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0. Quick Use

0.1 Check GPS Package

0.1.1 Standard Package

GPS-6021-X6 (GPS Receiver) + CD + Warranty Card + quick installation reference.

0.1.2 Optional Package

The shop may bundle different accessories for you as follows:

1. Active Antenna

2. PCMCIA Adapter

3. PDA Holder

4. Software (Navigation Software + Digital Map)

5. Others

0.2 Check CF Card Slot

1. The GPS-6021-X6 is a Type I CF device. Many new PDAs are equipped with Type II CF slot. Make sure to slot in properly to avoid damage.

2. When you connect GPS-6021-X6 with your PC (Webpad PC, Tablet PC, Laptop PC or other PCs) with PCMCIA adapter, you need to point to an installation file included in the CD.

0.3 Connect GPS-6021-X6 to your machine.

0.4 Turn on your machine.

0.5 Start GPS function

You may need to execute navigation software, then link to GPS device. Your GPS-6021-X6 starts to

provide you full GPS function.

1. Introduction

1.1 Overview

The SPK GPS-6021-X6 High Sensitivity CF GPS Receiver is a total solution GPS receiver, designed

based on SiRF Star II Architecture with the newest high sensitivity system. This revolutionary system

provides you unbelievable positioning sensitivity allowing you to have easy position fix in urban canyon

conditions. 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 RS-232 and saves critical

satellite data by built–in backup memory. With low power consumption, the GPS-6021-X6 tracks up to 12

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 GPS-6021-X6 provides a host of features that make it easy for integration and use.

1. SiRF Star II chipset with embedded ARM7TDMI CPU available for customized applications in firmware.

2. High performance receiver tracks up to 12 satellites while providing first fast fix and low power consumption.

3. Differential capability utilizes real-time RTCM corrections producing 1-5 meter position accuracy.

4. Compact design ideal for applications with minimal space.

5. A rechargeable battery sustains internal clock and memory. It is recharged during normal operation.

6. User initialization is not required.

7. Dual communication channels and user selectable baud rates allow maximum interface capability and flexibility.

8. FLASH based program memory: New software revisions upgradeable through serial interface.

9. LED display status: The LED will be “ON” when power connected.

10. Built-in WAAS / EGNOS demodulator.

11. Small size.

1.3 Technology specifications

1.3.1 Physical Dimension

Single construction integrated antenna/receiver.

Size: 83.0(H) x 47.5(W) x 14.5(D) (mm)

3.27"(H) x 1.87"(W) x 0.57"(D).

1.3.2 Environmental Characteristics

1) Operating temperature: -40oC to +85oC(internal temperature).

2) Storage temperature: -55oC to +100oC.

1.3.3 Electrical Characteristics

1) Input voltage: +2.5 ~ 5.5 VDC without accessories.

2) Backup power: 3V Rechargeable Lithium cell battery, up to 767 hours (31.9 days) discharge.

1.3.4 Performance

1) Tracks up to 12 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 45 sec., averaged

4) Position Accuracy

A) Non DGPS (Differential GPS)

Position	**5-25 meter CEP with SA off**
Velocity	**0.1 meters/second, with SA off**
Time	**1 microsecond synchronized GPS time**

B) DGPS (Differential GPS)

Position	**1 to 5 meter, typical**
Velocity	**0.05 meters/second, typical**

5) Dynamic Conditions:

Altitude	**18,000 meters (60,000 feet) max**
Velocity	**515 meters / second (1000 knots) max**

Acceleration 4 G, max

Jerk	**20 meters/second3, max**

1.3.5 Interfaces

1) Dual channel RS-232 level, with user selectable baud rate (4800-Default, 9600, 19200, 38400).

2) NMEA 0183 Version 2.2 ASCII output (GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG).

3) Real-time Differential Correction input (RTCM SC-104 message types 1, 5 and 9).

4) SiRF protocol.

2. Operational characteristics

2.1 Initialization

As soon as the initial self-test is complete, the GPS-6021-X6 begins the process of satellite acquisition and

tracking automatically. Under normal circumstances, it takes approximately 45 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 GPS-6021-X6 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 GPS-6021-X6 Auto-locate feature is capable of automatically determining a navigation solution without intervention from the host system. However, acquisition performance can be improved when the host system initializes the GPS-6021-X6 in the following situation:

1) Moving further than 1,500 kilometers.

2) Failure of data storage due to the inactive internal memory battery.

2.2 Navigation

After the acquisition process is complete, the GPS-6021-X6 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

The GPS-6021-X6 sets the default of auto-searching for real-time differential corrections in RTCM SC-104

standard format, with the message types 1, 5, or 9. It accomplishes the satellite data to generate a differential (DGPS) solution. The host system, at its option, may also command the GPS-6021-X6 to output a position whenever a differential solution is available.

3. Hardware interface

3.1 Dimension

Size: 83.0(H) x 47.5(W) x 14.5(D) (mm)

3.27"(H) x 1.87"(W) x 0.57"(D).

3.2 Hardware Interface

The GPS-6021-X6 includes an antenna in a unique style gadget. Simply put it into a CF card slot or

insert it into PCMCIA slot through a PCMCIA adapter of any type of PC with Windows OS. The interface is

through a standard 50-pin PCMCIA connector with RS-232 level.

.3 Connector

1) Standard 50-pin CF female connector.

2) Optional active antenna female connector.

3.3.1 Function definition of CF card connector

Please download detail at http://compactflash.org/specdl1.htm

3.4 Accessories

3.4.1 Active Antenna

A-10302-M Active Antenna with 2 meter 180˚ MMCX connector

A-10305-M Active Antenna with 5 meter 180˚ MMCX connector

4. PCMCA Installation File

4.1 System Requirements

IBM, Pentium or other compatible PC, Windows 98/Me/2000.

4.2 Installation

1. Turn your PC.

2. Your PC will show new device found.

3. Indicate to the direction you store GPS-6021-X6.inf file.

4. Click “Yes”. Your PC will installation the file automatically.

Note: 1// The GPS-6021-X6.inf installation file is needed when a PCMCIA adapter used.

2// PDA does not need to install any extra file.

Appendix A Software Interface

The GPS-6021-X6 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).

A.1 NMEA Transmitted Messages

The GPS-6021-X6 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 A-1 NMEA-0183 Output Messages

NMEA Sentence	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	Coruse over ground and ground speed

A.1.1 Global Positioning System Fix Data (GGA)

Table A-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 A-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 12
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 A-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

A.1.2 Geographic Position with Latitude/Longitude (GLL)

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

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

Table A-4 GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
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
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Checksum	*2C		
<CR> <LF>			End of message termination

A.1.3 GNSS DOP and Active Satellites (GSA)

Table A-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 A-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 12
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 A-6 Mode 1

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

Table A-7 Mode 2

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

A.1.4 GNSS Satellites in View (GSV)

Table A-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 A-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.

A.1.5 Recommended Minimum Specific GNSS Data (RMC)

Table A-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 A-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.

A.1.6 Course Over Ground and Ground Speed

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

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

Table A-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.

A.2 RTCM Received Data

The default communication parameters for DGPS Input are 9600 baud, 8 data bits, stop bit, and no parity.

Position accuracy of less than 5 meters can be achieved with the GPS-6021-X6 by using Differential GPS

(DGPS) real-time pseudo-range correction data in RTCM SC-104 format, with message types 1, 5, or 9. As

using DGPS receiver with different communication parameters, GPS-6021-X6 may decode the data correctly to

generate accurate messages and save them in battery-back SRAM for later computing.

Appendix B Earth Datums & Output Setting

B.1 Earth Datums

The GPS-6021-X6 is built in earth datum with WGS84.

B.2 Setting

B.2.1 Manufacturing Default

Datum: WGS84.

Baud Rate: 4800.

Output: GGA, GSA, GSV, RMC.

B.2.2 Baud Rate and Output Sentences Setting

B.2.2.1 By SiRFdemo Program

1// Connect your GPS-6021-X6 to PC (through PCMCIA adapter)

2// Execute SiRFdemo.exe (Program is in the CD)

3// When “Data Source Setup” shows, select the port (COM 1, 2 or 3….) you used, click “OK”.

4// Click “Action”, select “Open Data Source”, Then you will see lots of sentences shows. All the sentences start with $GPxxxx. This is NMEA protocol. If you do not see these sentences, please click “View”, “Select Message”, then click “Development”. The message will appear. If it still shows nothing, then continue below steps.

5// There is a screen “Selection of Target Receiver Software” might appear, please select “SiRFstar II”.

6// Click "Action", Select "Switch to SiRF Protocol". Then you will see SiRF binary and the sentences start with #Time, shows every 4 lines and you can not see the sentences start with $GP. These sentences are for setting or viewing the GPS receiver's performance. If your software is using standard NMEA protocol, please do the following:

7// Click "Action", Select "Switch to NMEA Protocol". You will see GGA, GSV, GSA and RMC in black and the Baud Rate is 4800. These are the default we put inside the receiver. Please click "OK". Then you can use it as a standard GPS receiver. If your software uses different sentence, please choose the sentences you need.

After above actions, the new setting will be kept in SRAM. If no power supplied to GPS-6021-X6 for more

than 30 days, user must re-set again when power on.

B.2.2.2 By other SiRF based demo program . Please watch out the Internet.

Appendix C Ordering Information

C.1 Product Options

C.1.1 Standard Package

GPS-6021-X6: CF GPS with main unit, CD, Warranty card and quick reference.

C.1.2 Optional Accessories

C.1.2.1 Active Antenna

A-10302-M Active Antenna with 2 meter 180˚ MMCX connector

A-10305-M Active Antenna with 5 meter 180˚ MMCX connector

C.1.2.1 PDA Holder

1	A-2001	PDA Holder, Suction Cup, 150mm, Short Arm
2	A-2001-L	PDA Holder, Suction Cup, 150-320mm Adjustable
3	A-2002	PDA Holder, Suction Cup, 150mm, Short Arm, Magnetic Pad
4	A-2002-L	PDA Holder, Suction Cup, 320mm, Long Arm, Magnetic Pad
5	A-2005	PDA Holder, Suction Cup, 150mm, Short Arm, 4-Claw
6	A-2005-L	PDA Holder, Suction Cup, 320mm Long Arm, 4-Claw
7	A-2006	PDA Holder, Suction Cup, 150mm Short Arm, 3-Claw
8	A-2006-L	PDA Holder, Suction Cup, 150mm Long Arm, 3-Claw