

## GPS & GLONASS Receiver (G-Mouse)

### 1. Product Information

- 1.1 Product Name :**    **GR-902GG**            (Adhesive Mount)  
                                 **GR-902MGG**        (Magnetic Mount)



### 1.2 Product Description:

GR-902(M) GG is a RS232 interface, compact, high performance, and low power consumption G-Mouse.

It uses the chipset of u-blox UBX-M8030-KT which can track up to 72 channels at a time and perform fast TTFF in weak signal environments.

GR-902(M)GG is suitable for the following applications:

- Automotive navigation
- Personal positioning
- Fleet management
- Marine navigation

### 1.3 Product Features:

- High performance and low power consumption GNSS Chipset
- Very high sensitivity
- Extremely fast TTFF (Time To First Fix) at low signal level
- Chipset protocol

## 1.4 Product Specifications

### GPS Performance

| GPS Receiver            |                                                                                                                                            |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Chip                    | UBX-M8030-KT                                                                                                                               |
| Frequency               | GPS, GALILEO, QZSS: L1 1575.42MHz, C/A code<br>GLONASS: L1 1598.0625MHz ~ 1605.375MHz, C/A code                                            |
| Protocol                | NMEA 0183<br>GALILEO L1 open service (with upgrade)<br>Default: GGA, GSA, GSV, RMC<br>Support: VTG, GLL, TXT ublox binary and NMEA Command |
| Baud Rate               | 9,600 bps                                                                                                                                  |
| Channels                | 72                                                                                                                                         |
| Sensitivity             | Tracking: -161dBm<br>Reacquisition: -160dBm<br>Cold Start: -147dBm                                                                         |
| Cold Start              | 29 seconds, average                                                                                                                        |
| Warm Start              | 28 seconds, average                                                                                                                        |
| Hot Start               | 1 second, average                                                                                                                          |
| Accuracy                | Horizontal Position: Autonomous < 2.5m average,<br>SBAS < 2.0m average<br>Velocity: 0.1 m/s<br>Timepulse signal: RMS 30 ns                 |
| Maximum Altitude        | 50,000 meter                                                                                                                               |
| Maximum Velocity        | 515 m/s (1000 knots)                                                                                                                       |
| Dynamics                | ≧ 4G                                                                                                                                       |
| Update Rate             | 4 Hz                                                                                                                                       |
| A-GPS                   | AssistNow on-line and off-line                                                                                                             |
| Physical Characteristic |                                                                                                                                            |
| Dimensions              | 45.00mm * 38.00 mm * 14.30mm                                                                                                               |
| Environmental Range     |                                                                                                                                            |
| Humidity Range          | 5% to 95% non-condensing                                                                                                                   |
| Operation Temperature   | -40°C to 85°C                                                                                                                              |
| Storage Temperature     | -40°C to 85°C                                                                                                                              |

## 1.5 DC Electrical characteristics

| Parameter                    | Symbol           | Conditions                                                                       | Min.                | Typ.                           | Max.                 | Units                |
|------------------------------|------------------|----------------------------------------------------------------------------------|---------------------|--------------------------------|----------------------|----------------------|
| Input Voltage                | VCC              |                                                                                  | 3.0                 |                                | 5.5                  | V                    |
| Input Backup Battery Voltage | V_BCKP           |                                                                                  | 2.0                 |                                | 3.6                  | V                    |
| Supply Current               | I <sub>ss</sub>  | VCC = 3.3V,<br>w/o active antenna,<br>Peak<br>Acquisition<br>Tracking<br>Standby |                     | 24<br>16 <sup>(2)</sup><br>365 | 150 <sup>(1)</sup>   | mA<br>mA<br>mA<br>uA |
| Backup Battery Current       | I <sub>bat</sub> | VCC = 0V                                                                         |                     | 7                              |                      | uA                   |
| High Level Input Voltage     | V <sub>IH</sub>  |                                                                                  | 0.7xV <sub>cc</sub> |                                | V <sub>cc</sub> +1.0 | V                    |
| Low Level Input Voltage      | V <sub>IL</sub>  |                                                                                  | -0.3                |                                | 0.3xV <sub>cc</sub>  | V                    |
| High Level Input Current     | I <sub>IH</sub>  | no pull-up or down                                                               | -1                  |                                | 1                    | uA                   |
| Low Level Input Current      | I <sub>IL</sub>  | no pull-up or down                                                               | -1                  |                                | 1                    | uA                   |
| High Level Output Voltage    | V <sub>OH</sub>  |                                                                                  | 0.8xV <sub>cc</sub> |                                | V <sub>cc</sub>      | V                    |
| Low Level Output Voltage     | V <sub>OL</sub>  |                                                                                  |                     |                                | 0.2xV <sub>cc</sub>  | V                    |
| High Level Output Current    | I <sub>OH</sub>  |                                                                                  |                     | 2                              |                      | mA                   |
| Low Level Output Current     | I <sub>OL</sub>  |                                                                                  |                     | 2                              |                      | mA                   |

**Note 1:** This happens when downloading AGPS data to Module.

**Note 2:** Measured when position fix (1Hz) is available, input voltage is 3.3V and the function of self-generated ephemeris prediction is inactive.

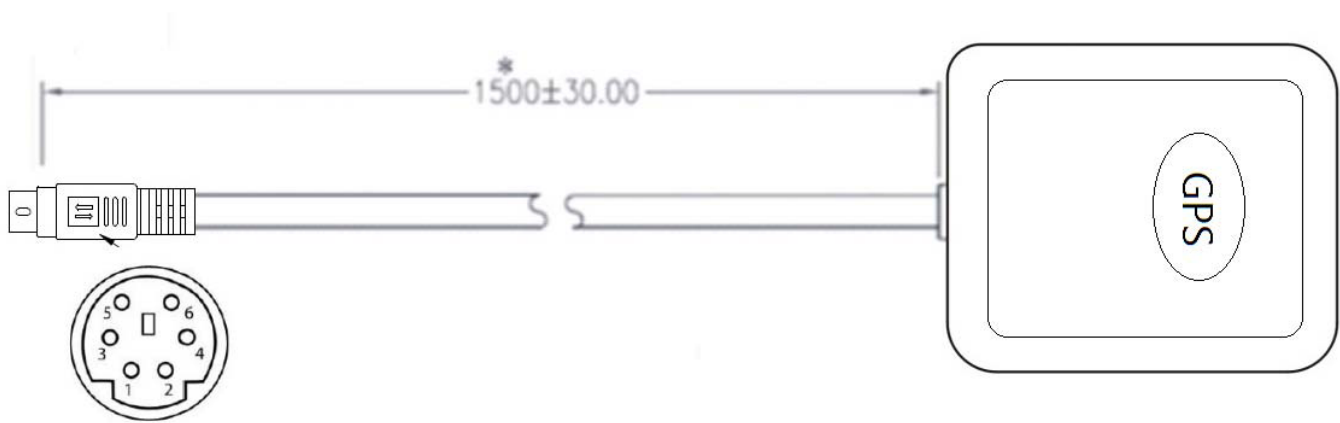
### Temperature characteristics

| Parameter             | Symbol           | Min. | Typ. | Max. | Units |
|-----------------------|------------------|------|------|------|-------|
| Operating Temperature | T <sub>opr</sub> | -40  | 25   | 85   | °C    |
| Storage Temperature   | T <sub>stg</sub> | -40  | 25   | 85   | °C    |

2. Physical Dimension

(Customized Specifications are Welcome.)

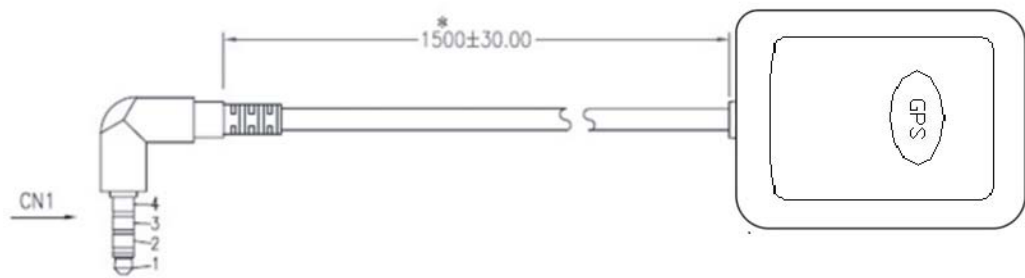
GR-902(M)GG-PS2



| IO Interface  | Voltage level |
|---------------|---------------|
| PS2 Interface | RS232 level   |

| Pin | Pin define | Level         |
|-----|------------|---------------|
| 1   | GND        | Ground        |
| 2   | Vcc        | 3.3 - 5.5V DC |
| 3   | TXD        | RS232 Output  |
| 4   | NC         | NC            |
| 5   | NC         | NC            |
| 6   | RXD        | RS232 Input   |

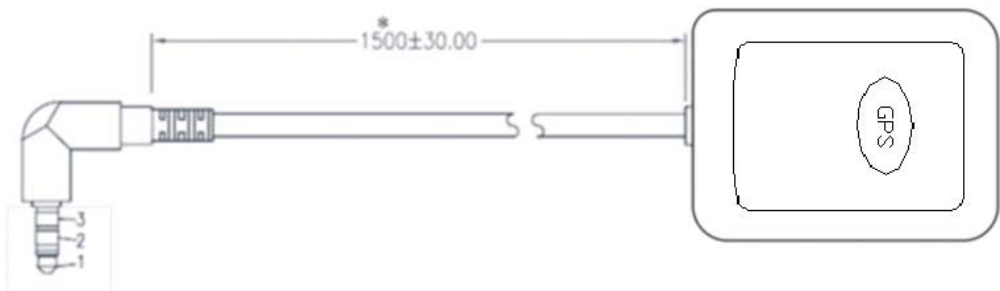
GR-902(M)GG-E25  
GR-902(M)GG-E35



| IO Interface                  | Voltage level |
|-------------------------------|---------------|
| 4 pin 2.5/3.5mm Earphone Jack | RS232 Level   |

| CN1 Pin | Pin define | Level         |
|---------|------------|---------------|
| 1       | Vcc        | 3.3 - 5.5V DC |
| 2       | RXD        | RS232 input   |
| 3       | TXD        | RS232 output  |
| 4       | GND        | Ground        |

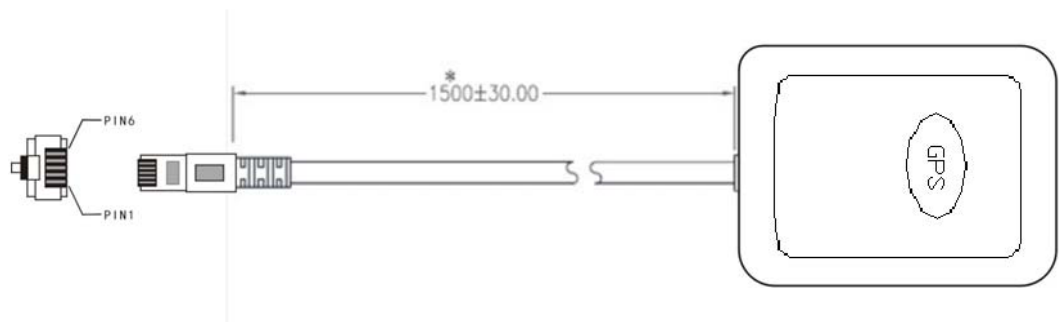
GR-902(M)GG-E253  
GR-902(M)GG-E353



| IO Interface                  | Voltage level |
|-------------------------------|---------------|
| 3 pin 2.5/3.5mm Earphone Jack | RS232 Level   |

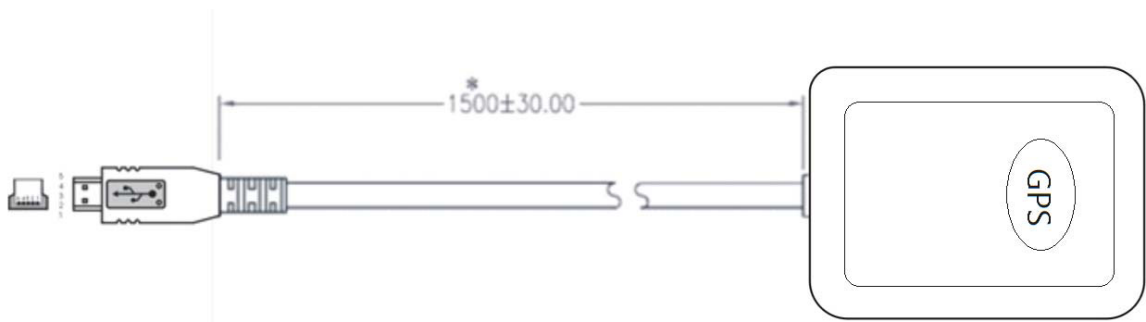
| Pin | Pin define | Level         |
|-----|------------|---------------|
| 1   | Vcc        | 3.3 - 5.5V DC |
| 2   | TXD        | RS232 output  |
| 3   | GND        | Ground        |

GR-902(M)GG-RJ45



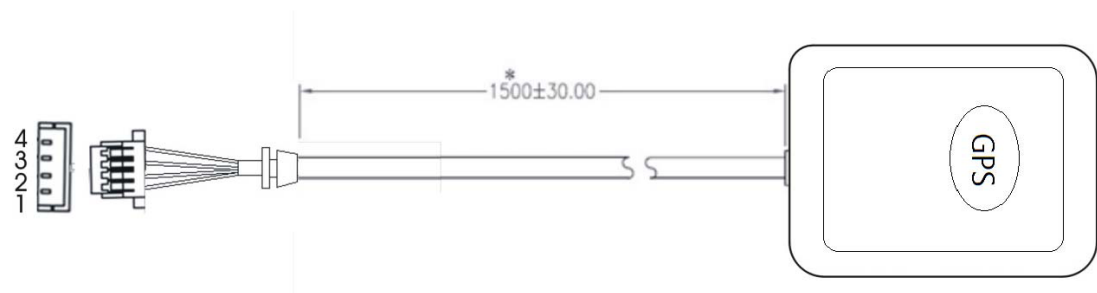
| Pin | Description | Internal wire color |
|-----|-------------|---------------------|
| 1   | NC          |                     |
| 2   | GND         | Ground              |
| 3   | RXD         | RS232 input         |
| 4   | TXD         | RS232 output        |
| 5   | Vcc         | 3.3 - 5.5V DC       |
| 6   | NC          |                     |

GR-902(M)GG-MUSB (Mini USB , Male)



| Pin | Pin define | Level         |
|-----|------------|---------------|
| 1   | Vcc        | 3.3 - 5.5V DC |
| 2   | TXD        | RS232 Output  |
| 3   | RXD        | RS232 input   |
| 4   | GND        | Ground        |
| 5   | GND        | Ground        |

GR-902(M)GG-NC4P



| Pin | Pin define | Level         |
|-----|------------|---------------|
| 1   | Vcc        | 3.3 - 5.5V DC |
| 2   | GND        | Ground        |
| 3   | TXD        | RS232 output  |
| 4   | VBAT       | 2.8-3.6V DC   |

## 3. NMEA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a \$ and with carriage return/line feed. GPS specific messages all start with \$GPxxx where xxx is a three-letter identifier of the message data that follows. NMEA messages have a checksum, which allows detection of corrupted data transfers.

GR-902(M) GGS support the following NMEA-0183 messages: GGA, GLL, GSA, GSV, RMC and VTG.

Table 1: NMEA-0183 Output Messages

| NMEA Record | DESCRIPTION                            |
|-------------|----------------------------------------|
| GGA         | Global positioning system fixed data   |
| GLL         | Geographic position—latitude/longitude |
| GSA         | GNSS DOP and active satellites         |
| GSV         | GNSS satellites in view                |
| RMC         | Recommended minimum specific GNSS data |
| VTG         | Course over ground and ground speed    |

## GGA-Global Positioning System Fixed Data

Table 2 contains the values of the following example:

\$GPGGA, 161229.487,3723.24751,N, 12158.34160,W, 1,07,1.0,9.0,M.0000\*18

Table 2: GGA Data Format

| Name                  | Example     | Units  | Description                       |
|-----------------------|-------------|--------|-----------------------------------|
| Message ID            | \$GPGGA     |        | GGA protocol header               |
| UTC Position          | 161229.487  |        | hhmmss.sss                        |
| Latitude              | 3723.24751  |        | ddmm.mmmmm                        |
| N/S indicator         | N           |        | N=north or S=south                |
| Longitude             | 12158.34160 |        | ddmm.mmmmm                        |
| E/W Indicator         | W           |        | E=east or W=west                  |
| Position FixIndicator | 1           |        | See Table 2-1                     |
| Satellites Used       | 07          |        | Range 0 to 12                     |
| HDOP                  | 1.0         |        | Horizontal Dilution of Precision  |
| MSLAltitude           | 9.0         | meters |                                   |
| Units                 | M           | meters |                                   |
| Geoids 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 2-1: Position Fix Indicators

| Value | Description                           |
|-------|---------------------------------------|
| 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               |

## GLL-Geographic Position – Latitude/Longitude

Table 3 contains the values of the following example:

\$GPGLL , 3723.24755, N,12158.34161,W,161229.487, A\*2C.

Table 3: GLL Data Format

| Name          | Example     | Units | Description                      |
|---------------|-------------|-------|----------------------------------|
| Message ID    | \$GPGLL     |       | GLL protocol header              |
| Latitude      | 3723.24755  |       | Ddmm.mmmmm                       |
| N/S Indicator | N           |       | N=north or S=south               |
| Longitude     | 12158.34161 |       | ddmm.mmmmm                       |
| 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       |

## GSA-GNSS DOP and Active Satellites

Table 4 contains the values of the following example:

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

Table 4: GSA Data Format

| Name           | Example | Units | Description                      |
|----------------|---------|-------|----------------------------------|
| Message ID     | \$GPGSA |       | GSA protocol header              |
| Mode 1         | A       |       | See Table 4-1                    |
| Mode 2         | 3       |       | See Table 4-2                    |
| Satellite Used | 07      |       | Sv on Channel 1                  |
| Satellite Used | 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       |

Table 4-1: Mode 1

| Value | Description       |
|-------|-------------------|
| 1     | Fix not available |
| 2     | 2D                |
| 3     | 3D                |

Table 4-2: Mode 2

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

## GSV-GNSS Satellites in View

Table 5 contains the values of 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 5: GGA Data Format

| Name               | Example | Units   | Description                           |
|--------------------|---------|---------|---------------------------------------|
| Message ID         | \$GPGSV |         | GSV protocol header                   |
| Number of Message  | 2       |         | Range 1 to 3                          |
| Message Number     | 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            |

Depending on the number of satellites tracked multiple messages of GSV data may be required

## RMC-Recommended Minimum Specific GNSS Data

Table 6 contains the values of the following example:

\$GPRMC, 161229.487, A, 3723.24751, N, 12158.34161, W, 0.13, 309.62, 120598,, \*10

Table 6: RMC Data Format

| Name               | Example     | Units   | Description                      |
|--------------------|-------------|---------|----------------------------------|
| Message ID         | \$GPRMC     |         | RMC protocol header              |
| UTS Position       | 161229.487  |         | hhmmss.sss                       |
| Status             | A           |         | A=data valid or V=data not valid |
| Latitude           | 3723.24751  |         | ddmm.mmmmm                       |
| N/S Indicator      | N           |         | N=north or S=south               |
| Longitude          | 12158.34161 |         | Ddmm.mmmmm                       |
| E/W Indicator      | W           |         | E=east or W=west                 |
| Speed Over Ground  | 0.13        | Knots   |                                  |
| Course Over        | 309.62      | Degrees | True                             |
| Ground             |             |         |                                  |
| Date               | 120598      |         | Dummy                            |
| Magnetic variation |             | Degrees | E=east or W=west                 |
| Checksum           | *10         |         |                                  |
| <CR><LF>           |             |         | End of message termination       |

## VTG-Course Over Ground and Ground Speed

Table 7 contains the values of the following example:

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

Table 7: 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                   |
| Speed      | 0.13    | Knots   | Measured horizontal speed  |
| Units      | N       |         | Knots                      |
| Speed      | 0.2     | Km/hr   | Measured horizontal speed  |
| Units      | K       |         | Kilometer per hour         |
| Checksum   | K       |         | Kilometer per hour         |
| Date       | *6E     |         |                            |
| <CR><LF>   |         |         | End of message termination |