of entries to follow	Ulong	4	H
3	Data	Manufacturer's data	Uchar[512]	512	H+4
4…	Next entry, offset = H+4+(#previous cards*512)				
variable	32-bit CRC		Hex	4	H + 4 + (#cards * 512)

5.5.11 MEASUREMENTDATAB

This log contains the channel measurements. One log is output containing all the information for all the signal channels. The measurement data is grouped by SV channel.

Output states: Operational

Valid trigger: ONTIME, ONCE

Frequency: Requested frequency

Message ID: 4103

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	header	G-III log header		H	0
2	#obs	Number of data sets to follow	Ulong	4	H
3	prn	Satellite PRN tracked	Ushort	2	H+4
4	svChan	SV channel	Ushort	2	H+6
5	sigChan	Signal channel	Ushort	2	H+8
6	HWchan	Hardware channel number	Ushort	2	H+10
7	Tracktype	Indicates tracking type data See *Table 45, Tracking Type Data* on *Page 115*	Ulong	4	H+12
8	Psr	Pseudorange measurement (m)	Double	8	H+16
9	Psr std	Pseudorange measurement standard deviation (m)	Float	4	H+24
10	adr	Accumulated Doppler range (cycles)	Double	8	H+28
11	Adr std	Carrier phase standard deviation (cycles)	Float	4	H+36
12	Dopp	Instantaneous Doppler frequency (Hz)	Float	4	H+40
13	C/No[a]	Carrier to noise density ratio (dB-Hz)	Float	4	H+44
14	Reserved	Reserved	Ulong	4	H+48
15	Reserved	Reserved	Ulong	4	H+52
16	Locktime	Number of seconds of continuous tracking	Double	8	H+56
17	Channel status	Channel tracking status See *Table 46, Channel Tracking Status* on *Page 116*	Ulong	4	H+64
18…	Next data set, offset = H + 4 + (#previous obs x 64)				
variable	32-bit CRC		Hex	4	H + 4 + (#obs x 64)

a. The C/No reported in this log is computed from the tracking component only.

Table 45: Tracking Type Data

Nibble	Bit #	Description	Range Value
N_0	0	Signal Type	0 = L1 C/A GPS 1 = L2 P(Y) 2 = L1 C 3 = L2 C 4 = L5 GPS 5 = L1 C/A SBAS 6 = L5 SBAS
	1		
	2		
	3		
N_1	4		
	5		
	6		
	7		
N_2	8	Component type/code type	0 = I 1 = Q 2 = CL 3 = CM 4 = D 5 = P 6 = L2 P 7 = L2 Y
	9		
	10		
	11		
N_3	12	Non Standard Code	0 = false 1 = true
	13	Correlator Spacing	0 = 0.1 chips 1 = 0.3 chips 2 = 1.0 chips
	14		
	15		
N_4 - N_7	16-31	Reserved	

Table 46: Channel Tracking Status

Nibble	Bit #	Description	Range Value
N_0	0	Tracking state	0 = idle 1 = coarsesearch 2 = coarsesearchcont 3 = coarsepullin 4 = coarsealign 5 = coarsefdll 6 = directedstart 7 = directedsearch 8 = directedfpdll 9 = pdll
	1		
	2		
	3		
N_1	4		
	5		
	6		
	7		
N_2	8	Measurement data valid (set to true once the navigation data is first framed)	0 = false 1 = true
	9	Channel assignment	0 = auto 1 = forced
	10	PLL high BW used	0 = false 1 = true
	11	PLL dynamic changed	0 = false 1 = true
N_3	12	Half cycle applied	0 = false 1 = true
	13-15	Reserved	
N_4 - N_7	16-31	Reserved	

5.5.12 RANGEB

This log contains the channel measurements. One log is output containing all the information for each tracked L1 C/A GPS, L1 C/A SBAS, and L2 P(Y) GPS signal. The measurement data is grouped by SV channel.

Output states: Operational

Valid trigger: ONTIME, ONCE

Frequency: Requested frequency

Message ID: 43

Header Format: Legacy Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	header	Legacy log header		H	0
2	#obs	Number of data sets to follow	Ulong	4	H
3	prn	Satellite PRN tracked	Ushort	2	H+4
4	Reserved	Reserved	Ushort	2	H+6
5	Psr	Pseudorange measurement (m)	Double	8	H+8
6	Psr std	Pseudorange measurement standard deviation (m)	Float	4	H+16
7	adr	Carrier phase in cycles (accumulated Doppler range)	Double	8	H+20
8	adr std	Carrier phase standard deviation (cycles)	Float	4	H+28
9	Dopp	Instantaneous Doppler frequency (Hz)	Float	4	H+32
10	C/No	Carrier to noise density ratio (dB-Hz)	Float	4	H+36
11	Locktime	Number of seconds of continuous tracking	Float	4	H+40
12	Channel status	Channel tracking status (see *Table 47, Channel Tracking Status* on *Page 118*)	Ulong	4	H+44
13…	Next data set, offset = H + 4 + (#previous obs x 44)				
Variable	32-bit CRC		Hex	4	H + 4 + (#obs x 44)

Table 47: Channel Tracking Status

Nibble	Bit #	Mask	Description	Range Value
N_0	0	0x0000001F	Tracking State	0 = C/A idle 1 = C/A sky search 2 = C/A wide frequency band pull-in 3 = C/A narrow frequency band pull-in 4 = C/A phase-lock loop 5 = C/A reacquisition 6 = C/A steering 7 = C/A frequency lock-loop 8 = P(Y) idle 9 = P(Y) P-code alignment 10 = P(Y) search 11 = P(Y) phase-lock loop
	1			
	2			
	3			
N_1	4			
	5	0x000003E0	SV channel number	0 - 25
	6			
	7			
N_2	8			
	9			
	10	0x00000400	Phase lock flag	0 = not locked 1 = locked
	11	0x00000800	Measurement data valid (set to true once the navigation data is first framed)	0 = false 1 = true
N_3	12	0x00001000	Code locked flag	0 = not locked 1 = locked
	13	0x0000E000	Reserved	
	14			
	15			
N_4	16	0x00070000	Satellite system	0 = GPS 2 = GEO
	17			
	18			
	19	0x00080000	Reserved	
N_5	20	0x00100000	Grouping	0 = not grouped 1 = grouped
	21	0x00600000	Frequency	0 = L1 1 = L2
	22			
	23	0x03800000	Code Type	0 = C/A 1 = P 2 = P codeless
N_6	24			
	25			
	26	0x7C000000	Reserved	
	27			
N_7	28			
	29			
	30			
	31	0x80000000	Channel assignment	0 = automatic 1 = forced

5.5.13 RAWFRAMEDATAB

This log contains the raw frame or subframe navigation data for all GPS and SBAS signals except for L2 P(Y). One log is output for each tracked signal.

Output states: Operational

Valid trigger: ONNEW

Frequency: When a frame or subframe has been decoded

Message ID: 4104

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	header	G-III log header		H	0
2	sigChan	Signal channel this frame was decoded on	Ushort	2	H
3	HWchan	Hardware channel this frame was decoded on	Ushort	2	H+2
4	prn	Satellite PRN tracked	Ushort	2	H+4
5	signal type	Signal type 0 = L1 C/A GPS 1 = L2 P(Y) 2 = L1 C 3 = L2 C 4 = L5 GPS 5 = L1 C/A SBAS 6 = L5 SBAS	Ushort	2	H+6
6	reserved	Reserved	Ushort	2	H+8
7	parity status	Parity status word See *Table 48, Parity Status* on *Page 121*	Ushort	2	H+10
8	#parity failures	Number of subframes that had parity failures since steady-state tracking	Ulong	4	H+12
9	#bits in frame	Number of bits in frame/subframe	Ulong	4	H+16
10	#bytes	Number of bytes to follow	Ulong	4	H+20
11	Data	Raw frame/subframe data	Hex [variable]	Variable[a]	H+24
12	32-bit CRC		Hex	4	Variable

a. Additional bytes of padding may be added to maintain 4 byte alignment. Padding bytes will be included in the #bytes count. For L1C messages padding bytes are added after each subframe so that each subframe begins on a 4 bytes boundary for a total of 928 bits (116 bytes).

Table 48: Parity Status

Nibble	Bit #	Description	Range Value
N_0	0	Parity/CRC check status	0 = Parity passed 1 = Parity failed 2 = Parity not checked
	1		
	2	Framing status	0 = Framed 1 = Not framed
	3	Reserved	
N_1	4	CRC status of L1C subframe 1	0 = Parity passed
	5		
	6	CRC status of L1C subframe 2	0 = Parity passed 1 = Parity failed
	7		
N_2	8	CRC status of L1C subframe 3	0 = Parity passed 1 = Parity failed
	9		
	10-11	Reserved	
N_3	12-15	Reserved	

5.5.14 RAWGPSSUBFRAMEWPB

This log contains the raw L1 C/A GPS 300-bit subframes. One log is output for each tracked L1 C/A GPS signal regardless of parity failures.

Output states: Operational

Valid trigger: ONNEW

Frequency: Once every 6 seconds

Message ID: 570

Header Format: Legacy Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	header	Legacy log header		H	0
2	Channel	Signal channel this frame was decoded on	Ulong	4	H
3	prn	Satellite PRN tracked	Ulong	4	H+4
4	#parity failures	Number of subframes that had parity failures since steady-state tracking	Ulong	4	H+8
5	Data	Raw subframe data	Hex[38]	40[a]	H+12
6	32-bit CRC		Hex	4	H+52

a. An additional 2 bytes of padding is added to maintain 4 byte alignment

5.5.15 RAWWAASFRAMEWPB

This log contains the raw L1 C/A SBAS 250-bit frames. One log is output for each tracked L1 C/A SBAS signal regardless of parity failures.

Output states: Operational

Valid trigger: ONNEW

Frequency: Once every second

Message ID: 571

Header Format: Legacy Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	header	Log header		H	0
2	Channel	Signal channel this frame was decoded on	Ulong	4	H
3	prn	Satellite PRN tracked	Ulong	4	H+4
4	parity flag	Parity failure flag	Ulong	4	H+8
5	Data	Raw SBAS frame data	Hex[32]	32	H+12
6	32-bit CRC		Hex	4	H+44

5.5.16 RXCOMMANDSB

This log contains the current receiver configuration parameters set either by default or by user issued commands. Each command may be included multiple times since they configure different signal types.

The command field is output as ASCII text.
The header and CRC are in binary format.
There is a null between each command output.
For the NSCODE command, the nonstandard field is not output in the RXCOMMANDS log.

Output states: Configuration, Operational, Maintenance

Valid trigger: ONCE, ONTIME

Frequency: When requested

Message ID: 4105

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	# com	Number of entries to follow	Ulong	4	H
3	Command	The command and its parameters	ASCII string	variable	H+4
4	32 bit CRC		Hex	4	variable

Table 49: Commands Included in RXCOMMANDSB Log

Commands
AGCMODE
ANTENNAPOWER
ASSIGN
CHANCONFIG
CORRSPACING
DLLBW
ECUTOFF
ETHCONFIG
FIX
ICOMCONFIG
IPCONFIG
LOG
NSCODE
PLLDYNAMIC
PULSEBLANKING
RFATTEN
RFIFTEMP
SETSBASPREAMBLE
THRESHOLD
TRACKMODE
TRACKTYPE

5.5.17 SATPOSB

This log contains the calculated satellite position, elevation angles, azimuth angles and calculated Dopplers for all GPS satellites. The accuracy of the data is dependent on the accuracy of the input position since the G-III Reference Receiver does not calculate its own position.

The satellite position is in WGS84 ECEF coordinates.

Output states: Operational

Valid trigger: ONCE, ONTIME

Frequency: Requested frequency

Message ID: 4106

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	System	System the log pertains to 0 = GPS	Enum	4	H
3	Sat vis	Indicates if the satellite visibility is valid.	Bool	4	H+4
4	Comp alm	Indicates if the entries in the log are computed from the almanac. TRUE = all data in the log is computed from the almanac FALSE = all data in the log is computed from the ephemeris.	Bool	4	H+8
5	# entries	Number of entries to follow	Ulong	4	H+12
6	PRN	GPS PRN	Ushort	2	H+16
7	Reserved	Reserved	Ushort	2	H+18
8	EphemValidity	Validity of the ephemeris data: 0 = Data is valid 1 = Data available but health status is all 1s 2 = No data available	Ushort	2	H+20
9	AlmValidity	Validity of almanac data: 0 = Data is valid 1 = Data available but health status is all 1s 2 = No data available	Ushort	2	H+22
10	EphemHealth	Health status from the ephemeris	Ulong	4	H+24
11	EphemElevation	Elevation angle from the ephemeris (degrees)[a]	Float	4	H+28
12	EphemAzimuth	Azimuth angle from the ephemeris (degrees)[b]	Float	4	H+32
13	EphemDop	Geometric Doppler from the ephemeris (Hz)	Float	4	H+36
14	AlmHealth	Health status from the almanac	Ulong	4	H+40
15	AlmElevation	Elevation angle from the almanac (degrees)[a]	Float	4	H+44
16	AlmAzimuth	Azimuth angle from the almanac (degrees)[b]	Float	4	H+48
17	AlmDop	Geometric Doppler from the almanac (Hz)	Float	4	H+52

Field	Field Name	Description	Format	# Bytes	Binary Offset
18…	Next data set, offset = H + 16 + (#previous entries x 40)				
variable	32-bit CRC		Hex	4	H + 16 + (#entries x 40)

a. The Elevation will be set to -100 (default) if it is not computed.
b. The Azimuth angle will be set to -1000 (default) if it is not computed.

5.5.18 SOFTLOADSTATUSB

This log returns current status of the software upgrade process. It is used only when upgrading the G-III Reference Receiver firmware.

Output states: Configuration, Operational, Maintenance

Valid trigger: ONCE, ONNEW, ONTIME

Frequency: Once per second

Message ID: 4110

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	Status	Current status of the upgrade process. See *Table 50, SOFTLOADSTATUSB Status Values* on *Page 127*	Ulong	4	H
3	32-bit CRC		Hex	4	H+4

Table 50: SOFTLOADSTATUSB Status Values

Value	Name	Description
1	NOT_STARTED	Process has not begun.
3	READY_FOR_DATA	Ready to receive data.
4	DATA_VERIFIED	Data saved to flash has passed CRC.
5	WRITING_FLASH	Storing data to flash.
6	WROTE_FLASH	Data stored in flash.
8	COMPLETE	Upgrade complete.
9	VERIFYING_DATA	Verifying the data stored in flash.
10	ERASING_FLASH	Erasing the flash.
12	MULTIPLE_IMAGES_IN_FLASH	Multiple application images have been found in flash.
Note: Any status >= 16 is an error code		
19	BAD_PLATFORM	This data cannot be loaded onto this platform.
20	BAD_MODULE	The data cannot be loaded into the APP NVM block.
29	BAD_IMAGE_CRC	CRC of the received image has failed.
30	IMAGE_OVERSIZE	The received image is too large to store in flash.
32	BAD_FLASH_ERASE	Erasing of flash failed.
33	BAD_FLASH_WRITE	Writing of flash failed.

5.5.19 TIMESOLUTIONB

This log outputs the information about the receiver clock offset and the results of the TRAIM calculations.

Output states: Operational

Valid trigger: ONTIME, ONCE

Frequency: When requested

Message ID: 4107

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	header	G-III log header		H	0
2	ClockModel	Status of the clock model 0 = Not Computed 1 = Computed	Enum	2	H
3	Signal Type	The signal type from which the clock model was computed. 0 = L1 C/A GPS 65535 = Unknown (not computed)	Enum	2	H+2
4	Clock offset	Receiver clock offset (µs)	Double	8	H+4
5	Offset std	Receiver clock offset standard deviation (µs)	Double	8	H+12
6	Clock drift	Receiver clock drift (µs/s)	Double	8	H+20
7	Reserved	Reserved	Ulong	4	H+28
8	#channels	Number channels	Ulong	4	H+32
9	svChan	SV channel	Ushort	2	H+36
10	sigChan	Signal channel	Ushort	2	H+38
11	PRN	Satellite PRN	Ushort	2	H+40
12	Reserved	Reserved	Ushort	2	H+42
13	TRAIM status	Time solution status word See *Table 51, TRAIM Status* on *Page 129*	Ulong	4	H+44
14	Residual	TRAIM residual (m)	Float	4	H+48
15	SVclockoffset	Calculated satellite clock offset from ephemeris (m)	Float	4	H+52
16	IonoCorr	Ionospheric correction to range residual (m)	Float	4	H+56
17	TropoCorr	Tropospheric correction to range residual (m)	Float	4	H+60
18	Sv pos X	Satellite position from ephemeris X coordinate (m)	Double	8	H+64
19	Sv pos Y	Satellite position from ephemeris Y coordinate (m)	Double	8	H+72
20	Sv pos Z	Satellite position from ephemeris Z coordinate (m)	Double	8	H+80
21…	Next data set, offset = H + 36 + (#previous channels x 52)				
Variable	32-bit CRC		Hex	4	H + 36 + (#channels x 52)

Table 51: TRAIM Status

Nibble	Bit #	Description	Range Value
N_0	0[a]	Residual could not be computed or was excluded from the clock offset computation	0 = false 1 = true
	1	No solution was computed (too few satellites or the solution failed an integrity check)	0 = false 1 = true
	2	Residual exceeds TRAIM threshold	0 = false 1 = true
	3	No ephemeris model is available	0 = false 1 = true
N_1	4	Ephemeris health status contains 1s	0 = false 1 = true
	5	Almanac health status contains 1s	0 = false 1 = true
	6	Satellite is below the minimum elevation	0 = false 1 = true
	7	No valid measurement is available	0 = false 1 = true
N_2	8	C/No is below the minimum threshold	0 = false 1 = true
	9	Reserved	
	10	Channel is tracking on a non-standard code	0 = false 1 = true
	11	Reserved	
N_3 - N_7	12-31	Reserved	

a. If bit 0 is cleared, the residual was used to attempt to compute the clock offset.
If bit 0 is set, one or more of bits 3-31 are set indicating the reason(s) the residual was excluded from the clock solution.
Bit 0 is not set at the same time as bits 1 or 2.

5.5.20 VERSIONB

This log contains the hardware and software version information for all cards in the receiver. One log will contain information on all cards.

Not all fields will be filled for all component types.

Output states: Configuration, Operational, Maintenance

Valid trigger: ONCE, ONTIME

Frequency: When requested

Message ID: 4108

Header Format: G-III Log

Field	Field Name	Description	Format	# Bytes	Binary Offset
1	Header	G-III log header		H	0
2	# comp	Number of component entries to follow	Ulong	4	H
3	component	Component type 0 = UNKNOWN 1 = IOMASTER 2 = DSPC 3 = RF CARRIER CARD (RFCC) 4 = RF DAUGHTER CARD (RFDC)	Enum	4	H+4
4	Slot ID	Slot ID IOMaster = 7 DSPC = slot ID of DSPC RFCC/RFDC = 4	Ushort	2	H+8
5	Module ID	Module ID of the card in the slot IOMaster = 0 DSPC = 0/1 RFCC = 0 RFDC = 1/2/3	Ushort	2	H+10
6	psn	Product serial number	Char[16]	16	H+12
7	hw version	Hardware version	Char[16]	16	H+28
8	sw version	Software version	Char[16]	16	H+44
9	pbc version	Primary boot code software version	Char[16]	16	H+60
10	sbc version	Secondary boot code software version (if applicable)	Char[16]	16	H+76
11	fpga version	FPGA version (if applicable)	Char[16]	16	H+92
12	comp date	Firmware compile date	Char[12]	12	H+108
13	comp time	Firmware compile time	Char[12]	12	H+120
14	fw info tag	Firmware information tag	Char[64]	64	H+132
15	pbc info tag	Primary boot code information tag	Char[20]	20	H+196
16	sbc info tag	Secondary boot code information tag	Char[20]	20	H+216
17…	Next component, offset = H + 4 + (#previous comp x 232)				

Field	Field Name	Description	Format	# Bytes	Binary Offset
Variable	32-bit CRC		Hex	4	H + 4 + (#comp x 232)

Chapter 6 Firmware Updates

The G-III Reference Receiver firmware is stored in on-board, non-volatile memory, which allows the receiver's firmware to be updated in the field.

Below is an outline of the procedure for updating your receiver's firmware:

1. Contact NovAtel at support@novatel.com
2. Download update files
3. Decompress files
4. Load the updates onto the G-III Reference Receiver

6.1 Contact NovAtel

The first step in updating the receiver is to contact NovAtel through any of the methods shown in *Customer Service* on *Page 9*.

When you call, ensure that you have the version available. You can get the version by requesting the VERSIONB log.

The necessary files are generally provided in a compressed file format, so you will also be given a file decompression password. The update files are available from NovAtel by FTP, e-mail, or storage media.

6.2 Download the Files

To proceed with your update, you will first need to download the appropriate files from NovAtel's FTP site at ftp.novatel.ca, or via e-mail at support@novatel.com. If downloading is not possible, the files can be mailed to you on storage media.

The files are available in compressed, password-protected file format. NovAtel advises you of the exact filenames you need. As well, you are given a file de-compression password.

6.3 Decompress the Files

After copying the compressed files to an appropriate directory on your computer, the file must be decompressed. The syntax for decompression is as follows:

```
[filename][password]
```

where filename is the name of the compressed file (but not including the .EXE extension) and password is the password required to allow decompression.

The self-extracting archive then generates the following file:

WhatsNew.txt	Information on the changes made in the firmware since the last revision
XXXX.hex	Firmware version update file where XXXX = firmware version string (for example AW3MM0001AN0000.hex)

6.4 Update the G-III Reference Receiver Firmware

There are two ways to perform a software update on the G-III Reference Receiver, either through Ethernet using the softload protocol or through COM port serial loading using WinLoad. It is not necessary to do both.

6.4.1 Serial Port Loading using WinLoad

Follow these steps to load the G-III Reference Receiver using a computer and NovAtel's COTS program Winload.

1. Connect the MAINTENANCE port on the G-III Reference Receiver to a COM port on the computer using an RS-232 serial cable.
2. Open WinLoad.
3. Click **File** | **File Open** and browse to the executable object code .hex file. This selects the file that will be loaded.
4. Click **Settings** | **Com Settings** to choose the com port settings. Select the appropriate COM port, select the highest supported baud rate for the download baud rate (typically 115200 bps via a computer port, but could be higher if using a device such as an EdgePort) and select 9600 for the connect baud rate. Click **OK**.
5. Disconnect power from the G-III Reference Receiver.
6. Click **Write Flash** to start the loading process.
7. Restore power to the G-III Reference Receiver. WinLoad searches for a specified period for the receiver. If the receiver is not found, confirm the COM settings are correct and the receiver is connected, then start again.
8. The loading process begins. If prompted for an auth code, click **Skip**.
9. When the loading process completes, the receiver should automatically reboot.

6.4.2 Ethernet Softload Protocol

Use the following procedure to update the firmware using the softload protocol:

1. Connect the DATA port on the G-III Reference Receiver to an Ethernet port on the computer using an Ethernet cable.
2. Transition the G-III Reference Receiver to the Maintenance state.

   ```
   CHANGESTATE MAINTENANCE
   ```

3. Capture SOFTLOADSTATUSB logs as follows:

   ```
   LOG SOFTLOADSTATUSB ONNEW
   ```

   For information about the SOFTLOADSTATUSB log, see *SOFTLOADSTATUSB* on *Page 127*.
4. Start the software load process by executing the following command.

   ```
   SOFTLOADRESET
   ```

5. Load the contents of the firmware update file (XXXX.hex) into a RAM buffer on the G-III Reference Receiver. The contents of the firmware update file are loaded using a script or utility created to load all of the individual S-Records contained in the hex file. For information about how to create this script or utility, see *Script Basics for Loading the Firmware Update File* on *Page 135*.

6. After the contents of the firmware update file has been transferred to RAM, use the SOFTLOADCOMMIT command to verify the integrity of the firmware and write the firmware to non-volatile flash storage by executing the following command.

   `SOFTLOADCOMMIT`

   The receiver writes the new image to the empty firmware image block, leaving the currently active and running image unchanged in the receiver flash storage. The process of verifying and storing can take several minutes. The `SOFTLOADCOMMIT` command returns a response immediately and then processes the firmware image. The SOFTLOADSTATUSB log will report an error if an error occurred at or after the SOFTLOADCOMMIT stage (e.g. problem with the application image).

7. Wait for the Commit operation to complete. When the SOFTLOADSTATUSB reports `WROTE_FLASH`, the SOFTLOADCOMMIT has completed.

8. Reset the G-III Reference Receiver to start using the new firmware by executing the following command.

   `RESET`

   The receiver will check the integrity of the image after SOFTLOADCOMMIT. If there is a CRC checksum failure (i.e. SOFTLOADSTATUSB reports `BAD_IMAGE_CRC`), the G-III Reference Receiver will not switch to the new firmware, but will continue to use the old firmware. Repeat the upgrade procedure.

9. Only one firmware image can be resident on the system when the G-III Reference Receiver is in Operational mode. Enter the following commands to erase the old firmware before proceeding to the Operational state.

   ```
   CHANGESTATE MAINTENANCE

   LOG SOFTLOADSTATUSB ONNEW

   SOFTLOADFINALIZE
   ```

   The process of erasing the old firmware can take several minutes. The `SOFTLOADFINALIZE` command returns a response immediately and then erases the flash.

10. Wait for the Erase operation to complete. When the SOFTLOADSTATUSB reports `COMPLETE`, the SOFTLOADFINALIZE has completed. Otherwise, it will report `BAD_FLASH_ERASE` and the procedure should be attempted again.

11. Reset the G-III Reference Receiver to exit from the Maintenance state and restart the system with only a single firmware image by executing the following command.

    `RESET`

12. Capture a VERSIONB log to verify the firmware version has changed:

    `LOG VERSIONB`

6.4.2.1 Script Basics for Loading the Firmware Update File

The firmware update file contains all of the programming code that constitutes the new release of G-III Reference Receiver firmware. This file is in ASCII hexadecimal and uses a modified implementation of the S-Record format.

The example below shows a small S-Record format file.

```
S0~P~G3IOM
S0~D~G3IOM
S0~V~AW3MM0000RN0000
S0~T~APP
S31D0000000006E0A6E1010000002800000048000800000001CE001001CE3
S31D00000018500000000D0344D00710040107A18512D4733494F4D000000F9
S31D000000300000000000000000415050000000000000000000000000000D1
S50000
S70000
```

Each line within an S-Record format file is an individual S-Record.

To update the G-III Reference Receiver, all of the S-Records in the firmware update file must be loaded onto the G-III Reference Receiver using the SOFTLOADSREC command. The SOFTLOADSREC command can be used to load a single S-Record or multiple S-Records. The following shows an example of loading the small S-Record file above using a SOFTLOADSREC command for each S-Record:

```
SOFTLOADSREC S0~P~G3IOM
SOFTLOADSREC S0~D~G3IOM
SOFTLOADSREC S0~V~AW3MM0000RN0000
SOFTLOADSREC S0~T~APP
SOFTLOADSREC S31D0000000006E0A6E1010000002800000048000800000001CE001001CE3
SOFTLOADSREC S31D00000018500000000D0344D00710040107A18512D4733494F4D000000F9
SOFTLOADSREC S31D000000300000000000000000415050000000000000000000000000000D1
SOFTLOADSREC S50000
SOFTLOADSREC S70000
```

The following shows an example of loading the small S-Record file using a SOFTLOADSREC command with all of the S-Records in the file (there should only be one carriage return at the end and not between S-Records):

```
SOFTLOADSREC S0~P~G3IOMS0~D~G3IOMS0~V~AW3MM0000RN0000S0~T~APPS31D0000000006E0A6E10100000
028000000480008000000001CE001001CE3S31D00000018500000000D0344D00710040107A18512D4733494F4
D000000F9S31D000000300000000000000000415050000000000000000000000000000D1S50000S70000
```

The S-Record examples used in this chapter are extremely small files that could be manually loaded using the command line. However, due to large number of S-Records in the firmware update file, it is not practical to manually load the file from the command line. To improve speed and accuracy, a script is required to load all of the S-Records in the firmware update file.

The basic structure of this script is:

1. Open the firmware update hex file.
2. Read the first line of the hex file. Ensure a carriage return is at the end of the line.
3. Use the contents of the line read to create a SOFTLOADSREC command.
4. Send the SOFTLOADSREC command to the G-III Reference Receiver through the Data port (J02).
5. Verify that the receiver has responded with `<OK`.
6. Read the next line of the hex file. Ensure a carriage return is at the end of the line.
7. Use the contents of the line read to create a SOFTLOADSREC command.

8. Send the SOFTLOADSREC command to the G-III Reference Receiver through the Data port (J02).
9. Verify that the receiver has responded with <OK.
10. Repeat steps 6 to 9 until all of the S-Records in the hex file have been read and sent to the G-III Reference Receiver.
11. Close the firmware update hex file.

A script should be created in a text editor and then run using Python or another similar utility. An example Python script is shown below. The DataPortIP, UDPPort, and SWFileName may need to be updated before executing the script to reflect the receiver configuration and file name of the .hex file. Note that using this sample script with a 13 MB .hex file will take approximately 2 minutes.

```
import socket
import time

# Default G-III IP address and UDP Port
DataPortIP = '192.168.0.10'
UDPPort = 3000

# File name of the .hex file to load one SREC at a time.
SWFileName = 'AW3MM0000RN0000.hex'

# Create the UDP socket to connect to the G-III
s = socket.socket( socket.AF_INET, socket.SOCK_DGRAM )

# Default IP address and UDP port to connect to the G-III
s.connect((DataPortIP, UDPPort))

# Set the timeout to 1 second to receive data
s.settimeout(1)

# Variable to hold the SOFTLOADSREC command to be sent to the G-III
scmd = ''

# Variable to hold the response from the receiver
response = ''

# Variable to detect loading failures
LoadingFailure = False

# Print message to screen
print 'Softloading G-III.  Please wait...'

# Open the G-III SW .hex file, read in one line at a time
with open(SWFileName, 'r') as hexSWfile:
   for line in hexSWfile:

      if LoadingFailure == True:
         print "Loading Failure."
         break

      # Prepare the SREC line to be sent
      scmd = 'SOFTLOADSREC ' + line
```

```
            # Send the SREC line
            s.send(scmd)

            # Wait for receiver response before sending next SREC line
            while 1:
               try:
                  response += s.recv(2048)

                  # Verify receiver accepts SRECORD
                  if '<OK' in response:
                     break

               except socket.timeout:
                  LoadingFailure = True
                  break
               except:
                  LoadingFailure = True
                  raise

            scmd = ''
            response = ''

      s.close()
```

Appendix A Technical Specifications

Table 52: Performance Specifications

PERFORMANCE	
ALL VALUES SUBJECT TO GPS SYSTEM CHARACTERISTICS	
Frequency	L1 (1575.42 MHz) L2 (1227.6 MHz) L5 (1176.45 MHz)
Codes Tracked	L1 C/A GPS L1C L2C L2 P(Y) L5 GPS L1-C/A SBAS L5 SBAS GPS SVN (PRN 1-63) GEO SVN (PRN 120-158)
Satellite Tracking Channels	Simultaneous tracking of up to 18 GPS satellites and up to 8 SBAS satellites
Pseudorange Measurement Accuracy **L1 C/A GPS** **L1C** **L2 P(Y)** **L2C** **L5 GPS** **L1 C/A SBAS** **L5 SBAS**	 10 cm RMS, C/No > 44 dB-Hz, DLL BW = 0.05 Hz 7 cm RMS, C/No > 44 dB-Hz, DLL BW = 0.05 Hz 50 cm RMS, C/No > 38 dB-Hz, DLL BW = 0.05 Hz 28 cm RMS, C/No > 44 dB-Hz, DLL BW = 0.05 Hz 5 cm RMS, C/No > 44 dB-Hz, DLL BW = 0.05 Hz 10 cm RMS, C/No > 44 dB-Hz, DLL BW = 0.05 Hz 4 cm RMS, C/No > 44 dB-Hz, DLL BW = 0.05 Hz
Single Channel Phase Accuracy **L1 C/A** **L1C** **L2 P(Y)** **L2C** **L5**	 3 mm RMS, C/No > 44 dB-Hz, PLL BW = 3 Hz 3 mm RMS, C/No > 44 dB-Hz, PLL BW = 3 Hz 5 mm RMS, C/No > 38 dB-Hz, PLL BW = 0.2 Hz 3 mm RMS, C/No > 44 dB-Hz, PLL BW = 3 Hz 3 mm RMS, C/No > 44 dB-Hz, PLL BW = 3 Hz
C/No Accuracy **L1 C/A** **L1C** **L2C** **L5** **L2 P(Y)**	 ±2 dB, 30-60 dB-Hz ±2 dB, 30-60 dB-Hz ±2 dB, 30-60 dB-Hz ±2 dB, 30-60 dB-Hz ±4 dB, 34-54 dB-Hz ±8 dB, 28-34 dB-Hz
Raw Data Availability Rate **Pseudorange, ADR and SQM** **Time**	 Once per second Once per second
Re-acquisition **L1 C/A, L2C, L5** **L2 P(Y)**	 45 seconds C/No = 44 dB-Hz average 45 seconds C/No = 38 dB-Hz average

Table 53: Physical Specifications

PHYSICAL	
Size (WxHxD)	482.2 x 266.4 x 486.5 mm (with the 19” mounting brackets)
Weight	12.6 kg (27.5 lb.)
MECHANICAL DRAWINGS	

Figure 9: G-III Reference Receiver Dimensions

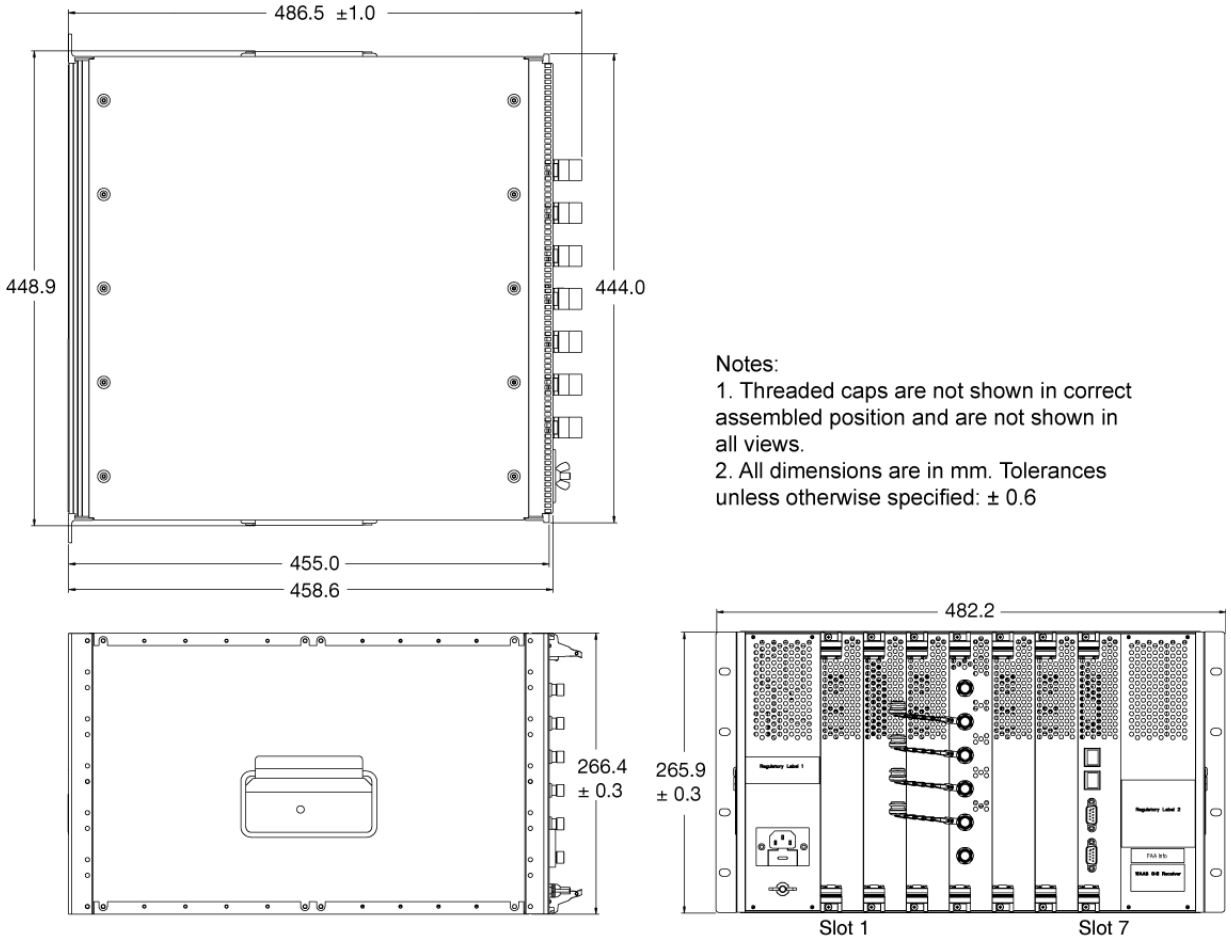


Table 54: Environmental Specifications

ENVIRONMENTAL	
Temperature, Operating	+12.7°C to +29.5°C
Temperature, Degraded	-25°C to +12.7°C and +29.5°C to +55°C
Temperature, Storage	-40°C to +85°C
Maximum Temperature Gradient	2°C/hour
Humidity, Operating and Degraded	10% - 80%[a]
Humidity, Storage	0% - 100%[a b]
Air Flow	1 m^3 / minute
Altitude, Operating and Degraded	-90 to 3,000 metres [c]
Altitude, Storage	0 to 5000 metres
Vibration, Operating and Degraded	MIL-STD-810, method 514.6, Procedure I, General Vibration[d]
Vibration Storage	MIL-STD-810, method 514.6-9, Procedure II, Loose Cargo Transportation[e]

a. Above 40°C, the relative humidity should be based on a dew point of 40°C.
b. Includes condensation due to temperature changes.
c. May operate above 3,000 m in a controlled environment, however is not certified as such
d. 0.21 g (rms) of random vibration applied to each axis (x, y, z); 5 - 350 Hz with Power Spectral Density (PSD) of 0.0001g^2/Hz; 350 - 500 Hz with slope of -6 dB/Oct and PSD of 0.0001g^2/Hz; 500 Hz with PSD of 0.00005g^2/Hz.
e. Severity; 25.4 mm P-P circular synchronous motion, at 5 Hz frequency. Duration: 45 minutes (each 20 minutes equivalent to 240 km of transportation).

Table 55: Port Specifications

J01 (POWER INPUT)	
Connector	IEC C14
Voltage	120/240 VAC ~ 50/60 Hz
Power Consumption	< 150 Watts
J02 DATA	
Connector	RJ-45
Media	100BaseTX
Standard	IEEE 802.3
J03 MON	
Connector	RJ-45
Media	100BaseTX
Standard	IEEE 802.3

J05 MAINT	
Connector	DE9P
Baud Rate	115200 bps
Standard	RS-232C
J06 10 MHZ IN	
See Table 56 on page 142 for specifications on the external frequency reference.	
Connector	TNC female
Capture Range	10 MHz ± 1Hz
Sensitivity	0 dBm to +17 dBm into 50 Ω
J07 10 MHZ OUT	
Connector	TNC female
Output	10 MHz reference signal within ±3 dB of 10 MHz input (J06)
J09 1 PPS OUT	
Connector	TNC female
Output Level **Frequency** **Pulse Width** **Polarity** **Fall Time (90% to 10%)** **Rise Time (10% to 90%)** **Voltage (high)** **Voltage (low)** **Nominal Load Impedance**	 1 Hz 1 ms ±25 ns Active high pulse < 5 ns < 5 ns > 2.4 VDC < 0.55 VDC 50 Ω
J10 RF1 OUT	
Connector	TNC female
RF Output	L1, L2 and L5 signals received from RF1 IN port (J11) This signal is attenuated by the value set on the software adjustable attenuator.
ANTENNA INPUT (J11 RF1 IN)	
Connector	TNC female
RF Input Frequencies	L1(1575.42 MHz), L2 (1227.6 MHz), L5 (1176.45 MHz)
Power	11.7 VDC to 14.0 VDC <250 mA <100 mV (p-p) ripple

Table 56: Recommended External Frequency Reference Specifications

EXTERNAL FREQUENCY REFERENCE	
Connector	TNC female
Frequency	10 MHz, ±1 Hz
Short-Term Stability (Allen Variance)	≤ 2×10^{-11} / 1 second
Accuracy Over Operating Temperature Range	± 5×10^{-12}
RF Output Power	0 to +17 dBm into 50 Ω
Output Waveform **Harmonics** **Spurious**	Sine wave ≤ -40 dBc ≤ -80 dBc
Phase Noise **at 10 Hz** **at 100 Hz** **at 1 kHz**	 ≤ -120 dBc/Hz ≤ -140 dBc/Hz ≤ -150 dBc/Hz

Table 57: Channel Configuration

SV CHANNEL	SIGNAL CHANNEL	SV TYPE	SIGNAL TYPE	SKY SEARCH
0	0, 18, 36, 62, 80	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
1	1, 19, 37, 63, 81	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
2	2, 20, 38, 64, 82	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
3	3, 21, 39, 65, 83	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
4	4, 22, 40, 66, 84	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
5	5, 23, 41, 67, 85	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
6	6, 24, 42, 68, 86	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
7	7, 25, 43, 69, 87	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
8	8, 26, 44, 70, 88	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
9	9, 27, 45, 71, 89	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
10	10, 28, 46, 72, 90	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
11	11, 29, 47, 73, 91	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
12	12, 30, 48, 74, 92	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
13	13, 31, 49, 75, 93	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
14	14, 32, 50, 76, 94	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
15	15, 33, 51, 77, 95	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
16	16, 34, 52, 78, 96	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
17	17, 35, 53, 79, 97	GPS	L1 C/A GPS, L2 P(Y), L2C, L1C, L5 GPS	Auto
18	54	WAAS	L1 C/A SBAS	Idle
19	55	WAAS	L1 C/A SBAS	Idle
20	56	WAAS	L1 C/A SBAS	Idle
21	57	WAAS	L1 C/A SBAS	Idle
22	58	WAAS	L1 C/A SBAS	Idle
23	59	WAAS	L1 C/A SBAS	Idle
24	60	WAAS	L1 C/A SBAS	Idle
25	61	WAAS	L1 C/A SBAS	Idle
26	98	WAAS	L5 SBAS	Idle
27	99	WAAS	L5 SBAS	Idle
28	100	WAAS	L5 SBAS	Idle
29	101	WAAS	L5 SBAS	Idle
30	102	WAAS	L5 SBAS	Idle
31	103	WAAS	L5 SBAS	Idle
32	104	WAAS	L5 SBAS	Idle
33	105	WAAS	L5 SBAS	Idle

Appendix B Standards/References

For copies of the GPS Interface Control Documents, go to: http://www.gps.gov/technical/icwg.

This information is subject to change.