HOLUX GR-213U

GPS Receiver

User's Guide

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1. Introduction

1.1 Overview

HOLUX **GR-213U Smart GPS Receiver** is a total solution GPS receiver, designed based on SiRF Star III Architecture. This positioning application meets strict needs such as car navigation, mapping, surveying, security, agriculture and so on. Only clear view of sky and certain power supply are necessary to the unit. It communicates with other electronic utilities via compatible dual-channel through USB interface and saves critical satellite data by built–in backup memory. With low power consumption, the **GR-213U** tracks up to 20 satellites at a time, re-acquires satellite signals in 100 ms and updates position data every second. Trickle-Power allows the unit operates a fraction of the time and Push-to-Fix permits user to have a quick position fix even though the receiver usually stays off.

1.2 Features

The GR-213U provides a host of features that make it easy for integration and use.

1. SiRFstarIII chipset with embedded ARM7TDMI CPU available for customized applications in firmware
2. High performance receiver tracks up to 20 satellites while providing first fast fix and low power consumption.
3. Compact design ideal for applications with minimal space.
4. A rechargeable battery sustains internal clock and memory. The battery is recharged during normal operation.
5. Users can adjust power-saving percentage (20%~80%), which achieves the best power efficiency.
6. User initialization is not required.
7. LED display status: The LED provides users visible positioning status. LED “ON” when power connected and “BLINKING” when GR-213U got positioned.
8. Water proof design for industry standard.

1.3 Technology specifications

1.3.1 Physical Dimension

Single construction integrated antenna/receiver.
Size: 64.5 x 42 x 17.8 (mm)
2.54" x 1.65 x 0.7 (Inch).

1.3.2 Environmental Characteristics

1) Operating temperature: -40°C to +80°C(internal temperature).
2) Storage temperature: -45°C to +100°C.

1.3.3 Electrical Characteristics

1) Input voltage: +4.5 ~ 5.5 VDC without accessories.
2) Backup power: 3V Rechargeable Lithium cell battery, up to 500 hours discharge.

1.3.4 Performance

1) Tracks up to 20 satellites.
2) Update rate: 1 second.
3) Acquisition time

Reacquisition	0.1 sec., averaged
Hot start	8 sec., averaged
Warm start	38 sec., averaged
Cold start	42 sec., averaged

4) Position accuracy:
A) Non DGPS (Differential GPS)

Position	5-25 meter CEP without SA
Velocity	0.1 meters/second, without SA
Time	1 microsecond synchronized GPS time

B) EGNOS/WAAS/Beacon
Position < 2.2 meters, horizontal 95% of time
< 5 meters, vertical 95% of time

5) Dynamic Conditions:

Altitude	18,000	meters (60,000 feet) max
Velocity	515	meters / second (700 knots) max
Acceleration	4 G, max	
Jerk	20	meters/second, max

1.3.5 USB Interfaces

1) USB interface with user selectable baud rate (4800-Default, 9600, 19200, 38400).
2) NMEA 0183 Version 2.2 ASCII output GGA, GSA, GSV, RMC (option GLL, VTG, ZDA).
3) SiRF binary protocol.

2. Operational characteristics

2.1 Initialization

As soon as the initial self-test is complete, the GR-213U begins the process of satellite acquisition and tracking automatically. Under normal circumstances, it takes approximately 42 seconds to achieve a position fix, 38 seconds if ephemeris data is known. After a position fix has been calculated, information about valid position, velocity and time is transmitted over the output channel.

The GR-213U utilizes initial data, such as last stored position, date, time and satellite orbital data, to achieve maximum acquisition performance. If significant inaccuracy exists in the initial data, or the orbital data is obsolete, it may take more time to achieve a navigation solution. The GR-213U Auto-locate feature is capable of automatically determining a navigation solution without intervention from the host system. However, acquisition performance can be improved as the host system initializes the GR-213U in the following situation:

1) Moving further than 500 kilometers.
2) Failure of data storage due to the inactive internal memory battery.

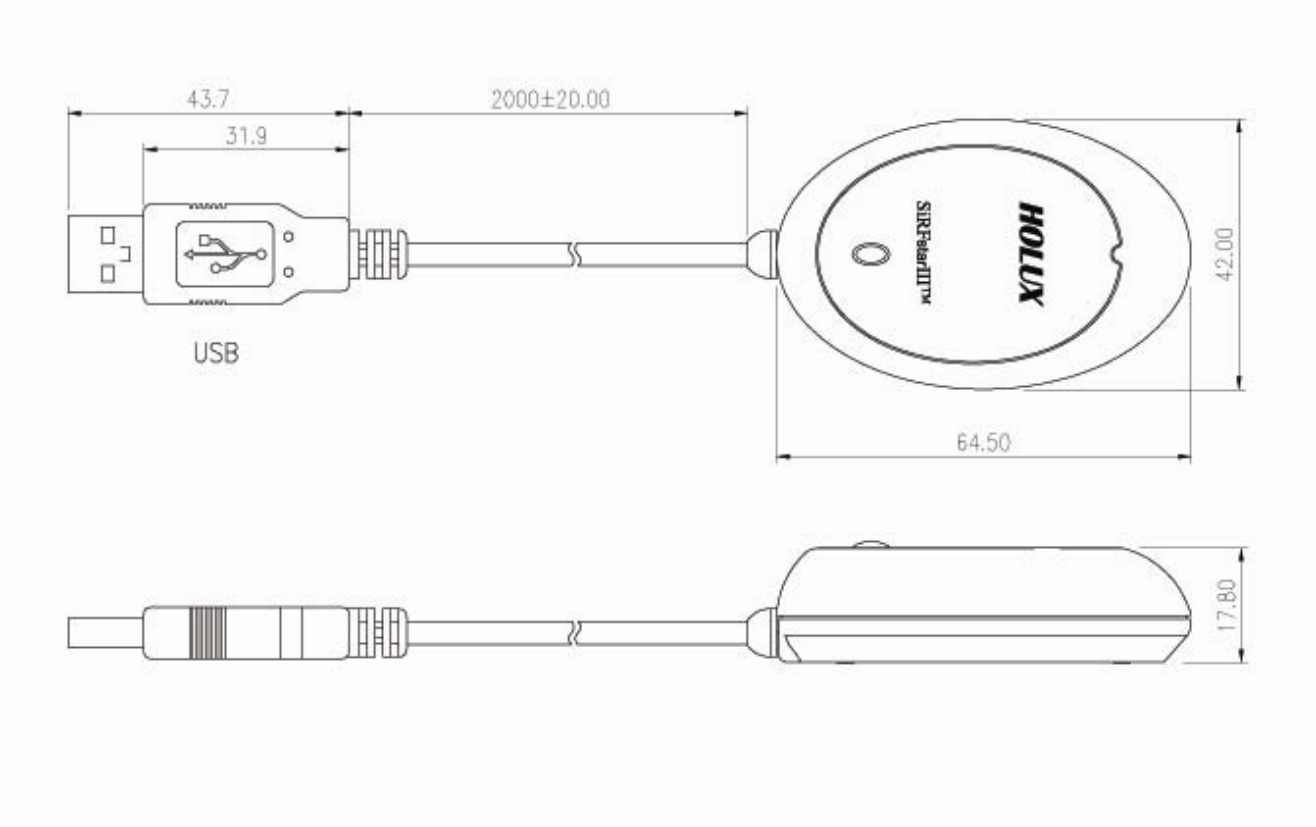
2.2 Navigation

After the acquisition process is complete, the GR-213U sends valid navigation information over output channels. These data include:

1) Latitude/longitude/altitude
2) Velocity
3) Date/time
4) Error estimates
5) Satellite and receiver status

3. Hardware interface

3.1 Dimension

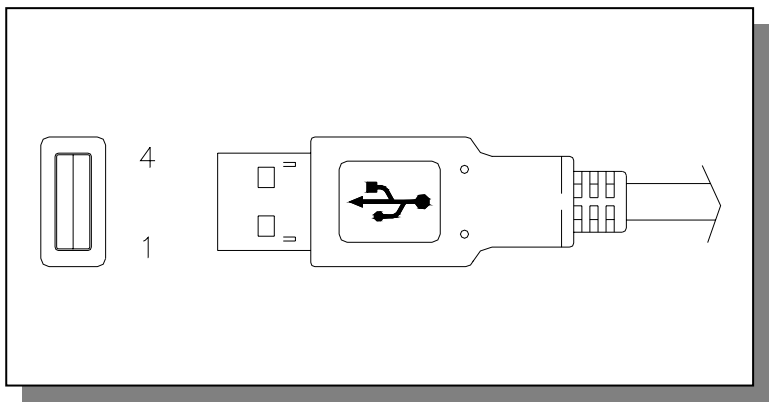


3.2 Hardware Connection

1) The GR-213U includes an antenna in a unique style waterproof gadget. With the USB connector, you can easily access to your notebook PC, or other USB devices.

2) USB connector

The USB A Type is equipped with GR-213U. The function definition is as follows:



Pin	Signal Name
1	+5V
2	D +
3	D -
4	Ground

4. USB Driver

4.1 System Requirements

IBM, Pentium compatible PC and above.
16 MB memory and above
Windows 98/Me/2000/XP;
VGA Graphic Adapter.

4.2 Installation

1. Copy the ＜GR-213U->English->USB Driver->Win98_2k_XP＞USB-V2.1.0.exe from CD to hard disk.
2. Install USB-V2.1.0.exe.
3. Plug the GR-213U USB connector into the computer, the computer will search plug and play (P&P) device automatically, and the installation of GR-213U USB Driver is complete.

4.3 Important

Verify the COM port # to start using your own navigating software.
1. Click **<Start>** menu, select **<Settings>,** then enter <**Control Panel>.**
2. After entering **<Control Panel>**, select **<System>.**
3. Select **<Device Manager>.**
4. Find the **<Connect port>** and check the Virtual COM Port, which was created by the USB driver, Please note that the Virtual COM Port number might be different from every computer. Before using navigating software, please confirm the COM Port numbers created by your computer and provided by your navigation software. Otherwise, the navigating software won't receive the satellite signal, because of the un-match COM Port setting.
   "#" sign represents the COM port number that being created by USB port. Usually the value will be COM1 in normal navigation software. So the correct COM port of the navigation software needs to be the same as the one in PC that created by USB port, and then the navigation is able to receive correct data.

5. Software Interface

The GR-213U interface protocol is based on the National Marine Electronics Association's NMEA 0183 ASCⅡ interface specification, which is defined in NMEA 0183, Version 2.2 and the Radio Technical Commission for Maritime Services (RTCM Recommended Standards For Differential Navstar GPS Service, Version 2.1, RTCM Special Committee No.104, Type 1,2,9) or **WAAS** (in **USA area**) or **EGNOS** (in **European area**).

5.1 NMEA Transmitted Messages

The GR-213U supported by SiRF Technology Inc. also outputs data in NMEA-0183 format as defined by the National Marine Electronics Association (NMEA), Standard.

The default communication parameters for NMEA output are 4800 baud, 8 data bits, stop bit, and no parity.

Table 5-1 NMEA-0183 Output Messages

NMEA Record	Description
GPGGA	Global positioning system fixed data
GPGLL	Geographic position- latitude/longitude
GPGSA	GNSS DOP and active satellites
GPGSV	GNSS satellites in view
GPRMC	Recommended minimum specific GNSS data
GPVTG	Course over ground and ground speed

5.1.1 Global Positioning System Fix Data (GGA)

Table 5-2 contains the values for the following example:

$GPGGA,161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M, , , ,0000*18

Table 5-2 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	161229.487		hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 5-3
Satellites Used	07		Range 0 to 20
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	Meters	
Units	M	Meters	
Geoid Separation		Meters	
Units	M	Meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR> <LF>			End of message termination

Table 5-3 Position Fix Indicator

Value	Description
0	0 Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3	GPS PPS Mode, fix valid

5.1.2 Geographic Position with Latitude/Longitude(GLL)

Table 5-4 contains the values for the following example:

$GPGLL,3723.2475,N,12158.3416,W,161229.487,A*2C

Table 5-4 GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N/S Indicator N N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Checksum	*2C		
<CR> <LF>			End of message termination

5.1.3 GNSS DOP and Active Satellites (GSA)

Table 5-5 contains the values for the following example:

$GPGSA,A,3,07,02,26,27,09,04,15, , , , , ,1.8,1.0,1.5*33

Table 5-5 GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 5-6
Mode 2	3		See Table 5-7
Satellite Used(1)	07		Sv on Channel 1
Satellite Used (1)	02		Sv on Channel 2
……			….
Satellite Used			Sv on Channel 20
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*33		
<CR> <LF>			End of message termination

1. Satellite used in solution.

Table 5-6 Mode 1

Value	Description
M	Manual—forced to operate in 2D or 3D mode
A	2DAutomatic—allowed to automatically switch 2D/3D

Table 5-7 Mode 2

Value	Description
1	Fix Not Available
2	2D
3	3D

5.1.4 GNSS Satellites in View (GSV)

Table 5-8 contains the values for the following example:

$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42*71
$GPGSV,2,2,07,09,23,313,42,04,19,159,41,15,12,041,42*41

Table 5-8 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages	2		Range 1 to 3
Message Number	1		Range 1 to 3
Satellites in View	07		Range 1 to 12
Satellite ID	07		Channel 1 (Range 1 to 32)
Elevation	79	degrees	Channel 1 (Maximum 90)
Azimuth	048	degrees	Channel 1 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
....	....		
Satellite ID	27		Channel 4 (Range 1 to 32)
Elevation	27	degrees	Channel 4 (Maximum 90)
Azimuth	138	degrees	Channel 4 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
Checksum	*71		
<CR> <LF>			End of message termination

NOTE: Items <4>,<5>,<6> and <7> repeat for each satellite in view to a maximum of four (4) satellites per sentence. Additional satellites in view information must be sent in subsequent sentences. These fields will be null if unused.

5.1.5 Recommended Minimum Specific GNSS Data (RMC)

Table 5-9 contains the values for the following example:

$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598, ,*10

Table 5-9 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation (1)		degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

1. SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

5.1.6 Course Over Ground and Ground Speed (VTG)

Table 5-10 contains the values for the following example:

$GPVTG,309.62,T, ,M,0.13,N,0.2,K*6E

Table 5-10 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	309.62	degrees	Measured heading
Reference	T		True
Course		degrees	Measured heading
Reference	M		Magnetic (1)
Speed	0.13	knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Checksum	*6E		
<CR> <LF>			End of message termination

1. SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

5.1.7 ZDA—SiRF Timing Message

Outputs the time associated with the current 1 PPS pulse. Each message will be output within a few hundred ms after the 1 PPS pulse is output and will tell the time of the pulse that just occurred.

Table 5-11 contains the values for the following example:

$GPZDA,181813,14,10,2003,00,00*4F

Table 5-11 ZDA Data Format

Name	Example	Units	Description
Message ID	$GPZDA		ZDA protocol header
UTC Time	181813		Either using valid IONO/UTC or estimated from default leap seconds
Day	14		01 TO 31
Month	10		01 TO 12
Year	2003		1980 to 2079
Local zone hour	00	knots	Offset from UTC (set to 00)
Local zone hour	00		Offset from UTC (set to 00)
Checksum	4F		
<CR> <LF>			End of message termination

6. Warranty

The GR-213U is warranted to be free from defects in material and functions for one year from the date of purchase. Any failure of this product within this period under normal conditions will be replaced at no charge to the customers.