

# Marine GPS Receiver

## MODEL: MR-650M

MTK MT3339 Chip GPS Marine Receiver with Full Waterproof



Garmin compatible Marine GPS Receiver

### Key Feature:

- MTK high Sensitivity sokution MT3339
- Very Fast TTFF
- Up to 10Hz update rate
- Standard and NMEA-0183 output
- User selectable baud rate
- Capable of SBAS (WAAS,EGNOS,MSAS)
- Support AGPS
- Support 66 channel gps

### Possible Application:

- Marine Navigation.
- Fleet Management.
- Mileage Management.
- Tracking devices/system.
- Data logging for marine Navigation.
- Mapping devices for PC & Pocket PC.
- Marine Navigation or touring devices.
- AVL and Location-Based service system

### Specifications:

| Specifications          | Parameter            | Description                                                                                  |
|-------------------------|----------------------|----------------------------------------------------------------------------------------------|
| General                 |                      | L1 frequency 1575.42Mhz, C/A code(SPS),<br>Support 66 channels (22 Tracking, 66 Acquisition) |
| Update rate             |                      | 1Hz Default , up to 10Hz                                                                     |
| Accuracy<br>Sensitivity | Position             | 3M (2D RMS)                                                                                  |
|                         | SBAS                 | 2.5m (depends on accuracy of correction data)                                                |
|                         | Tracking             | -162dBm, up to -165dBm (with external LNA)                                                   |
|                         | Cold start           | -143.5dBm, up to -148dBm (with external LNA)                                                 |
| Acquisition             | Cold start           | 32s (typical) without AGPS<br><15s (typical) with AGPS (hybrid ephemeris prediction)         |
|                         | Hot start (Open Sky) | < 1s (typical)                                                                               |
|                         | Hot start (Indoor)   | < 30s                                                                                        |
| Reacquisition           |                      | 100 ms typical (signal reacquisition)                                                        |

|                              |               |                                                  |
|------------------------------|---------------|--------------------------------------------------|
| <b>Dynamics</b>              | Altitude      | 18000m max.                                      |
|                              | Velocity      | 515 m/sec.                                       |
|                              | Vibration     | 4G max.                                          |
| <b>Operation Temperature</b> |               | -40° C to +85° C                                 |
| <b>Storage Temperature</b>   |               | -45° C to +90° C                                 |
| <b>Operating Humidity</b>    |               | 0% to 95% RH, non condensing                     |
| <b>Water Resistance</b>      |               | 100% waterproof                                  |
| <b>Primary Power</b>         |               | 9V ~ 70V DC                                      |
| <b>Power Consumption</b>     |               | <100mA                                           |
| <b>Protocol</b>              |               | NMEA-0183 v3.01 baud rate default 4800           |
| <b>Signal level</b>          |               | RS-232(standard),USB & RS-422 optional           |
| <b>NMEA Message</b>          |               | GGA, GLL, GSA, GSV, RMC, and VTG                 |
| <b>EMI filter</b>            |               | Rejects power line interference                  |
| <b>Power cable</b>           |               | UL 2464/24Awg , 15M-OPEN                         |
| <b>Enclosure</b>             |               | High impact, corrosion-proof polycarbonate resin |
| <b>Connector</b>             |               | 45CM-7PIN(M)                                     |
| <b>Dimensions</b>            | GPS Locator   | 60mm(Dia.) x 95mm(H)                             |
|                              | Mounting Base | 70mm(W) × 41.5mm(H)                              |
| <b>Weight</b>                |               | 200 grams                                        |
| <b>Standard Mounting</b>     |               | Concinnity and Solid design                      |

\* This specification is subject to change without prior notice

**User selectable datum \*Pole mount to 1"-14 UNS threaded mast**

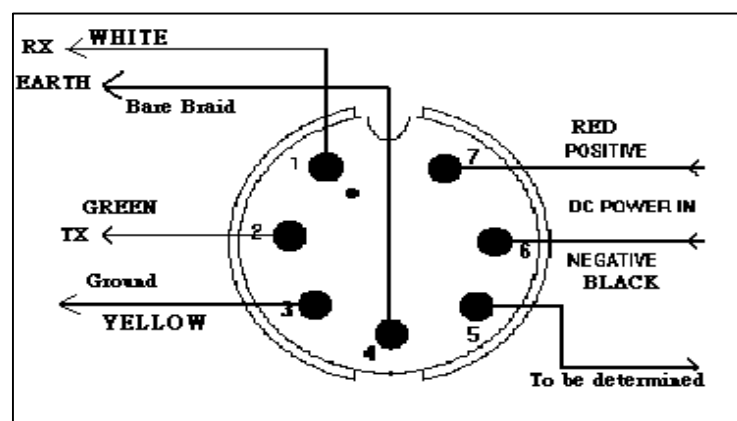


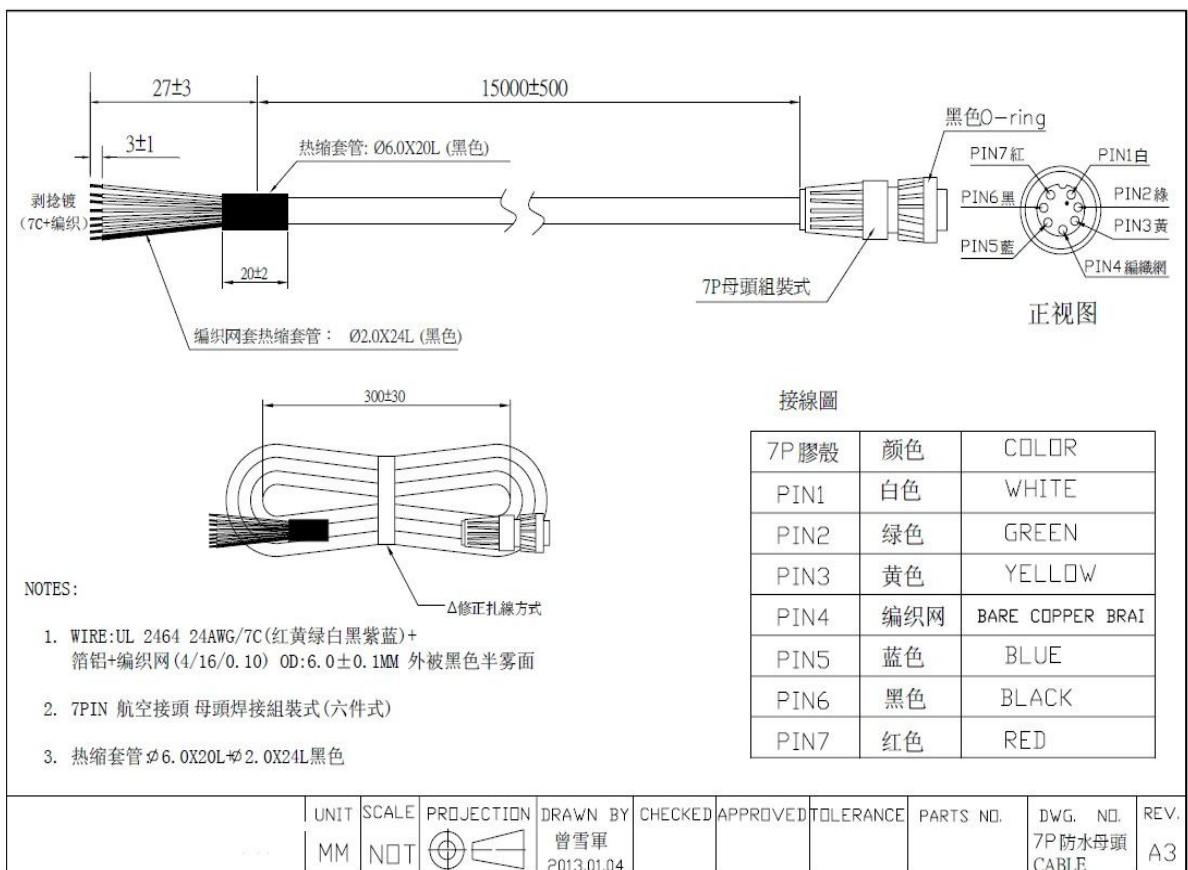
## RS232 I/O Connection

| I/O PIN & CABLE |                      |            |
|-----------------|----------------------|------------|
|                 | Wire                 | Function   |
|                 | White (白)            | Receive    |
|                 | Green(綠)             | Transmit   |
|                 | Yellow(黃)            | GND        |
|                 | Bare Braid(隔離地線/熱縮黑) | Earth/GND  |
|                 | Blue(藍)              | NG         |
|                 | Purple(紫)            | NG         |
|                 | Black(黑)             | Power- GND |
|                 | Red(紅)               | Power+     |

## RS422 I/O Connection

|  | Wire                 | Function              |
|--|----------------------|-----------------------|
|  | White (R+) 白         | Differential input +  |
|  | Green (T-) 綠         | Differential output - |
|  | Yellow (T+) 黃        | Differential output + |
|  | Purple (R-) 紫        | Differential input -  |
|  | Blue 藍               | NG                    |
|  | Bare Braid(隔離地線/熱縮黑) | Earth/GND             |
|  | Black ( - ) 黑        | Power-                |
|  | Red (+) 紅            | Power+                |





## Software interface

### 5.1 NMEA output message

Table 5.1-1 NMEA output message

| 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 5.1-2 contains the values for the following example:

\$GPGGA,053740.000,2503.6319,N,12136.0099,E,1,08,1.1,63.8,M,15.2,M,,0000\*64

Table 5.1- 2 GGA Data Format

| Name                   | Example    | Units  | Description                       |
|------------------------|------------|--------|-----------------------------------|
| Message ID             | \$GPGGA    |        | GGA protocol header               |
| UTC Time               | 053740.000 |        | hhmmss.sss                        |
| Latitude               | 2503.6319  |        | ddmm.mmmm                         |
| N/S indicator          | N          |        | N=north or S=south                |
| Longitude              | 12136.0099 |        | dddmm.mmmm                        |
| E/W Indicator          | E          |        | E=east or W=west                  |
| Position Fix Indicator | 1          |        | See Table 5.1-3                   |
| Satellites Used        | 08         |        | Range 0 to 12                     |
| HDOP                   | 1.1        |        | Horizontal Dilution of Precision  |
| MSL Altitude           | 63.8       | mters  |                                   |
| Units                  | M          | mters  |                                   |
| Geoid Separation       | 15.2       | mters  |                                   |
| Units                  | M          | mters  |                                   |
| Age of Diff. Corr.     |            | second | Null fields when DGPS is not used |
| Diff. Ref. Station ID  | 0000       |        |                                   |
| Checksum               | *64        |        |                                   |

|           |  |  |                            |
|-----------|--|--|----------------------------|
| <CR> <LF> |  |  | End of message termination |
|-----------|--|--|----------------------------|

Table 5.1-3 Position Fix Indicators

| Value | Description                           |
|-------|---------------------------------------|
| 0     | Fix not available or invalid          |
| 1     | GPS SPS Mode, fix valid               |
| 2     | Differential GPS, SPS Mode, fix valid |
| 3-5   | Not supported                         |
| 6     | Dead Reckoning Mode, fix valid        |

## ● GLL--- Geographic Position – Latitude/Longitude

Table 5.1-4 contains the values for the following example:

\$GPGLL,2503.6319,N,12136.0099,E,053740.000,A,A\*52

Table 5.1-4 GLL Data Format

| Name          | Example    | Units | Description                      |
|---------------|------------|-------|----------------------------------|
| Message ID    | \$GPGLL    |       | GLL protocol header              |
| Latitude      | 2503.6319  |       | ddmm.mmmm                        |
| N/S indicator | N          |       | N=north or S=south               |
| Longitude     | 12136.0099 |       | dddmm.mmmm                       |
| E/W indicator | E          |       | E=east or W=west                 |
| UTC Time      | 053740.000 |       | hhmmss.sss                       |
| Status        | A          |       | A=data valid or V=data not valid |
| Mode          | A          |       | A=autonomous, D=DGPS, E=DR       |
| Checksum      | *52        |       |                                  |
| <CR> <LF>     |            |       | End of message termination       |

## ● GSA---GNSS DOP and Active Satellites

Table 5.1-5 contains the values for the following example:

\$GPGSA,A,3,24,07,17,11,28,08,20,04,,,,,2.0,1.1,1.7\*35

Table 5.1-5 GSA Data Format

| Name                 | Example | Units | Description         |
|----------------------|---------|-------|---------------------|
| Message ID           | \$GPGSA |       | GSA protocol header |
| Mode 1               | A       |       | See Table 5.1-6     |
| Mode 2               | 3       |       | See Table 5.1-7     |
| ID of satellite used | 24      |       | Sv on Channel 1     |
| ID of satellite used | 07      |       | Sv on Channel 2     |
| ....                 |         |       | ....                |

|                      |     |  |                                  |
|----------------------|-----|--|----------------------------------|
| ID of satellite used |     |  | Sv on Channel 12                 |
| PDOP                 | 2.0 |  | Position Dilution of Precision   |
| HDOP                 | 1.1 |  | Horizontal Dilution of Precision |
| VDOP                 | 1.7 |  | Vertical Dilution of Precision   |
| Checksum             | *35 |  |                                  |
| <CR> <LF>            |     |  | End of message termination       |

Table 5.1-6 Mode 1

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

Table 5.1-7 Mode 2

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

## ● GSV---GNSS Satellites in View

Table 5.1-8 contains the values for the following example:

\$GPGSV,3,1,12,28,81,285,42,24,67,302,46,31,54,354,,20,51,077,46\*73

\$GPGSV,3,2,12,17,41,328,45,07,32,315,45,04,31,250,40,11,25,046,41\*75

\$GPGSV,3,3,12,08,22,214,38,27,08,190,16,19,05,092,33,23,04,127,\*7B

Table 5.1-8 GSV Data Format

| Name                                  | Example | Units   | Description                                        |
|---------------------------------------|---------|---------|----------------------------------------------------|
| Message ID                            | \$GPGSV |         | GSV protocol header                                |
| Total number of messages <sup>1</sup> | 3       |         | Range 1 to 3                                       |
| Message number <sup>1</sup>           | 1       |         | Range 1 to 3                                       |
| Satellites in view                    | 12      |         |                                                    |
| Satellite ID                          | 28      |         | Channel 1 (Range 01 to 32)                         |
| Elevation                             | 81      | degrees | Channel 1 (Range 00 to 90)                         |
| Azimuth                               | 285     | degrees | Channel 1 (Range 000 to 359)                       |
| SNR (C/No)                            | 42      | dB-Hz   | Channel 1 (Range 00 to 99, null when not tracking) |
| Satellite ID                          | 20      |         | Channel 4 (Range 01 to 32)                         |
| Elevation                             | 51      | degrees | Channel 4 (Range 00 to 90)                         |
| Azimuth                               | 077     | degrees | Channel 4 (Range 000 to 359)                       |
| SNR (C/No)                            | 46      | dB-Hz   | Channel 4 (Range 00 to 99, null when not tracking) |
| Checksum                              | *73     |         |                                                    |
| <CR> <LF>                             |         |         | End of message termination                         |

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

### ● RMC---Recommended Minimum Specific GNSS Data

Table 5.1-9 contains the values for the following example:

\$GPRMC,053740.000,A,2503.6319,N,12136.0099,E,2.69,79.65,100106,,,A\*53

Table 5.1-9 RMC Data Format

| Name               | Example    | Units   | Description                      |
|--------------------|------------|---------|----------------------------------|
| Message ID         | \$GPRMC    |         | RMC protocol header              |
| UTC Time           | 053740.000 |         | hhmmss.sss                       |
| Status             | A          |         | A=data valid or V=data not valid |
| Latitude           | 2503.6319  |         | ddmm.mmmm                        |
| N/S Indicator      | N          |         | N=north or S=south               |
| Longitude          | 12136.0099 |         | dddmm.mmmm                       |
| E/W Indicator      | E          |         | E=east or W=west                 |
| Speed over ground  | 2.69       | knots   | True                             |
| Course over ground | 79.65      | degrees |                                  |
| Date               | 100106     |         | ddmmyy                           |
| Magnetic variation |            | degrees |                                  |
| Variation sense    |            |         | E=east or W=west (Not shown)     |
| Mode               | A          |         | A=autonomous, D=DGPS, E=DR       |
| Checksum           | *53        |         |                                  |
| <CR> <LF>          |            |         | End of message termination       |

### ● VTG---Course Over Ground and Ground Speed

Table 5.1-10 contains the values for the following example:

\$GPVTG,79.65,T,,M,2.69,N,5.0,K,A\*38

Table 5.1-10 VTG Data Format

| Name               | Example | Units   | Description         |
|--------------------|---------|---------|---------------------|
| Message ID         | \$GPVTG |         | VTG protocol header |
| Course over ground | 79.65   | degrees | Measured heading    |
| Reference          | T       |         | True                |
| Course over ground |         | degrees | Measured heading    |
| Reference          | M       |         | Magnetic            |
| Speed over ground  | 2.69    | knots   | Measured speed      |
| Units              | N       |         | Knots               |
| Speed over ground  | 5.0     | km/hr   | Measured speed      |
| Units              | K       |         | Kilometer per hour  |

|           |     |  |                            |
|-----------|-----|--|----------------------------|
| Mode      | A   |  | A=autonomous, D=DGPS, E=DR |
| Checksum  | *38 |  |                            |
| <CR> <LF> |     |  | End of message termination |

## 5.2 Proprietary NMEA input message

Please refer to MTK proprietary message.