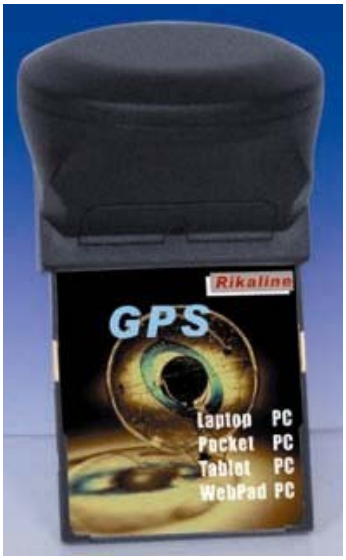
Rikaline **GPS-6020**

CF GPS

User's Guide

May 08, 2003



High Accuracy --- 3 Meters (50%) or 5 Meters (90%)
Low Power -------- 29mA at 3.3V in Continuous Mode and With Active Antenna

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1. INTRODUCTION

1.1 Overview

The ***Rikaline*** GPS-6020 CF GPS is a total solution GPS Receiver designed for use with PDA, Tablet PC, Webpad PC or any portable PCs. features the revolutionary FirstGPS™ architecture. This complete enabled GPS receiver provides high position and speed accuracy performances as well as high sensitivity and tracking capabilities in urban canyon conditions. The GPS-6020 delivers major advancements in GPS performances, accuracy, integration, computing power and flexibility. 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.

1.2 Features

1. Facilitating FirstGPS™ core technology.
2. High sensitivity: to **-143 dBm** tracking, superior urban canyon performances
3. High positioning accuracy: < **3m CEP** (50%), OR <**5M CEP** (90%) without SA (horizontal)
4. Ultra low power: **29mA typical** with active antenna -- tracking at 3.3 Volts, full power
5. A rechargeable battery sustains internal clock and memory and is recharged during normal operation.
6. Dual communication channels and user selectable baud rates allow maximum interface capability and flexibility.
7. LED display status: The LED provides users visible positioning status. LED “BLINKING” when power connected and “ON” when GPS-6020 got position fix. No more extra device needed.
8. Low Cost.

1.3 FirstGPS™ Architecture Highlights

1.3.1 Industry Leading GPS Performance

1. Builds on high performance FirstGPS™ core
2. Satellite signal tracking engine to perform GPS acquisition and tracking functions without CPU intervention
3. High sensitivity: to -143 dBm tracking, superior urban canyon performances
4. Position accuracy: < 3m CEP (50%) or < 5m (90%) without SA (horizontal)
5. Warm Start is under 42 seconds (90%)
6. Hot Start is under 10 seconds (90%)

1.3.2 Low Power

1. Ultra low power integrated circuit design, optimized RF and DSP architectures
2. Further power saving thanks to 4 different power down mode

1.4 Technology specifications

1.4.1 Physical Dimension

Single construction integrated antenna and receiver.
Size: 85.0(W) x 42.0(D) x 20.6(H) (mm)
3.35"(W) x 1.65"(D) x 0.81"(H).

1.4.2 Environmental Characteristics

1) Operating temperature: -40°C to +85°C(internal temperature).
2) Storage temperature: -55°C to +100°C.

1.4.3 Environmental Characteristics

1) Operating temperature: -40°C to +85°C(internal temperature).
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Remark: FirstGPS™ is a trademark from Trimble.

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1.4.4 Electrical Characteristics

1) Input voltage: +2.6 ~ 5.5 VDC.
2) Backup power: 3V Rechargeable Lithium cell battery, up to 200 hours discharge.

1.4.5 Performance

1) Tracks up to 8 satellites.
2) Update rate: 1 second.
3) Acquisition time

Reacquisition	1 sec.,
Hot start	10 sec. (90%)
Warm start	42 sec. (90%)
Cold start	120 sec. (90%)

4) Position accuracy:

NON-DGPS

Position	<3 meter (50%) or <5 meter (90%)
Velocity	0.05 meters/second, typical

DGPS (Differential GPS)

Position	<1 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/second, max

1.4.6 Important Characters

Receiver	L1, C/A code
Channels	8
Update Rate	1/second down to 1/min
Satellite Reacquisition Time	< 1 second
Hot Start	< 10 seconds (90%)
Warm Start	< 42 seconds (90%)
Cold Start	< 120 seconds (90%)
Tracking Sensitivity	-143 dBm
Power Consumption (Full Power)	< 20 mA at 3.3 Volts (Typically: 17 mA)
Voltage Supply	3.0 – 3.65 Volts
Protocol	NMEA 0183 V2.1
Position Accuracy	3 meters CEP (50%) horizontal, SA off < 1 meter, DGPS corrected

1.4.7 Interfaces

1) Dual channel RS-232 or TTL compatible level, with user selectable baud rate (2400, 4800-Default, 9600, 19200, 38400, 57600, 115200).
2) NMEA 0183 Version 2.1 ASCII output (GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG, GPZDA).
3) Real-time Differential Correction input (RTCM SC-104 message types 1, 5 and 9).

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2. Operational characteristics

2.1 Initialization

As soon as the initial self-test is complete, the GPS-6020 begins the process of satellite acquisition and tracking automatically. Under normal circumstances, it takes approximately 120 seconds to achieve a position fix, 42 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-6020 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 FirstGPS™ feature is to provide fast and accurate position. However, acquisition performance can be improved when the host system initializes the GPS-6020 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-6020 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-6020 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-6020 to output a position whenever a differential solution is available.

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3. Hardware interface

3.1 Dimension

Size: 85.0(W) x 42.0(D) x 20.6(H) (mm)
3.35"(W) x 1.65"(D) x 0.81"(H).

3.2 Hardware Interface

The GPS-6020 includes an active antenna in a unique style gadget. Simply insert it into the CF slot of a PDA or other devices or insert it in a PCMCIA adapter.

3.3 Connector

Standard 50 pins CF type I connectors.

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4. Software Interface

The GPS-6020 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).

4.1 NMEA Transmitted Messages

The GPS-6020 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 4-1 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	Course over ground and ground speed
GPZDA	Date and Time

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 4-3
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 4-3 Position Fix Indicator

Value	Description
0	0 Fix not available or invalid

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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=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 4-6
Mode 2	3		See Table 4-7
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 4-6 Mode 1

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

Table 4-7 Mode 2

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

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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	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.

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		Degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

4.1.6 Course Over Ground and Ground Speed (VTG)

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

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$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) All “course over ground” data are geodetic WGS84 directions.

4.1.7 Time & Date (ZDA)

Table 4-11 contains the values for the following example:

$GPVTG,114523.62,12,04,2001,10,34*6E

Table 4-11 zda Data Format

Name	Example	Units	Description
Message ID	$GPZDA		ZDA protocol header
Hour, Min, Sec, Sub Sec	114523.62		Hhmmss.ss
Day	12		Day in UTC, 01to 12
Month	04		Month in UTC, 01 to 12
Year	2001		Year in UTC
Local Zone Hours	10		Local zone hours, +/- 13 hours
Local Zone Minutes	34		Local zone minutes, 0 to +59
Checksum	*6E		
<CR> <LF>			End of message termination

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-6020 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-6020 may decode the data correctly to generate accurate messages and save them in battery-back SRAM for later computing.

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5. Ordering Information

5.1 Product Options

GPS-6020

5.1.2 Color Option

BK Black (Standard)
Other Color: by demand

6. Warranty

The GPS-6020 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.

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