HOLUX GM-82

GPS Engine Board

User's Guide

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Version 2.0

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1. Introduction

1.1 Overview

The *HOLUX* **GM-82 Engine Board** is a total solution GPS receiver, designed based on SiRF star II/LP Architecture. This positioning application meets strict needs such as car navigation, mapping, surveying, agriculture and so on. Only clear view of sky and certain power supply are necessary to the unit.

GM-82 communicates with other electronic utilities via compatible dual-channel through RS-232 or TTL and saves critical satellite data by built–in memory backup. With low power consumption, the GM-82 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 GM-82 provides a host of features that make it easy for integration and use.

- SiRF Star II/LP chipset with embedded ARM7TDMI CPU available for customized applications in firmware。
- 12 parallel satellite-tracking channels for fast acquisition and reacquisition。
- High speed signal acquisition using 1920 time/frequency search channels。
- Built-in WAAS/EGNOS Demodulator。
- Low power consumption with Advanced Trickle-Power and Push-To-Fix mode。。
- Optional Rechargeable battery for memory and RTC backup and for fast Time To First Fix(TTFF)。
- Support NMEA0183 v2.2 data protocol and SiRF binary code。
- Enhanced algorithms -SnapLock and SnapStart provide superior navigation performance in urban, canyon and foliage environments。
- For Car Navigation , Marine Navigation ,Fleet Management ,AVL and Location-Based Services , Auto Pilot ,Personal Navigation or touring devices, Tracking devices/systems and Mapping devices application。

1.3 Technology Specifications

1.3.1 Physical Dimension

1) PCB Size: 40(W) x 50(D) x 12(H) (mm)
2) Weight: 18 g

1.3.2 Environmental Characteristics

1) Operating temperature: -40^{o}C to +85^{o}C (internal temperature)
2) Storage temperature: -45^{o}C to +100^{o}C

1.3.3 Electrical Characteristics

1) Input voltage: 5.0Vdc +/-10% or 3.3Vdc +/- 10%.
2) Input current: Less than 80mA (without antenna)
3) Backup power:(optional). 3V Rechargeable Lithium cell battery, up to 1000 hours discharge.
4) MCX antenna connector: Active .

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:

Non DGPS (Differential GPS)		
Position	5~25	meter CEP
Velocity	0.1	meters/second.
Time	1	microsecond synchronized GPS time
DGPS (Differential GPS)		
Position	1 to 5	meters, typical
Velocity	0.05	meters/second, typical
EGNOS/WAAS		
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^3, max

1.3.5 Interfaces

1) Dual communication channel TTL or RS232 levels, with user selectable baud rate (4800-Default, 9600, 19200, 38400).
2) NMEA 0183 Version 2.2 ASCII output (GGA, GSA, GSV, RMC (VTG and GLL for optional)).
3) Real-time Differential Correction input (RTCM SC-104 message types 1, 2 and 9).

2. Operational characteristics

2.1 Initialization

As soon as the initial self-test is complete, the GM-82 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 GM-82 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 GM-82 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 GM-82 in the following situation:

- Moving further than 500 kilometers.
- Failure of Data storage due to the inactive internal memory battery.

2.2 Navigation

After the acquisition process is complete, the GM-82 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

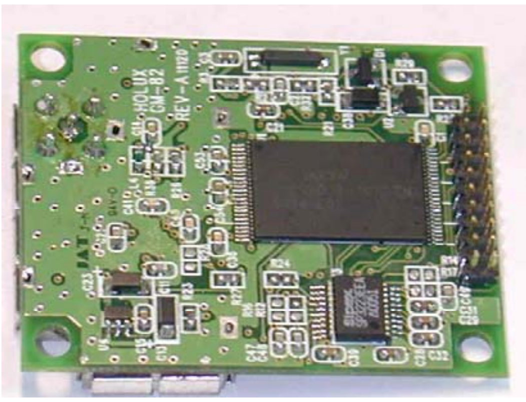
2.3 Manufacturing Default:

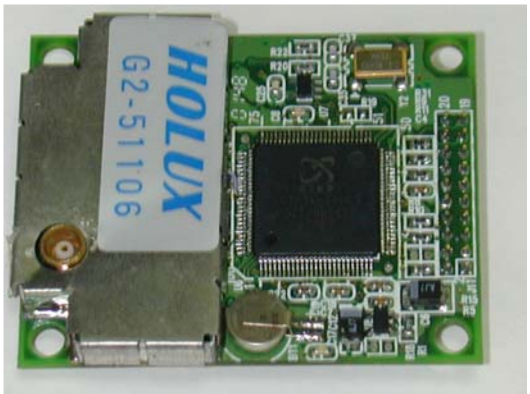
Datum: WGS84.
Baud Rate: 4800.
Output: GGA, GSA, GSV, RMC or by demand.
DGPS: RTCM SC-104(Type 1,2,9) or **WAAS** (in **USA area**) or **EGNOS** (in **European area**)

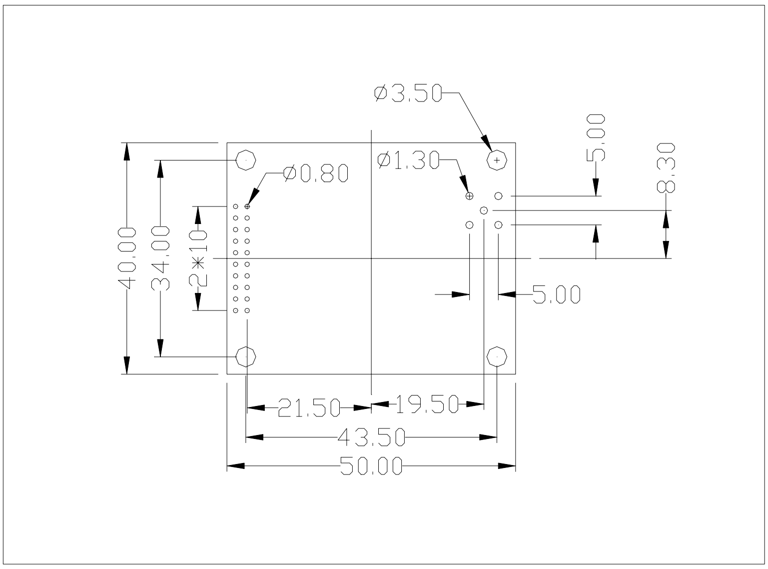
3. Hardware interface

3.1 Standard Model GM-82

GM-82-A W/ angle MCX connector and standard hole to hole dimension







J1 connector pin definition:

Pin #	Name	Description
1	NC	No function
2	***VCC_5V***	Regulated 5.0V +/-5% input power, 80mA typical.
3	***VBAT***	Battery backup input. 2.5V to 3.3V ,10uA typical.
4	***NC***	No function
5	***PBRESEN***	Manual reset input, ground to reset receiver. Leave floating for normal operation. The minimum plus width is 150 ms reset signal.
6	***GPIO1***	General purpose I/O pin 1
7	***GPIO2***	General purpose I/O pin 2
8	***GPIO3***	General purpose I/O pin 3
9	***GPIO4***	General purpose I/O pin 4
10	***GND***	Ground
11	***TXA***	Port A Serial Transmit Data GPS messages.
12	***RXA***	Port A Serial Receive Data GPS commands.
13	***GND***	Ground
14	***TXB***	Port B Serial Transmit Data.
15	***RXB***	Port B Serial Receive Data DGPS messages.
16	***GND***	Ground.
17	***GPIO5***	Reserved for re-programming flash.
18	***GND***	Ground
19	***TIMEMARK***	1PPS Time mark output
20	***NC***	No function

1. **VCC_5V:** + 5V DC voltage input.

2. Dual communication channel TTL levels (GM-82-T0/T1) or RS-232 levels (GM-82-A0/A1), with user selectable baud rates (4800-Default, 9600, 19200, 38400).

   RXA: Main Receive Channel. This input is used to receive software commands to the GM-82 from user written software.
   RXB: Auxiliary Receive Channel. This input is used to receive serial differential GPS data.
   TXA: Main Serial Output. This output provides navigation data to user written software.
   TXB: For user's application (not currently used).

3. ***PBRESEN:*** This pin provides an active-low reset input to the GM-82. Activation of this pin will reset and start acquisition process. It may be left open if not utilized.

4. ***TIMEMARK:*** This pin provides One-Pulse-Per-Second output from the GM-82 board, which is synchronized to GPS time. This is not available in Trickle-Power mode.

5. ***VBAT:*** Battery backup input for powering the RAM and RTC. Typical current is 10uA. Without an external backup battery the GM-82 will execute a cold start when turning on each time. To achieve the faster start-up offered by a hot or warm start, either a battery backup must be connected. A 2.5V and 3.6V power source is required in order to maximize battery lifetime. With a lithium cell battery, the data retention is 1,000 hours.

6. ***GPIO Functions:*** Several I/Os of CPU are connected to the digital interface connector for customer's applications and are labeled as GPIO1 to GPIO5.

4. Software Interface

The GPS-82 interface protocol is based on the National Marine Electronics Association's NMEA 0183 ASC II 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).

4.1 NMEA Transmitted Messages

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

Table 4-1 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
GPMSS	Radio-beacon Signal-to-noise ratio, signal strength, frequency, etc.

4.1.1 Global Positioning System Fix Data (GGA)

Table 4-2 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 4-2 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 (1)	9.0	Meters	
Units	M	Meters	
Geoid Separation(1)		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

(1). SiRF Technology Inc. does not support geoid corrections. Values are WGS84 ellipsoid heights.

Table 4-3 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

4.1.2 Geographic Position with Latitude/Longitude(GLL)

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

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

Table 4-4 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

4.1.3 GNSS DOP and Active Satellites (GSA)

Table 4-5 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 4-5 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(1)			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 4-6 Mode 1

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

Table 4-7 Mode 2

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

4.1.4 GNSS Satellites in View (GSV)

Table 4-8 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 4-8 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages(1)	2		Range 1 to 3
Message Number(1)	1		Range 1 to 3
Satellites in View	07		
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

(1). Depending on the number of satellites tracked multiple messages of GSV data may be required.

4.1.5 Recommended Minimum Specific GNSS Data (RMC)

Table 4-9 contains the values for the following example:

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

Table 4-9 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.

4.1.6 Course Over Ground and Ground Speed (VTG)

Table 4-10 contains the values for the following example:

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

Table 4-10 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.

4.1.6 MSK Receiver Signal (MSS)

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

$GPMSS,55,27,318.0,100,*66

Table C-9 MSS Data Format

Name	Example	Units	Description
Message ID	$GPMSS	MSS	protocol header
Signal Strength	55	dB	dB SS of tracked frequency
Signal-to-Noise Ratio	27	dB	SNR of tracked frequency
Beacon Frequency	318.0	kHz	Currently tracked frequency
Beacon Bit Rate	100		100 bits per second

Note – The MSS NMEA message can only be polled or scheduled using the MSK NMEA input message.

4.2 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-82 by using Differential GPS (DGPS) real-time pseudo-range correction data in RTCM SC-104 format, with message types 1,2, or 9. As using DGPS receiver with different communication parameters, GPS-82 may decode the data correctly to generate accurate messages and save them in battery-back SRAM for later computing.

5. Earth Datums

5.1 Earth Datums

The following is a list of the GM-82 earth datum index and the corresponding earth datum name:

Item	Datum	Reference Ellipsoid	Data name
1	Adindan - Ethiopia	Clarke 1880	Data1.dat
2	Afgooye - Somalia	Krassovsky	Data2.dat
3	Alaska, Conus - North American 1983	GRS 1980	Data3.dat
4	Argentina	South American 1969	Data4.dat
5	Bahrain - Ain el ABD 1970	International	Data5.dat
6	Bangladesh	Everest 1830	Data6.dat
7	Botswana - ARC 1950	Clarke 1880	Data7.dat
8	Bolivia	South American 1969	Data8.dat
9	Brazil	South American 1969	Data9.dat
10	Canada - North American 1983	GRS 1980	Data10.dat
11	Colombia - Provisional American 1956	International	Data11.dat
12	Colombia	South American 1969	Data12.dat
13	Chile	South American 1969	Data13.dat
14	Ecuador	South American 1969	Data14.dat
15	European 1950 - Cyprus	International	Data15.dat
16	European 1950 - Eastern Regional Mean	International	Data16.dat
17	European 1950 - Egypt	International	Data17.dat
18	European 1950 - Finland, Norway	International	Data18.dat
19	European 1950 - Greece	International	Data19.dat

20	European 1950 – Iran	International	Data20.dat
21	European 1950 – Italy (Sardinia)	International	Data21.dat
22	European 1950 – Italy (Sicily)	International	Data22.dat
23	European 1950 – Malta	International	Data23.dat
24	European 1950 – Northern Regional Mean	International	Data24.dat
25	European 1950 – Portugal, Spain	International	Data25.dat
26	European 1950 – Southern Regional Mean	International	Data26.dat
27	European 1950 – Tunisia	International	Data27.dat
28	European 1950 – Western Regional mean	International	Data28.dat
29	European 1950 – Central Regional Mean	International	Data29.dat
30	Guyana - South American 1969	South American 1969	Data30.dat
31	Hong Kong	International	Data31.dat
32	Hawaii-North American 1983	GRS1980	Data32.dat
33	Hu_Tsu_Shan Taiwan	International	Data33.dat
34	Indian 1960	Everest 1830	Data34.dat
35	Ireland - 1965	Modified Airy	Data35.dat
36	Liberia - 1964	Clarke 1880	Data36.dat
37	Brunel, East Malaysia	Everest (Sabah & Sarawak)	Data37.dat
38	Mexcio, central America	GRS1980	Data38.dat
39	OMAN	Clarke 1880	Data39.dat
40	Pakistan	Everest 1830	Data40.dat
41	Perul - South American 1969	South American 1969	Data41.dat
42	Paraguay - South American 1969	South American 1969	Data42.dat
43	Philippines	Clarke 1866	Data43.dat
44	Puerto Rico - Virgin Islands	Clarke 1866	Data44.dat
45	Qatar national	International	Data45.dat
46	Qornoq - Greenland (SOUTH)	International	Data46.dat
47	Reunion - Mascarene Islands	International	Data47.dat
48	Regional Mean	South American 1969	Data48.dat
49	Rome 1940 - Italy	International	Data49.dat
50	Saudi Arabia- Ain el Abd 1970	International	Data50.dat
51	Singapore	Modified Fischer 1960	Data51.dat
52	South Africa	Clarke 1880	Data52.dat
53	Kenya, Tanzania- ARC 1960	Clarke 1880	Data53.dat
54	Thailand 1975	Everest 1830	Data54.dat
55	Trinidad, Tobago	South American 1969	Data55.dat
56	Venezuela - Provisional American 1956	International	Data56.dat
57	Venezuela	South American 1969	Data57.dat
58	WGS84	WGS84	Data58.dat
59	Tokyo_Mean	Bessel 1841	Data59.dat
60	Tokyo_Japan	Bessel 1841	Data60.dat
61	Tokyo_Korea	Bessel 1841	Data61.dat
62	Tokyo_Okinawa	Bessel 1841	Data62.dat
63	Albania - S-42(Pulkovo 1942)	Krassovsky 1940	Data63.dat
64	Czechoslovakia - S-42(Pulkovo 1942)	Krassovsky 1940	Data64.dat
65	Hungary - S-42(Pulkovo 1942)	Krassovsky 1940	Data65.dat
66	Kazakhstan - S-42(Pulkovo 1942)	Krassovsky 1940	Data65.dat
67	Latvia - S-42(Pulkovo 1942)	Krassovsky 1940	Data67.dat
68	Poland - S-42(Pulkovo 1942)	Krassovsky 1940	Data68.dat
69	Romania - S-42(Pulkovo 1942)	Krassovsky 1940	Data69.dat
70	Australia	Australian – National	Data70.dat
71	Potsdam	Bessel 1841	Data71.dat

5.2 . Manufacturing Default:

Parameter	Com A	Com B
Input Protocol	NMEA Binary	RTCM SC-104
Output Protocol	NMEA Binary	None
Baud Rate	4800	9600
Parity None	None	
Stop Bits	1	1
Data Bits	8	8
Datum:	WGS84.	
Protocol	GGA, GSA, GSV, RMC or by demand.	

5.2.1 Setting Syntax

Datum change syntax:

>DOS\Sirfprog /Fdataxx.dat –Px –Bx –Csh1

-Px: x is com port, 1= COM1 2 = COM2
-Bx: Baud rate, 4800, 9600, 19200 or 38400
Example:
Change Datum to WGS84,
Sirfprog /Fdata58.dat –P1 –B4800 –Csh1 <Entry>

After change datum, the new datum will keep in SRAM. If long time (more than 20 days) no power supplied to GM82, user must resend datum to GM82 when power on.

5.2.2 Addition Software

SiRFdemo is the Evaluation Receiver configuration and monitoring software provided with the GM-82. This software can be used to monitor real-time operation of the GM-82 Receiver, log data for analysis, upload new software to the Receiver, and configure the Receiver operation. See setup.pdf for more information on the use and operation of SiRFdemo software.

6. Ordering Information

6.1 Products Options

Model No.	Output Level	Back-up battery Type		Input Power	Power Saving	Connector Type	
	TTL or RS-232	Lithium	No	Volt.		MCX	SMA
GM-82-A0X-5	RS-232	Y	-	5	Y	Y	-
GM-82-A0X-3	RS-232	Y	-	3	Y	Y	-
GM-82-A0A-5	RS-232	Y	-	5	Y	-	Y
GM-82-A0A-3	RS-232	Y	-	3	Y	-	Y
GM-82-A1X-5	RS-232	-	Y	5	-	Y	-
GM-82-A1X-3	RS-232	-	Y	3	-	Y	-
GM-82-A1A-5	RS-232	-	Y	5	-	-	Y
GM-82-A1A-3	RS-232	-	Y	3	-	-	Y
GM-82-T0X-5	TTL	Y		5	Y	Y	-
GM-82-T0X-3	TTL	Y		3	Y	Y	-
GM-82-T0A-5	TTL	Y		5	Y	-	Y
GM-82-T0A-3	TTL	Y		3	Y	-	Y
GM-82-T1X-5	TTL	-	Y	5	-	Y	-
GM-82-T1X-3	TTL	-	Y	3	-	Y	-
GM-82-T1A-5	TTL	-	Y	5	-	-	Y
GM-82-T1A-3	TTL	-	Y	3	-	-	Y

6.2 Accessories

Option Active antenna .

Part No.	Cable length		Connector	
	2 M	5M	MCX	SMA
A-10003	Y		Y	
A-1000305		Y	Y	
A-30503	Y			Y
A-3050305		Y		Y

6.3 Other Products

SiRF START II GPS Receiver: GM-210
Palm Vx GPS Receiver: GM-250.
Palm M500/505 GPS Receiver: GM-251.
Handheld GPS: GM-100/GM-305/GM-101.
CF CARD Type GPS Receiver: GM-270
Bluetooth GPS Receiver: GR-230
Mini GPS Receiver: GR-211