# USB MOUSE
# GPS RECEIVER


# USER'S GUIDE

# Contents

# 1. Introduction

## 1.1 Overview

The **DA-80101** series GPS receiver incorporates low noise, high sensitivity, low power consumption SiRF StarⅢ chipset solution in a compact, waterproof enclosure. The receiver is very suitable for broad applications such as car navigation, mapping, surveying, etc. Only clear view of sky and certain power supply are necessary to the unit. It communicates with other host device via one full duplex serial communication RS-232 port or one universal USB port. With its ultra low power consumption, the receiver tracks up to 20 satellites at a time while offering fast time-to-first-fix, re-acquires satellite signals less than 1 second (average) and updates position data every second.

## 1.2 Features

The DA-80101 series provides a host of features that make it easy for integration and use.

1. With SiRF StarⅢ high sensitivity chipset.
2. High performance receiver tracks up to 20 satellites.
3. Compact design ideal for applications with minimal space.
4. A rechargeable battery sustains internal clock and memory.
5. User initialization is not required.
6. One full duplex serial RS-232 port or USB port meets all applications.
7. Waterproof design for all weather.
8. Built-in low noise, high gain active antenna.
9. LED display provides users visible positioning status.
10. Support Standard NMEA-0183 and SiRF Binary protocol.

## 1.3 Electrical Characteristics

**General**

| | |
|---|---|
| Frequency | L1, 1575.42 MHz |
| C/A code | 1.023 MHz chip rate |
| Channels | 20 channels all in view tracking |
| Antenna | internal |

**Sensitivity**

| | |
|---|---|
| Tracking | -159 dBm typical |

**Accuracy**

| | |
|---|---|
| Position | < 10 meters, 2D RMS |
| | < 7 meters 2D RMS, WAAS corrected |
| | 1-5 meters, DGPS corrected |
| Time | 1 microsecond synchronized to GPS time |

**Datum**

| | |
|---|---|
| Default | WGS-84 |

**Acquisition Rate (Open Sky)**

| | |
|---|---|
| Hot start | 1 sec, average |
| Warm start | 38 sec, average |
| Cold start | 42 sec, average |
| Reacquisition | 0.1 sec, average |

**Dynamic Conditions**

| | |
|---|---|
| Altitude | < 18,000 meters (60,000 feet) |
| Velocity | < 515 meters/sec (1000 knots) |
| Acceleration | < 4G |
| Jerk | 20 meters/sec max |

**Power Consumption**

| | |
|---|---|
| Main power input | 5.0 ±5% VDC input. |
| Supply Current | 80 mA @5V |

**Serial Port**

| | |
|---|---|
| Electrical interface | One full duplex serial communication via RS232/ TTL interface. |
| Protocol message | NMEA-0183, SiRF Binary. |
| Default NMEA | GGA, GSA, GSV, RMC, (VTG, GLL, and ZDA optional). |
| | 4800 baud rate (other rate optional). |
| | 8 bits data, 1 stop bit, no parity. |

**Weight** < 85 g

**Environmental Characteristics**

| | |
|---|---|
| Operating temperature range | -40 $^{o}$C to +80 $^{o}$C |
| Storage temperature range | -45 $^{o}$C to +95 $^{o}$C |

# 2. Hardware Interface

## 2.1 Dimension

The receiver enclosure is with the dimension:

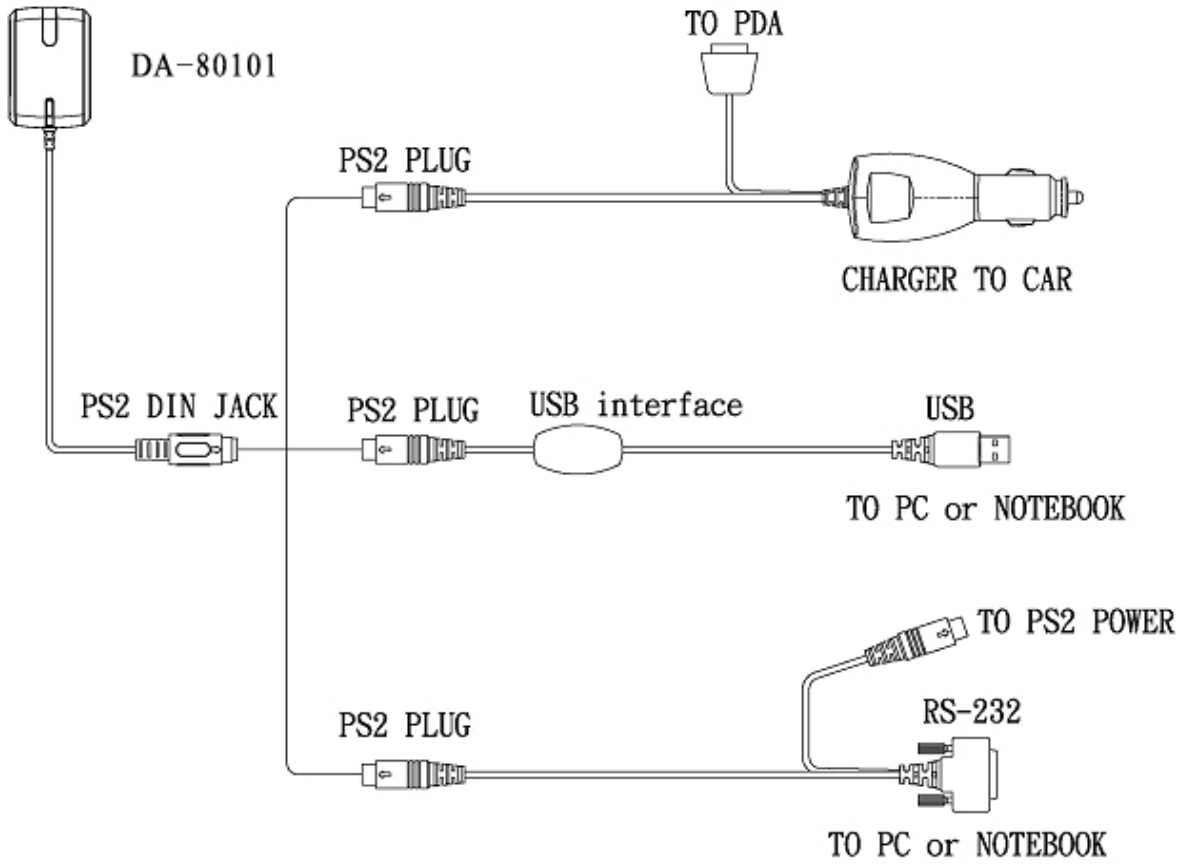
59.7 mm (L) x 39 mm (W) x 16.4 mm (H)

## 2.2 Interface

The DA-80101 series GPS receiver includes a variety of models. The main difference is the output connector. These interface options are described in the following.

### DA-80101

DA-80101 is with a PS2 DIN jack output connector. Following figure shows various connection arrangements. The one-piece cigarette lighter adapter assembly allows you to utilize power from the front power socket of vehicles. Simply connect DA-80101 to the PS-2 plug of the adapter assembly and link the other connector to your PDA. For Notebook users, a PS-2 to USB adapter assembly is required. This is an optional purchase. A CD with USB driver is provided with the assembly. For users intend to use RS-232 port of PC or Notebook, the other optional adaptor assembly can be purchased.

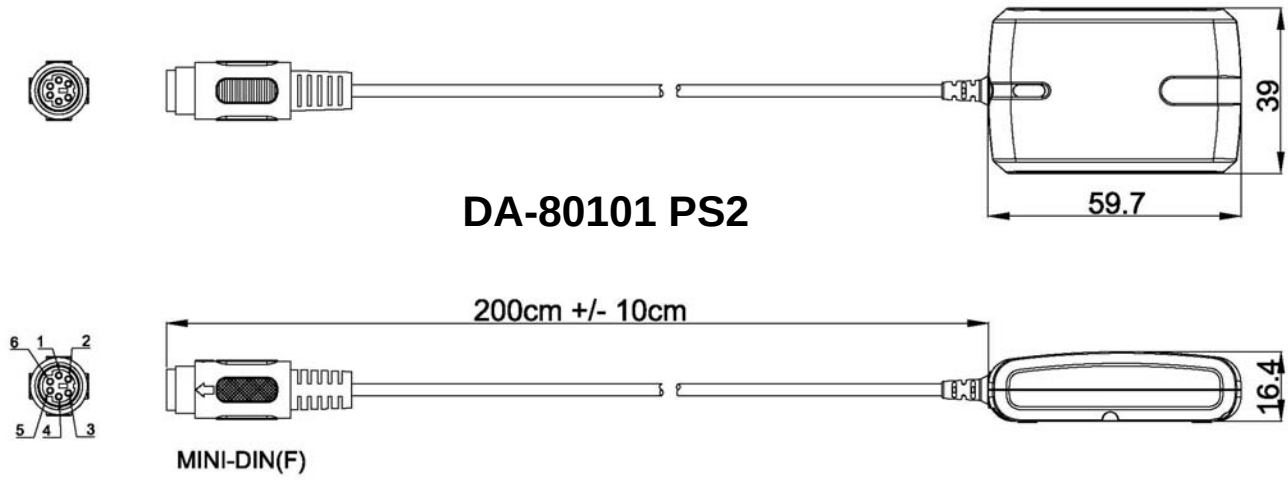


## 2.3 Connector

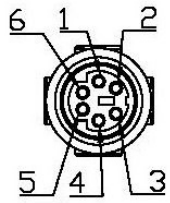
Following are the description of the output connector.

## DA-80101

Standard cable is two meters in length with a female PS-2 Jack as shown in the following.




Pin assignment of standard PS-2 Din Jack connector is in the following drawing and table.



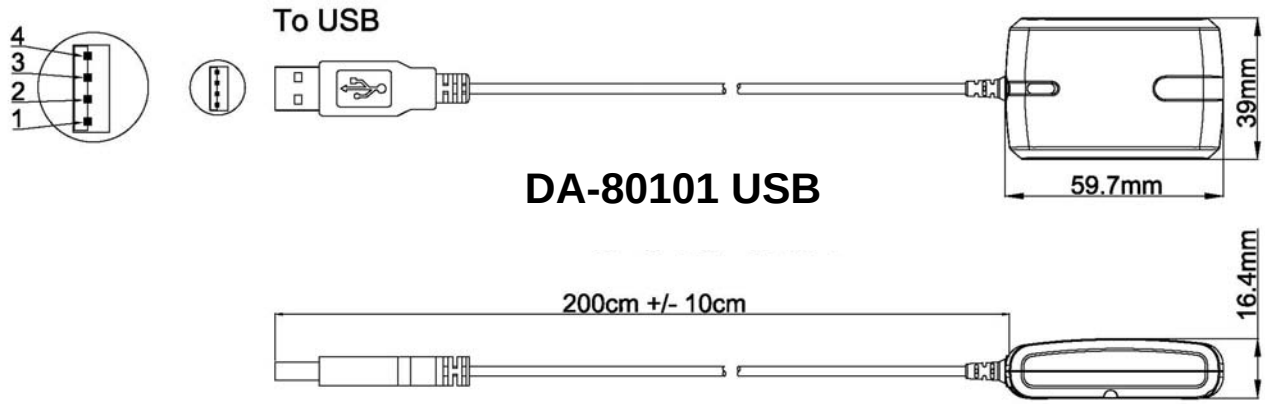

| Pin | Signal |
|---|---|
| 1 | Tx (RS-232) |
| 2 | +5VDC |
| 3 | Tx (TTL) |
| 4 | GND |
| 5 | Rx (TTL) |
| 6 | Rx (RS-232) |

The accessory is a Y-cable with a cigarette lighter adapter to a vehicle's front power socket. Please refer to the drawing on previous page. The Y cable is with one branch of PS2 Plug to connect to the PS2 Jack of DA-80101, while the other branch to connect to a PDA. However, due to the many variety of PDAs, an appropriate adaptor type must be specified.

For users with PC or Notebook, a USB interface cable or RS-232 adaptor cable shown in previous page may be used. Drivers for the USB interface cable are available on a CD associated with the cable. These are optional purchases.

### DA-80101USB

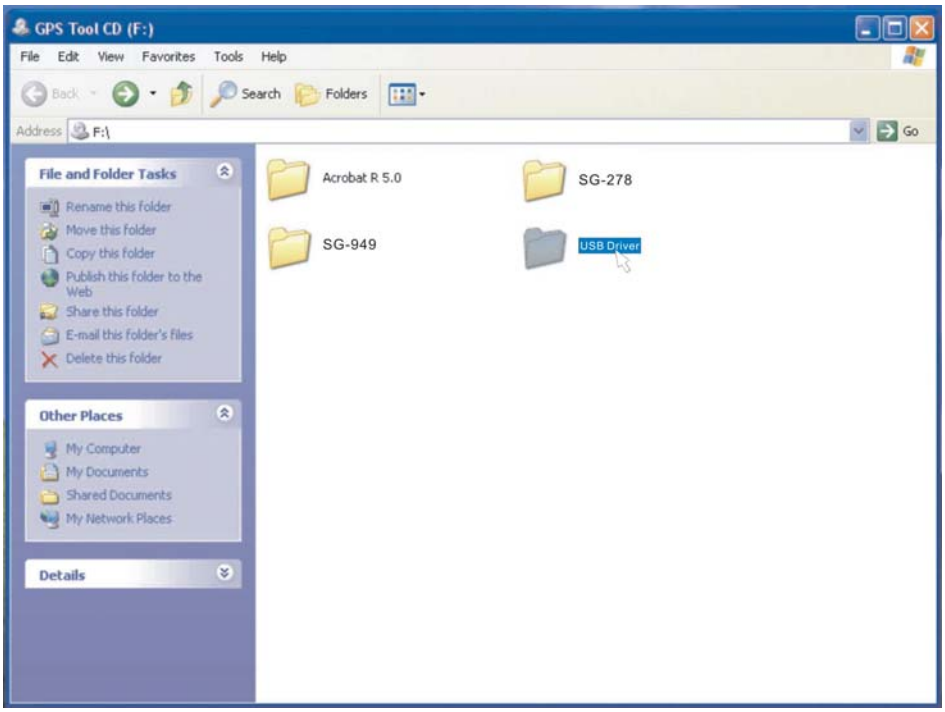
DA-80101USB provides PC or Notebook users a convenient choice. There is no unusual assignment about the connector. Definitions of USB connector pins are compliant with the standard.



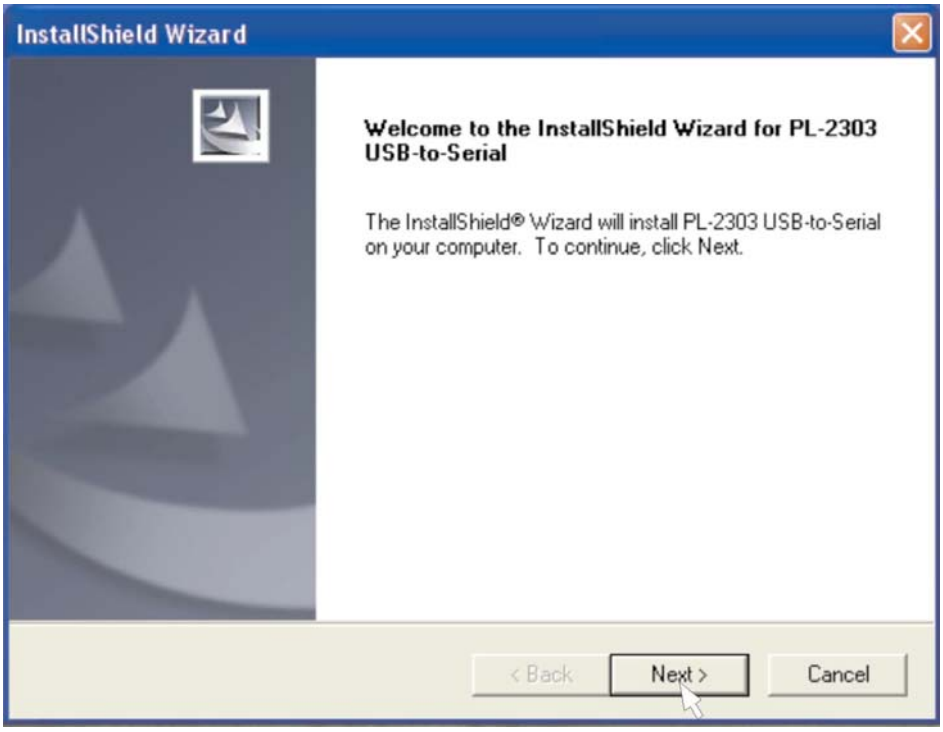

# 3. Operation

## 3.1 USB Driver Installation and Com Port Searching

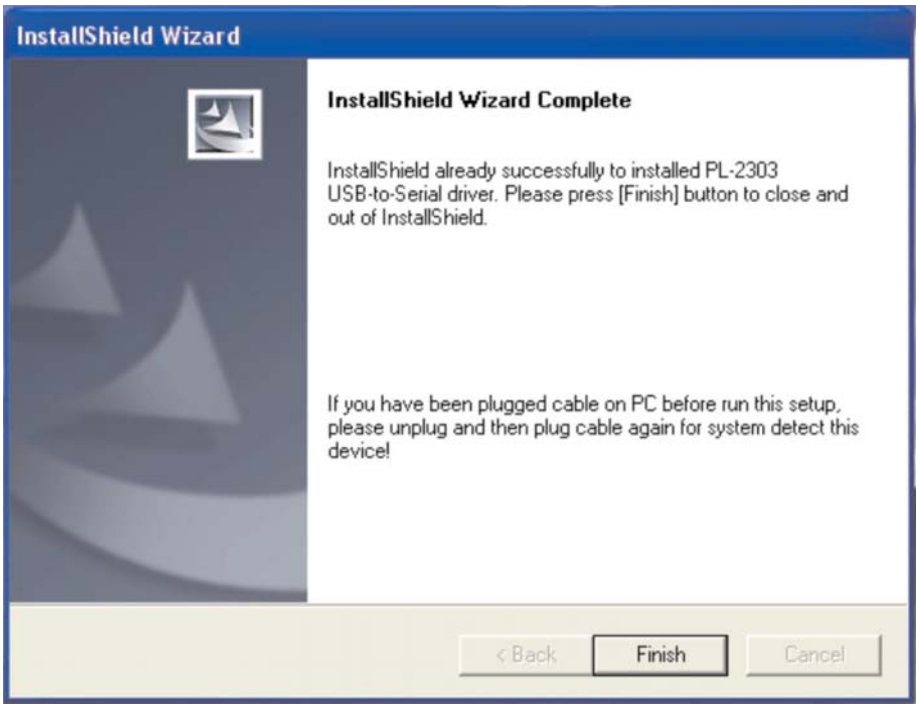
For DA-80101 series GPS receiver using the USB type terminal, you have to install the driver first. Here we use WinXP OS as an example. Please insert the installation CD into CD-ROM drive. You can browse the CD contents and find the "**USB Driver**" folder.



Please open the folder and double click the PL-2303 driver icon. The installation will start. Please click the "**Next**" button on the InstallShield Wizard's "**Welcome**" window.

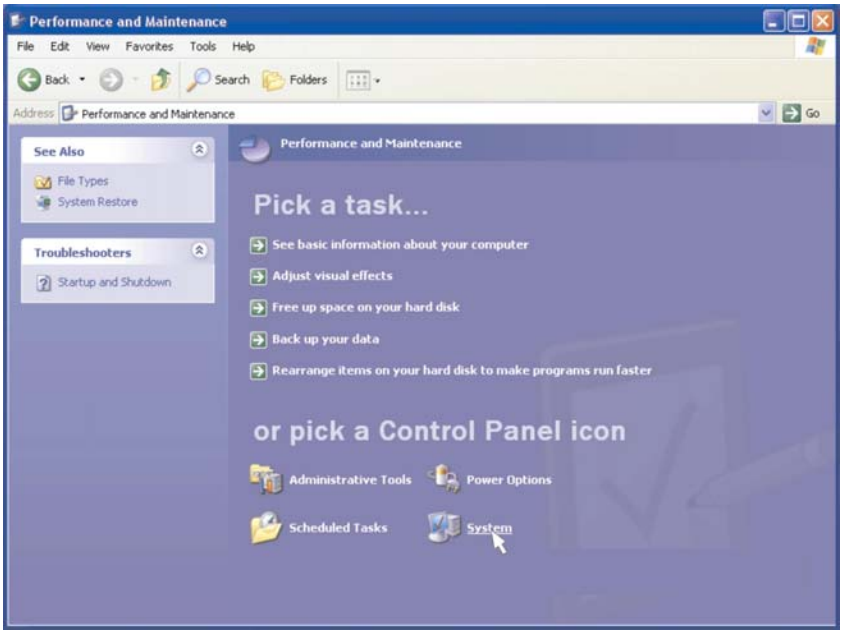



Once the InstallShield Wizard completes the installation of the driver to your system, please click "**Finish**" button.

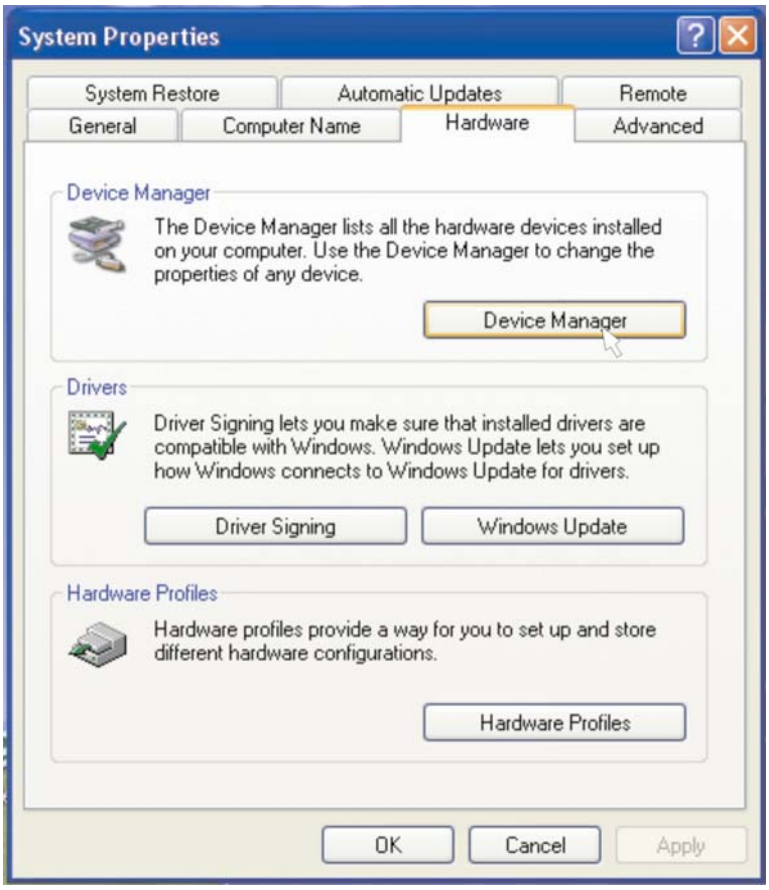


You can plug the receiver's USB terminal into USB port on your PC or NB now. However, for receiving the GPS data stream properly, you have to set the correct Com port and Baud rate in the utility software. Here is an easy approach for finding which Com port the mouse is connecting to. Please click **Start** → **Settings**, and then select "**Control Panel**."

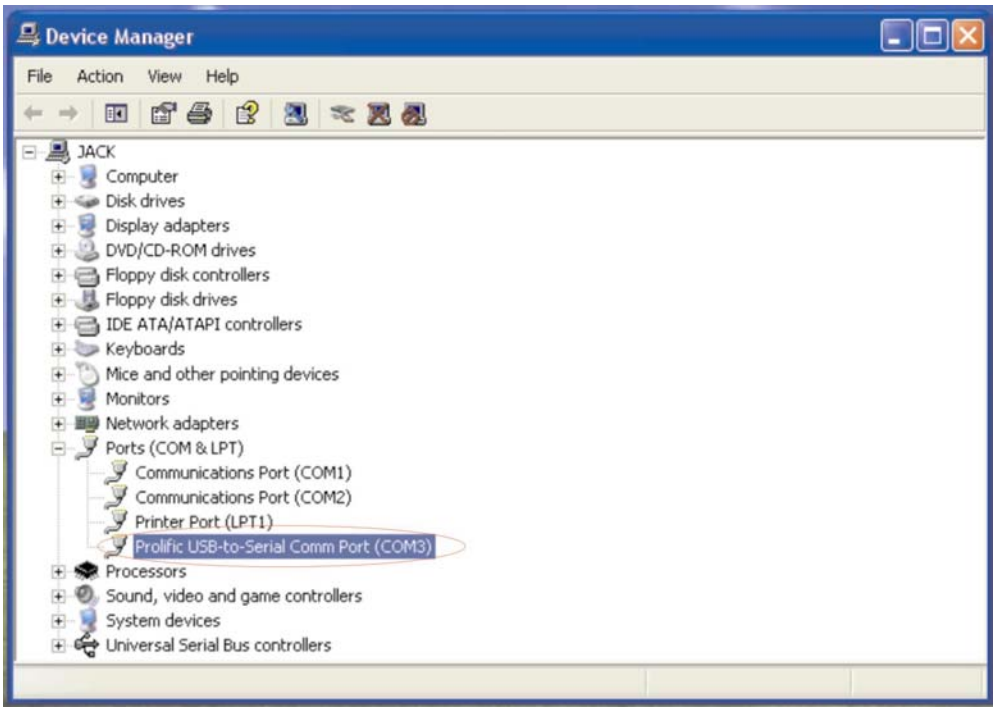

Please click the "**System**" icon and open the "**System Properties**" window.



Click the “**Hardware**” tab and find the “**Device Manager**” button on the page.




Click the button and the window will show the hardware status. Please find the “**Ports (Com & LPT)**” category and look for the Com port shown “**Prolific USB-to-Serial Com Port (COMxx)**”, the xx is the Com port number you are connecting to.




Although the above installation steps are under WinXP, basically the procedures are somewhat the same for other Windows operating systems.

## 3.2 Getting Start

Connect the DA-80101 GPS receiver with an appropriate adaptor assembly. It depends on the type of power source and host device. Install USB driver first when you connect to a host device with a USB adaptor cable.

Take the GPS receiver to places with clear view of the sky. The **Red LED** indicates the status.

(a) LED steady on when power is connected and for the initial acquisition process;

(b) LED flashes with 0.5 second on and 0.5 second off when the receiver outputs position fix data.

## 3.3 Viewer for Testing

Install appropriate viewer program to host device. You may check the status of the GPS receiver whenever you like to. Following are standard buttons and operation steps.

(a) Execute the Viewer program. Press the “COM” button to set “Com Port” for this data link and “Baud Rate” to 4800.

(b) Click “OPEN” to download the received data. Usually one window shows the NMEA format data stream and another window shows tracked satellite constellation and signal quality status.

(c) Once the link is successful, click “CLOSE” button to exit the program. However, you may click the “Cold” button to perform “cold start” testing.

### 3.4 Function

As soon as the power on, the DA-80101 series GPS receiver begins the process of satellite acquisition, and tracking. Under normal circumstances, it takes around 42 seconds (average) to achieve a position fix at the first time. After a position fix has been calculated, information about valid position, velocity, and time is transmitted over the output channel. The DA-80101 GPS receiver 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.

### 3.5 Navigation

After the acquisition process is complete, the DA-80101 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

## 4. Warranty

The GPS smart receiver 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.

# Appendix: Software Specifications

## NMEA Protocol

The DA-80101 interface protocol is based on the National Marine Electronics Association (NMEA) interface specification, namely, the NMEA 0183 standard. The DA-80101 is capable of supporting following NMEA message formats specifically developed and defined by SiRF.

| NMEA Message Prefix | Format | Direction |
|---|---|---|
| $GPGGA | Time, position and fix type data. | Out |
| $GPGLL | Latitude, longitude, time of position fix and status. | Out |
| $GPGSA | GNSS DOP and active satellites | Out |
| $GPGSV | Satellites in view. | Out |
| $GPMSS | Radio beacon signal-to-noise ratio, signal strength, frequency, etc. | Out |
| $GPRMC | Recommended minimum specific GNSS data. | Out |
| $GPVTG | Speed and course over ground. | Out |
| $GPZDA | Date and time. | Out |

## General NMEA Format

The general NMEA format consists of an ASCII string commencing with a '$' character and terminating with a <CR><LF> sequence. NMEA standard messages commence with 'GP' then a 3-letter message identifier. The message header is followed by a comma delimited list of fields optionally terminated with a checksum consisting of an asterix '*' and a 2 digit hex value representing the checksum. There is no comma preceding the checksum field. When present, the checksum is calculated as a bitwise exclusive of the characters between the '$' and '*'. As an ASCII representation, the number of digits in each number will vary depending on the number and precision, hence the record length will vary. Certain fields may be omitted if they are not used, in which case the field position is reserved using commas to ensure correct interpretation of subsequent fields.

## *$GPGGA*

This message transfers global positioning system fix data. Following is an example.

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

The $GPGGA message structure is shown below:

| Field | Example | Unit | Notes |
|---|---|---|---|
| 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 Indictor | 1 | | 0: Fix not available or invalid.<br>1: GPS SPS mode, fix valid.<br>2: Differ. GPS, SPS mode, fix valid<br>3-5: Not supported.<br>*6: Dead Reckoning Mode, fix valid.* (1) |
| Satellites Used | 07 | | Number of satellites used to calculate fix. Range 0 to 12. |
| HDOP | 1.0 | | Horizontal Dilution of Precision. |
| MSL Altitude (2) | 9.0 | Meter | Altitude above mean seal level. |
| Units | M | Meter | M stands for “meters”. |
| Geoid Separation (2) | | Meter | Separation from Geoids can be blank. |
| Units | | Meter | M stands for “meters”. |
| Age of Diff. Corr. | | Second | Age in seconds. Blank (Null) fields when DGPS is not used. |
| Diff Ref. Station ID | 0000 | | |
| Checksum | *18 | | |
| <CR> <LF> | | | Message terminator. |

**(1)** Only apply to NMEA version 2.3 (and later) in this NMEA message description.

**(2) SiRF does not support geoid corrections. Values are WGS84 ellipsoid heights.**

## *$GPGLL*

This message transfers geographic position, latitude, longitude, and time. Following is an example.

**$GPGLL,3723.2475,N,12158.3416,W,161229.487,A,A*41**

The $GPGLL message structure is shown below:

| **Field** | **Example** | **Unit** | **Notes** |
|---|---|---|---|
| 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 Time | 161229.487 | | hhmmss.sss |
| Status | A | | A: Data valid or V: Data invalid. |
| *Mode* | *A* | | *A=Autonomous, D=DGPS, E=DR (Only present in NMEA version 3.00).* |
| Checksum | *41 | | |
| <CR><LF> | | | Message terminator. |

## *$GPGSA*

This message transfers DOP and active satellites information. Following is an example.

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

The $GPGSA message structure is shown below:

| **Field** | **Example** | **Unit** | **Notes** |
|---|---|---|---|
| Message ID | $GPGSA | | GSA protocol header. |
| Mode | A | | M: Manual, forced to operate in selected 2D or 3D mode.<br>A: Automatic switching between modes. |
| Mode | 3 | | 1 Fix not available.<br>2 2D position fix.<br>3 3D position fix. |
| Satellites Used (1) | 07 | | SV on channel 1. |
| Satellites Used (1) | 02 | | SV on channel 2. |
| … | | | .. |
| Satellites Used (1) | | | SV on channel 12. |
| PDOP | 1.8 | | |
| HDOP | 1.0 | | |
| VDOP | 1.5 | | |
| Checksum | *33 | | |
| <CR> <LF> | | | Message terminator. |

**(1) Satellites used in solution.**

*$GPGSV*

This message transfers information about satellites in view. The $GPGSV message structure is shown below. Each record contains the information for up to 4 channels, allowing up to 12 satellites in view. In the final record of the sequence the unused channel fields are left blank with commas to indicate that a field has been omitted. Following is an 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**

The $GPGSV message structure is shown below:

| **Field** | **Example** | **Unit** | **Notes** |
|---|---|---|---|
| Message ID | $GPGSV | | GSA protocol header. |
| Number of messages (1) | 2 | | Number of messages, maximum 3. |
| Message number | 1 | | Sequence number, range 1 to 3. |
| Satellites in view | 07 | | Number of satellites currently in view. |
| Satellite ID | 07 | | Channel 1, ID range 1 to 32. |
| Elevation | 79 | degree | Elevation of satellite, maximum 90. |
| Azimuth | 048 | degree | Azimuth of satellite, range 0 to 359. |
| SNR ($C/N_0$) | 42 | dBHz | Range 0 to 99, null when not tracking. |
| Satellite ID | 02 | | Channel 2, ID range 1 to 32. |
| Elevation | 51 | degree | Elevation of satellite, maximum 90. |
| Azimuth | 062 | degree | Azimuth of satellite, range 0 to 359. |
| SNR ($C/N_0$) | 43 | dBHz | Range 0 to 99, null when not tracking. |
| Satellite ID | 26 | | Channel 3, ID range 1 to 32. |
| Elevation | 36 | degree | Elevation of satellite, maximum 90. |
| Azimuth | 256 | degree | Azimuth of satellite, range 0 to 359. |
| SNR ($C/N_0$) | 42 | dBHz | Range 0 to 99, null when not tracking. |
| Satellite ID | 27 | | Channel 4, ID range 1 to 32. |
| Elevation | 27 | degree | Elevation of satellite, maximum 90. |
| Azimuth | 138 | degree | Azimuth of satellite, range 0 to 359. |
| SNR ($C/N_0$) | 42 | dBHz | Range 0 to 99, null when not tracking. |
| Checksum | *71 | | |
| <CR> <LF> | | | Message terminator. |

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

## *$GPMSS*

This message transfers information about radio beacon signal-to-noise ratio, signal strength, frequency, etc. Following is an example.

**$GPMSS,55,27,318.0,100,1,*57**

The $GPMSS message format is shown below.

| **Field** | **Example** | **Unit** | **Notes** |
|---|---|---|---|
| Message ID | $GPMSS | | MSS protocol header. |
| Signal Strength | 55 | 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 | | Bits per second. |
| *Channel Number* [(1)] | *1* | | *The channel of the beacon being used if a multi-channel beacon receiver is used.* |
| Checksum | *57 | | |
| <CR> <LF> | | | Message terminator. |

***(1)*** *Fields marked in italic red apply only to NMEA version 2.3 (and later) in this NMEA message description.*

## *$GPRMC*

This message transfers recommended minimum specific GNSS data. Following is an example.

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

The $GPRMC message format is shown below.

| Field | Example | Unit | Notes |
|---|---|---|---|
| Message ID | $GPRMC | | RMC protocol header. |
| UTC Time | 161229.487 | | hhmmss.sss |
| Status | A | | A: Data valid or V: Data invalid. |
| Latitude | 3723.2475 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south. |
| Longitude | 12158.3416 | | ddmm.mmmm |
| E/W indicator | W | | E=east or W=west. |
| Speed over ground | 0.13 | knot | Speed over ground |
| Course over ground | 309.62 | degree | Course over ground |
| Date | 120598 | | ddmmyy, current date. |
| Magnetic variation (1) | | degree | Not used. |
| *Mode (2)* | *A* | | *A=Autonomous, D=DGPS, E=DR.* |
| Checksum | *10 | | |
| <CR> <LF> | | | Message terminator. |

**(1) SiRF does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.**

***(2)*** *Fields marked in italic red apply only to NMEA version 2.3 (and later) in this NMEA message description.*

## *$GPVTG*

This message transfers velocity, course over ground, and ground speed. Following is an example.

**$GPVTG,309.62,T, ,M,0.13,N,0.2,K,A*23**

The $GPVTG message format is shown below.

| Field | Example | Unit | Notes |
|---|---|---|---|
| Message ID | $GPVTG | | VTG protocol header. |
| Course (true) | 309.62 | degree | Measured heading |
| Reference | T | | T = true heading |
| Course (magnetic) | | degree | Measured heading |
| Reference (1) | M | | M = magnetic heading (1) |
| Speed | 0.13 | knot | Speed in knots |
| Units | N | | N = knots |
| Speed | 0.2 | km/hr | Speed |
| Units | K | | K = km/hour. |
| *Mode (2)* | *A* | | *A=Autonomous, D=DGPS, E=DR.* |
| Checksum | *23 | | |
| <CR> <LF> | | | Message terminator. |

**(1) SiRF does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.**

***(2)*** *Fields marked in italic red apply only to NMEA version 2.3 (and later) in this NMEA message description.*

*$GPZDA*

This message transfers UTC Time and Date. Following is an example.

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

The $GPZDA message format is shown below.

| **Field** | **Example** | **Unit** | **Notes** |
|---|---|---|---|
| Message ID | $GPZDA | | ZDA protocol header. |
| UTC Time | 181813 | | Either using valid IONO/UTC or estimated from default leap seconds. |
| UTC Day | 14 | | 01 to 31, day of month. |
| UTC Month | 10 | | 01 to 12. |
| UTC Year | 2003 | | 1980 to 2079. |
| Local zone hours | 00 | | Offset from UTC (set to 00). |
| Local zone minutes | 00 | | Offset from UTC (set to 00). |
| Checksum | *4F | | |
| <CR> <LF> | | | Message terminator. |