# ZYM-GM23-5R

# G-MouseGPS Receiver

## User's Guide

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# TABLE OF CONTENTS

# Usage Notice

Please read before you start to use the GPS receiver:

- GPS(Global Position System) is found and operated by US Department of defense. The Organization is responsible for accuracy and maintenance of the system with full authority. Any change that is made by the organization will affect accuracy and function of GPS.
- For your driving security, we strongly suggest that you do not operate the device during driving.
- When satellite is navigating, if you are inside a building, tunnel or near huge blocks, it will affect GPS satellite signal receiving. At this time, this device probably dose not have positioning capability.
- If you have a speed alarm in your car, the signal receiving of this device will be interfered. If this situation happens, please stop using your speed alarm.
- Please do not expose this device to sun for a long time to avoid damage to internal precision circuit.

# 1、 Introduction

## 1.1 Overview

The ZYM-GM23 **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 RS-232 or TTL and saves critical satellite data by built–in backup memory. With low power consumption, the **GM23** 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

G-Mouse provides a host of features that make it easy for integration and use.

1. Use the most advantage SIRFstarIII GPS module, the module got high performance CPU inside(ARM7TDMI CPU), allow users to design different applications, store in the module, to provide the most economic solution for anybody.

2.High performance receiver tracks up to 20 satellites.

3. High sensitivity(-159 dBm) for indoor fixes. the SiRFstarIII GPS module can acquire in only seconds even at low signal levels. As part of SiRF's patented multi-mode GPS, the SiRFstarIII GPS module can track signal levels as low as -159 dBm. The SiRFstarIII supports real-time navigation in urban canyons as well as high sensitivity acquisition needed for indoor environments.

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

5. Compact design ideal for applications with minimal space.

6. A rechargeable battery sustains internal clock and memory. The battery is recharged during normal operation.

7. Optional communication levels, RS-232 and TTL 。

8. LED display status: The LED provides users visible positioning status. LED “ON” when power connected and “BLINKING” when ZYM-GM23 got positioned.

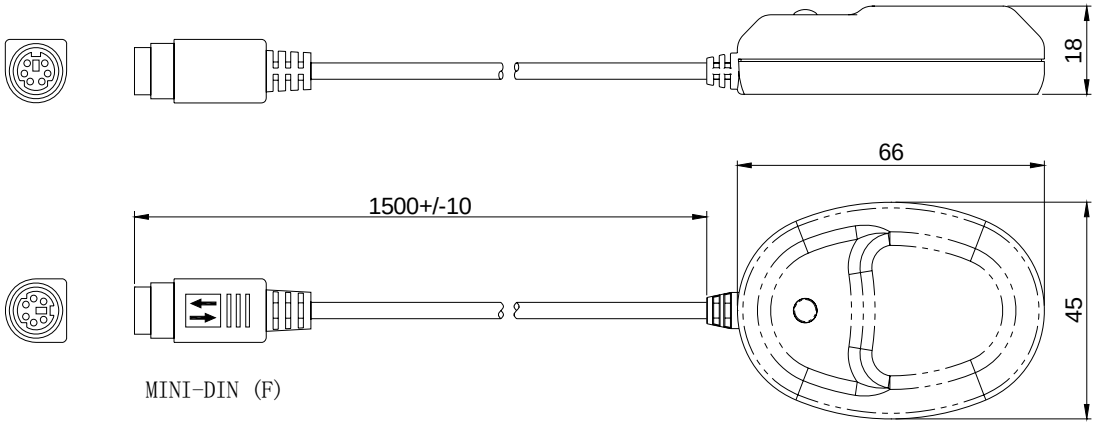
9. Built-in WAAS Demodulator.

10. Water proof design for industry standard.

## 1.3 、Technical Specification

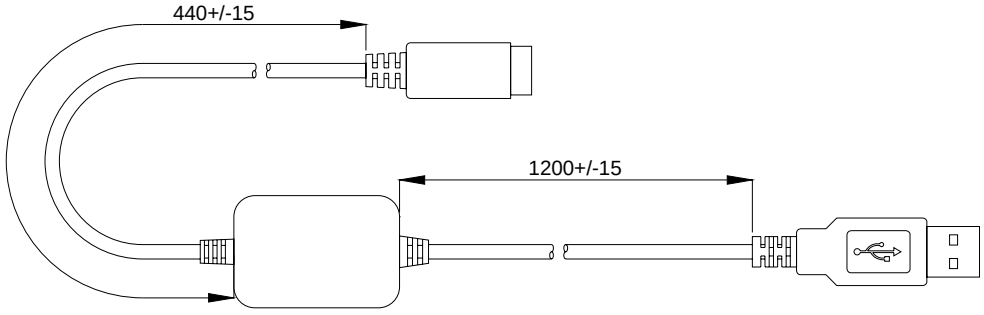
### 1.3.1、 Outline,Pin connection

Outline: (mm)。



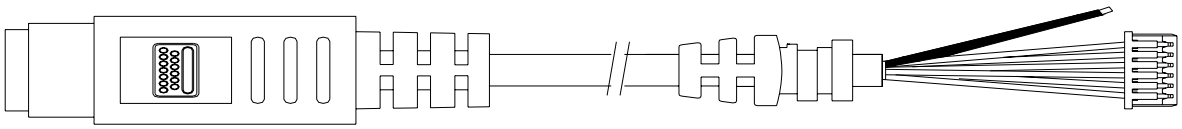

### 1.3.2 Hardware Interface

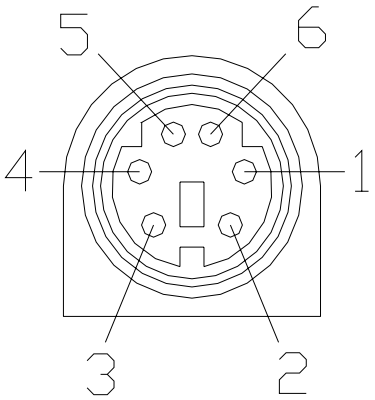
The ZYM-GM23 includes an antenna in a unique style waterproof gadget. Simply connect PS-2 female connector to one of the accessories linking to your notebook PC or other devices. connector are listed and described below:



## PIN CONNECTIONS:

### RS232 INTERFACE：

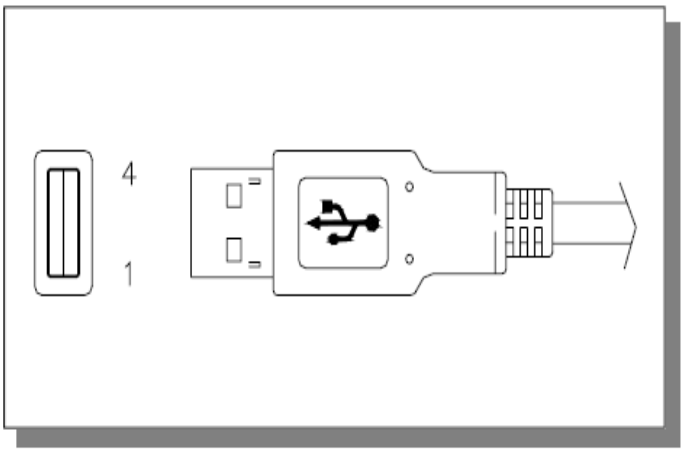





| Pin | Signal name |
|---|---|
| 1 | TX（232） |
| 2 | VCC(3.3-5.2V) |
| 3 | NC |
| 4 | GND |
| 5 | NC |
| 6 | RX(232) |

**USB connector：**

The USB A Type is equipped with ZYM-GM23. The function definition is as follows:




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

### 1.3.2 、Environmental Characteristics

1)Working Temperature: -40~+85° C

2) Storage temperature: -40 ~85° C

3) Humidity：≦95%

### 1.3.3、 Electrical Characteristics

1) Input voltage: +3.3~+5.2V DC

2) Backup battery: +3.0 DC (Inner Rechargeable Lithium battery.)

### 1.3.4 、Performance

1) Tracks up to 20 satellites.

2) Update rate: 1 second.

3) Acquisition time (average)

Hot start: <1 second(open sky)。

Cold start: <48 second(open sky)。

4) Position accuracy:

Position: <10m 90%  no SA

Velocity: 0.1 m/sec  no SA

Time: 1 second synchronized GPS time

5) Dynamic Conditions:

Altitude: 60,000 ft  max

Velocity: 515 m/sec (1,000 knots)  max

Acceleration: 4G max

### 1.3.5 、Interfaces

1) Dual channel TTL compatible level, with user selectable baud rate (4800-Default, 9600, 19200, 38400)

2) NMEA 0183 Version 3.01 ASCII output (GPGGA, GPGSA, GPGSV, GPRMC, option GPGLL,GPVTG).

# 2、 Operational Characteristics

## 2.1、 Initialization Setup

After the initial self-test is complete, the G-mouse will begin the process of satellite acquisition and tracking. The acquisition process is fully automatic and, under normal circumstances, will take approximately 48 seconds to achieve a position fix (38 seconds if ephemeris data is know). After a position fix has been calculated, valid position and time information will be transmitted over the output channel(s).

The G-Mouse utilizes initial data such as last stored position, data and time as well as satellite orbital data to achieve maximum acquisition performance. If significant inaccuracy exists in the initial data, or if the orbital data is obsolete, it may take a long time to achieve a navigation solution. The G-mouse Auto-locate feature is capable of automatically determining a navigation solution without intervention from the host system. However, acquisition performance can be improved if the host system initialized the G-mouse following the occurrence of one or more of the following events:

1) The GPS receiver is not in use for more than 3 months or transportation over distances further than 500 kilometers.
2) Failure of the external memory battery without system standby power.

## 2.2 、Navigation

After the acquisition process is complete, the G-Mouse will begin sending valid navigation information over its output channels. These data include:

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

# 3、Appendix A Software Protocol

The protocol of G-Mouse is designed base on NMEA(National Marine Electronics Association) 0183 ASCII format. The full protocol is defined in “NMEA 0183, Version 3.01” and “RTCM (Radio Technical Commission for Maritime Services), Recommended Standards For differential Navistar GPS Service, Version 2.1, RTCM Special Committee No.104.”

## A.1、NMEA Transmitted Message

G-Mouse GPS receiver use FirstGPSTM as the core, and output NMEA-0183 standard format message. 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 | Course over ground and ground speed |
| GPZDA | Data and Time |

### A.1.1 Global Positioning System Fix Data (GGA)

**Samples:$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 | Description | 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 Table4-3 |
| Satellites Used | 07 | | Range 0 to 12 |
| HDOP | 1.0 | | Horizontal Dilution of Precision |

| Name | Description | Units | Description |
|---|---|---|---|
| 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 | | |

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 - Latitude/Longitude (GLL)

**Samples:**

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

Table **1-4** GLL Data Format

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGLL | | GLL protocol header |
| Latitude | 3723.2475 | | dd mm.mmmm |
| N/S Indicator | N | | N = north or S = south |
| Longitude | 12158.3416 | | ddd mm.mmmm |
| E/W Indicator | W | | E = east or W = west |
| UTC Position | 161229.487 | | hh mm ss.sss |
| Status | A | | A = data valid or V = data not valid |
| Checksum | *2C | | |

### A.1.3 GNSS DOP and Active Satellites (GSA)

**Samples:**

**$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 4-6 |
| Mode 2 | 3 | | See Table 4-7 |
| Satellite Used *1 | 07 | | SV on Channel 1 |
| Satellite Used *1 | | | SV on Channel 2 |
| ….. | | | …… |
| Satellite Used *1 | | | SV on Channel N |
| PDOP | 1.8 | | Position Dilution of Precision |
| HDOP | 1.0 | | Horizontal Dilution of Precision |
| VDOP | 1.5 | | Vertical Dilution of Precision |
| Checksum | *33 | | |

*1 Satellite used in solution.

Table **A-6** Mode 1

| Value | Description |
|---|---|
| M | Manual – forced to operate in 2D or 3D mode |
| 3 | Automatic – allowed to automatically switch 2D/3D |

Table **A-6** Mode 2

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

### A.1.4 GNSS Satellites In View (GSV)

**Samples:**

**$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 Messages1 | 2 | | Range 1 to 3 |
| Message Number 1 | 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 | | |
| | | | |

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

### A.1.5 Recommended Minimum Specific GNSS Data (RMC)

**Samples:**

$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 Position | 161229.487 | | Hh mm ss.sss |
| Status | A | | A = data valid or V = data not valid |
| Latitude | 3723.2475 | | dd mm.mmmm |
| N/S Indicator | N | | N = north or S = south |
| Longitude | 12158.3416 | | ddd mm.mmmm |
| E/W Indicator | W | | E = east or W = west |

| Name | Example | Units | Description |
|---|---|---|---|
| Speed Over Ground | 0.13 | knots | |
| Course Over Ground | 309.62 | degrees | True |
| Date | 120598 | | dd mm yy |
| Magnetic Variation1 | 02.6 | degrees | |
| E/W Indicator | W | | E = east or W = west |
| Checksum | *10 | | |

### A.1.6 Course Over Ground and Ground Speed (VTG)

**Samples:**

**$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 | | |
| Course | | Degrees | Measured heading |
| Reference | M | | Magnetic*1 |
| Speed | 0.13 | Knots | Measured horizontal speed |
| Units | N | | |
| Speed | 0.2 | Km/hr | Measured horizontal speed |
| Units | K | | Kilometer per hour |
| Checksum | *6E | | |

Note *1:All "course over ground" data are geodetic WGS84.

### A.1.7 Time & Date (ZDA)

**Samples:**

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

Table **1-11** 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, 01 to 31 |
| Month | 4 | | 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 | | |

## 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 CF card receiver by using Differential GPS (DGPS) real-time pseudo-range correction data in RTCM SC-104 format, with message type 1,5 or 9. As using DGPS receiver with different communication parameters, GPS CF card receiver may decode the data correctly to generate accurate messages and save them in battery –back SRAM for later computing.

# 4、Appendix B Coordinate System and Output Settings

## B.1 Coordinate System

World standard coordinate system WGS84 is builds in.

## B.2 Output Settings

Coordinate System: WGS84。

Baud rate: 9600

Output message: GGA, GLL, GSA, GSV, RMC, VTG , ZDA