## KNCTEK GNSS positioning module

# UGL-1612M10 Specification

Version 1.0
2022/10/17



**KNCTEK Company LTD.**

**6F03, Ace High-End Tower 6th, 60-25,**
**Gasan-dong, Geumcheon-gu**
**SEOUL, KOREA**
**TEL: 82-2-839-5701**
**FAX: 82-2-830-5703**
**E-Mail: knc3@knctek.co.kr**
**http://www.knctek.co.kr**

# UGL-1612M10 Specification

REVISION HISTORY ....3
INTRODUCTION ....4
PRODUCT FEATURES ....4
PRODUCT APPLICATIONS ....4
PRODUCT PICTURE ....5
UGL-1612M10 SYSTEM BLOCK DIAGRAM ....5
TECHNICAL SPECIFICATION ....6
Supported GNSS constellations ....8
RECOMMENDED GPS/Galileo ACTIVE EXTERNAL ANTENNA ....9
MECHANICAL PIN LAYOUT ....10
RECOMMENDED LAND PATTERN DIMENSION ....10
HARDWARE INTERFACE ....11
DEFINITION OF PIN ASSIGNDMENT ....12
PACKING SPECIFICATION ....15
GNSS RECEIVER USER'S TIP ....16
CONTACT INFORMATION SECTION ....17
NMEA PROTOCOL ....18

# Revision History

- 2022-10-17 : Initiated Version 1.0

# UGL-1612M10 Operational Manual

## INTRODUCTION

The **UGL-1612M10** is the newest generation of KNCTEK GNSS positioning module. The GNSS Module is powered by U-Blox & KNCTEK technology and easy to integrate and combine exceptional positioning performance with highly flexible power, design, and connectivity options. The miniature design is the best choice to be embedded in a portable device various Trackers, Vehicle & personal Locaters and etc. The excellent sensitivity of **UGL-1612M10** gets the great performance when going though the urban canyon and foliage environmental condition.

## PRODUCT FEATURES

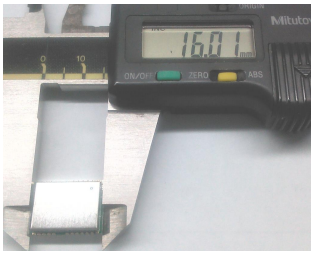
- ✧ Default setting for GPS, Galileo including QZSS, SBAS and selectable combination for GPS+Galileo+GLONASS, GPS+Galileo+Beidou B1I, GPS+Galileo+Beidou B1C and GPS+Galileo+Beidou B1C+GLONASS by sending message string
- ✧ u-blox M10 Engine
- ✧ Operable from 3.3V/Typ 20mA for Acquisition and 18mA for Tracking Mode
- ✧ Signal Detection better than -167dBm in Ultra High Tracking Sensitivity
- ✧ Enhanced Cold Acquisition Sensitivity at -148dBm and Reacquisition at -160dBm
- ✧ Fast TTFF 29 seconds for Cold start
- ✧ RF interference and jamming detection and reporting; Active GNSS in-band filtering
- ✧ AssistNow™ Online/Offline/Autonomous supported
- ✧ Excellent Sensitive for Urban Canyon and Foliage Environmental condition
- ✧ NMEA-0183 compliant protocol
- ✧ Automotive-grade Quality GPS/GLONASS solution
- ✧ Small form factor (16X12.2X2.4mm)
- ✧ ODM/OEM development is fully supported Application Engineering
- ✧ RoHS compliant

## PRODUCT APPLICATION

- ✧ Automotive applications
- ✧ Speed camera detector
- ✧ Personal and Car navigation

- ✧ Marine navigation
- ✧ Timing application and the others

## PRODUCT PICTURE

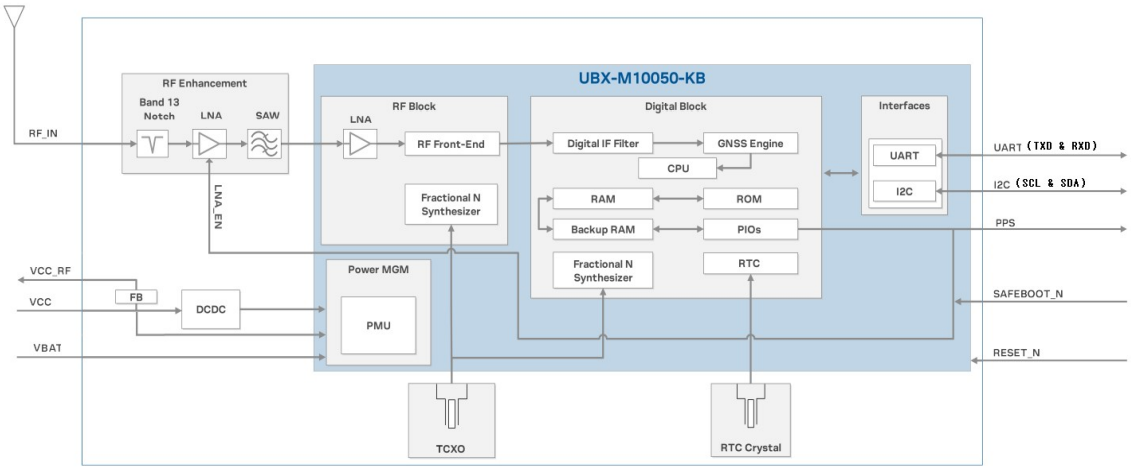



## UGL-1612M10 SYSTEM BLOCK DIAGRAM

The UGL-1612M10 consists of U-Blox M10 chipsets Technology.

The system is described as follows.

UGL-1612M10 BLOCK DIAGRAM



# TECHNICAL SPECIFICATION

## 1. Electrical Characteristics

### 1.1 Absolute Maximum Rating

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| **Power Supply** | | | | |
| Power Supply Volt. | VCC | -0.3 | 3.6 | V |
| **Input Pins** | | | | |
| Input Pin Voltage | Vin | -0.3 | VCC_IO+0.3 | V |
| Backup Battery | Vbat | -0.3 | 3.6 | V |
| **Environment** | | | | |
| Operating Temperature | Topr | -30 | 85 | ℃ |
| Storage Temperature | Tstg | -40 | 85 | ℃ |
| Peak Reflow Soldering Temperature < 10S | Tpeak | | 260 | ℃ |

Note : Absolute maximum ratings are stress ratings only, and functional operation at the maximums is not guaranteed. Stress beyond the limits specified in this table may affect device reliability or cause permanent damage to the device.

For functional operating conditions, please refer to the operating conditions tables as follow.

### 1.2 Operating Condition

| Parameter | Symbol | Condition | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Power supply voltage | VCC | | 2.7 | 3.3 | 3.6 | V |
| Power Supply voltage ripple | Vcc_PP | Vcc = 3.3V | | | 50 | mV |
| Acquisition current | IccA | Vcc = 3.3V | | 20 | | mA |
| Tracking current | IccT | Vcc = 3.3V | | 18 | | mA |
| Input high voltage | $V_{IH}$ | | 0.68*Vcc_IO | | | V |
| Input low voltage | $V_{IL}$ | | | | 0.63 | V |
| Output high voltage | $V_{OH}$ | | Vcc_IO-0.4 | | | V |
| Output low voltage | $V_{OL}$ | | | | 0.4 | V |

**Note : The in-rush current at startup can up to 100mA. Ensure that the external power supply is able to deliver to 100mA.**

## 2. General & Performance Specification

| Parameter | Specification | |
|---|---|---|
| Receiver Type | Default setting for GPS, Galileo including QZSS, SBAS and selectable combination for GPS+Galileo+GLONASS, GPS+Galileo+Beidou B1I, GPS+Galileo+Beidou B1C and GPS+Galileo+Beidou B1C+GLONASS by sending message string,<br>u-blox M10 engine | |
| Sensitivity[1] | Tracking | -167dBm |
| | Re-acquisition | -160dBm |
| | Cold Start | -148dBm |
| | Hot Start[2] | -159dBm |
| Accuracy | Position[3,4] | 2.0m CEP |
| | Velocity[5] | 0.05m/s |
| Acquisition Time[2,3,6] | Cold Start | 29 sec. typical |
| | Hot Start | 1 sec. typical |
| | Aided start[7] | 1 sec. typical |
| Power Consumption<br>( Typical ) | Tracking | 18mA @ 3.3V |
| | Acquisition | 20mA @ 3.3V |
| | Back-up | 32uA @ 3.3V |
| Navigation Data Update Rate | 1Hz_Default | In case of using Binary input : Max 10Hz[8] |
| Operational Limits[9] | Velocity | Max 500 m/s |
| | Altitude | Max 80,000m |
| | Acceleration | Less than 4g( 39.2m/sec$^2$) |
| Mechanical data | Dimension | 16.0 X 12.2 X 2.4mm (+/- 0.3mm ) |
| | Weight | 1.0grams ±5% |
| Protocol<br>( UART or I2C ) | NMEA-0183 V4.11<br>38400bps | GNRMC 1Hz( one time per sec)<br>GNVTG 1Hz<br>GNGGA 1Hz<br>GNGSA 1Hz<br>GPGSV 1Hz<br>GAGSV 1Hz<br>GQGSV[10] 1Hz<br>GNGLL 1Hz |

** 1. Demonstrate with a good external LNA. Measured at room temperature.

2. Commanded starts.
3. GPS is always in combination with SBAS and QZSS.
4. CEP, 50%, 24 hours static, -130dBm, >6SVs for each GNSS system.
5. 50% at 30m/s for dynamic operation
6. All satellites at -130dBm. Measured at room temperature.
7. Dependent on the speed and latency of the aiding data connection, commanded starts.
8. For high navigation update rates, increase the communication baud rate and reduce the number of enabled messages.
9. Assuming Airborne 4g platform
10. GQGSV is GSV Message ID for QZSS satellite.

## Supported GNSSS constellations

UGL-1612M10 is a concurrent GNSS receiver that can receive and track multiple GNSS systems. The single RF front-end architecture enables concurrent reception of four major GNSS constellations. The receiver can be configured for a subset of GNSS constellations to achieve lower power consumption.

The default configuration on UGL-1612M10 is concurrent reception of GPS, Galileo with QZSS and SBAS enabled.

### Supported GNSS and signals on UGL-1612M10

| System | Signals |
|---|---|
| GPS/QZSS | L1C/A (1575.42MHz) |
| Galileo | E1-B/C (1575.42MHz) |
| GLONASS | L1OF(1602MHz + k*562.5kHz, k=-7,…,5,6) |
| Beidou | B1I(1561.098MHz), B1C(1575.42MHz) |

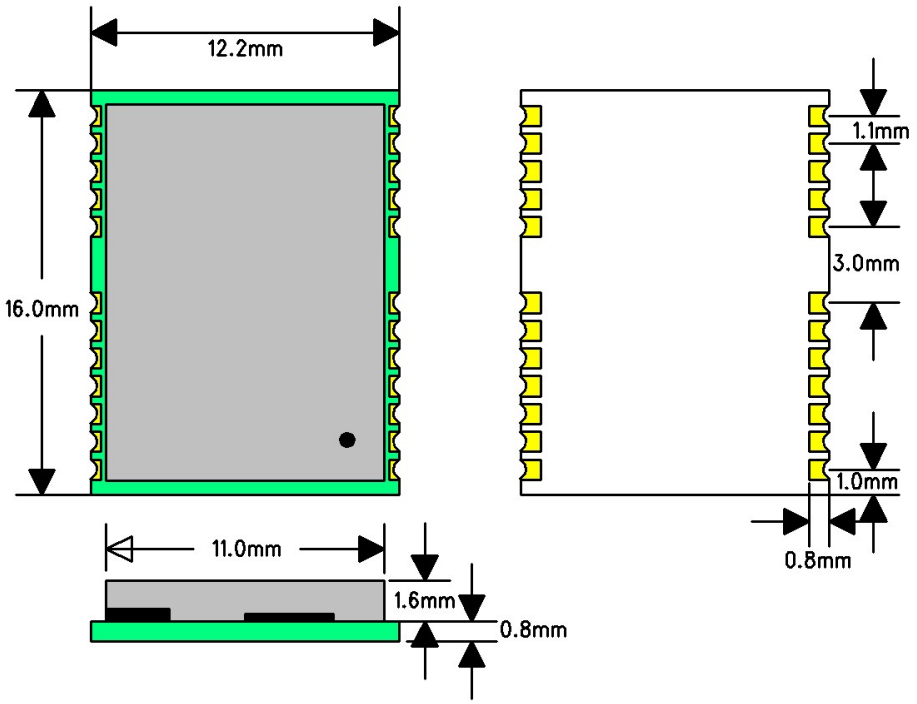
## RECOMMENDED GPS/Galileo ACTIVE EXTERNAL ANTENNA

It's recommended to use a GPS/Galileo active external antenna with supply voltage of 3.3VDC and a current draw of 15mA maximum. The quality of the GPS/Galileo active external antenna chosen is of paramount importance for the overall sensitivity of the GPS/Galileo system. A GPS/Galileo active external antenna should have a typical gain 20dB and a noise figure ≤ 1.5dB, which applies to more than 90% of the antennas available in the market.

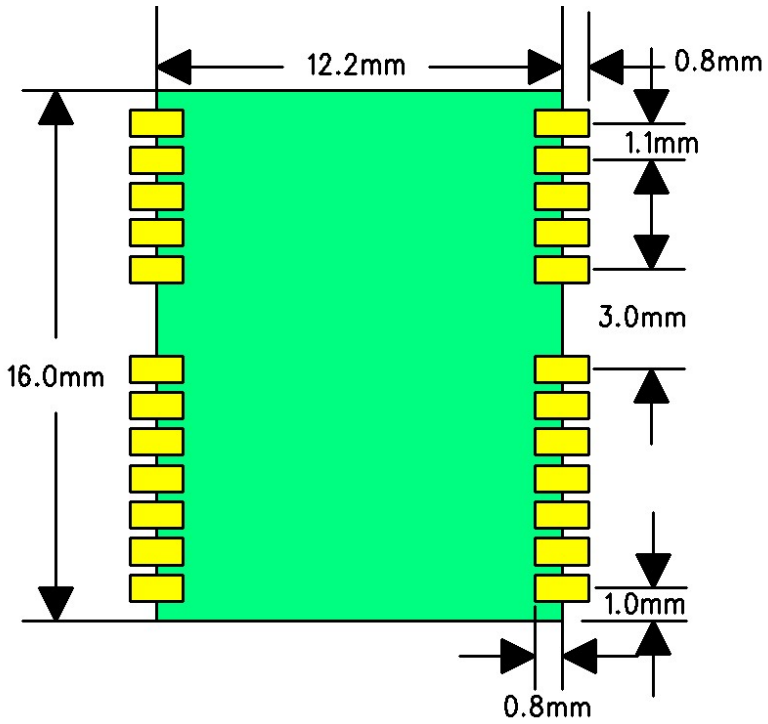
### 3.3V GPS/Galileo Active External Antenna Specification

| Characteristics | Specification |
|---|---|
| Center Frequency | GPS, Galileo : 1575.42±1.023MHz |
| Band Width(-10dB return loss) | 10MHz @ each Band |
| Gain at Zenith | 5.0dBi Typical |
| VSWR | 2.0 : 1 Max |
| Polarization | R.H.C.P |
| Axial Ratio | 3.0dB max |
| Gain | Typical 15dB (max 20dB) |
| Noise Figure | Less than 1.5dB |
| Out Band Attenuation | 20dB min for ±50MHz |
| Voltage | 3.0 ± 10%VDC or 2.7 ~ 3.3 VDC |
| Current | < 15 mA |

## MECHANICAL LAYOT

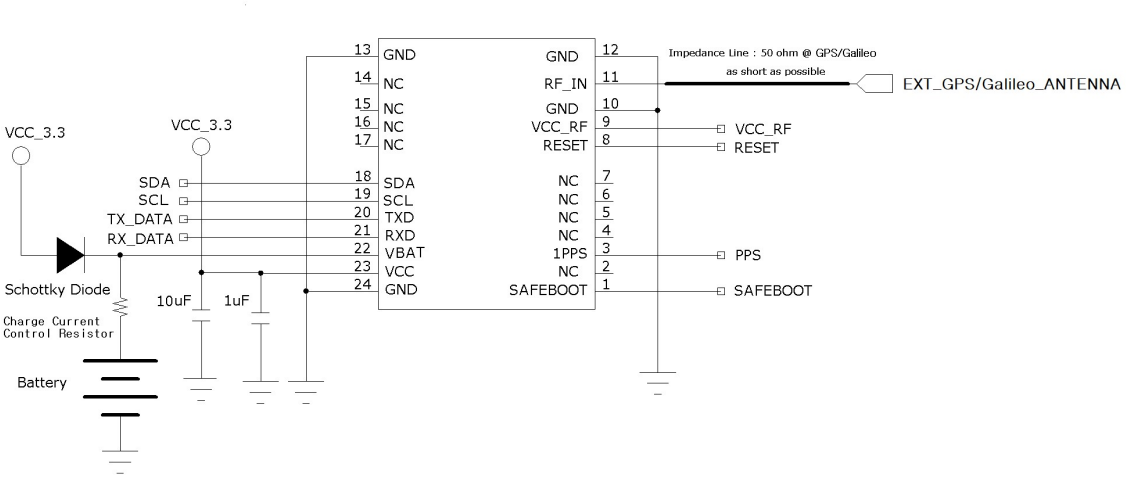



## RECOMMENDED LAND PATTERN DIMENSION

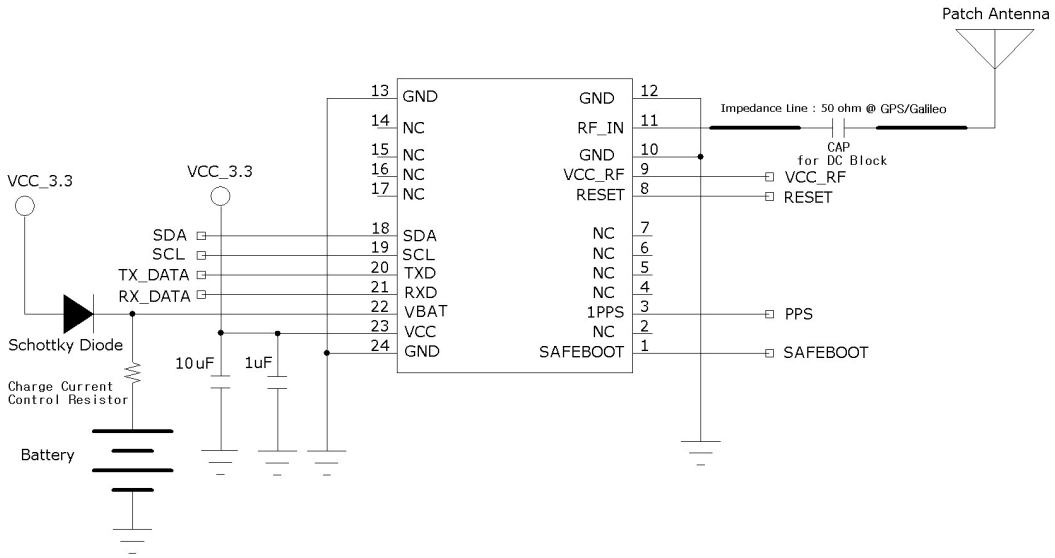


## HARDWARE INTERFACE

1. Example 1 for GPS/Galileo External Active Antenna




2. Example 1 for GPS/Galileo Patch Antenna



## DEFINITION OF PIN ASSIGNDMENT

| PIN | SIGNAL NAME | I/O | DESCRIPTION | CHARACTER |
|---|---|---|---|---|
| 1 | SAFEBOOT | I | Safeboot mode | Leave open for normal operation |
| 2 | NC | - | Not connecting | |
| 3 | 1PPS | O | 1 Pulse per Second(shared with SAFEBOOT_N pin) | Leave open if not used |
| 4 | NC | - | Not connecting | |
| 5 | NC | - | Not connecting | |
| 6 | NC | - | Not connecting | |
| 7 | NC | - | Not connecting | |
| 8 | RESET | I | RESET(Active LOW) | Leave open for normal operation |
| 9 | VCC_RF | O | Voltage output of VCC_RF | Output voltage for Active Antenna |
| 10 | GND | GND | Ground | |
| 11 | RF_IN | I | GPS/Galileo SIGNAL INPUT | 50Ω Impedance Line @ GPS/Galileo / 3.3V Bias output for Active Antenna |
| 12 | GND | GND | Ground | |
| 13 | GND | GND | Ground | |
| 14 | NC | - | Not connecting | |
| 15 | NC | - | Not connecting | |
| 16 | NC | - | Not connecting | |
| 17 | NC | - | Not connecting | |
| 18 | SDA | I/O | I2C data | Data for I2C communication |
| 19 | SCL | I | I2C clock | Clock for I2C communication |
| 20 | TXD | O | UART TX | UART Serial Data Output, 3.3V LVTTL |
| 21 | RXD | I | UART RX | UART Serial Data Input, 3.3V LVTTL |
| 22 | VBAT | I | Backup Battery supply | DC +1.65V ~ +3.6V |
| 23 | VCC | I | DC Power Supply Voltage input | DC +3.3V( 2.7 ~ 3.6V) |
| 24 | GND | GND | Ground | |

**VCC : Main DC Power Input**

This is the main power supply for the Engine board. The power range is **DC 3.3V** ±10% **( 2.7 ~ 3.6V).** Suitable decoupling must be provided by external decoupling circuitry.

**GND**

GND provides the ground for the Engine board. Connect all grounds.

**TXD**

UART Interface TX for serial communication to a host CPU. This is the main transmit channel and used to output standard NMEA_0183 sentence or response to input binary command. The default setup is NMEA Output, 38400bps, 8 data bits, no parity, 1 stop bit. The default sentences are GNRMC, GNVTG, GNGGA, GNGSA, GPGSV, GAGSV, GQGSV, GNGLL.

**RXD**

UART Interface RX for serial communication to a host CPU. This is the main receiving channel and is used to input binary commands to the Engine board from host CPU.

**PPS**

The TIMEPULSE output generates pulse trains synchronized with a GNSS or UTC time grid, with intervals configurable over a wide frequency range. Thus it may be used as a low frequency time synchronization pulse or as a high frequency reference signal.
By default the time pulse signal is configured to 1 pulse per second.
PPS is shared with SAFEBOOT_N. If this pin is low at start up, enters safeboot mode.
In normal operation, this pin is used for PPS. Make sure there is no load at this pin, which could cause the pin being low at startup.

**RESET**

Driving RESET low activates a hardware reset of the system. Driving RESET low for at least 1ms will trigger a reset of the receiver.
Leave open for normal operation. RESET should be used only in critical situations to recover the system. RESET resets the receiver and clears the BBR content including receiver configuration, Real-Time Clock (RTC), and GNSS orbit data, triggering a cold start. No capacitor should be placed at RESET to GND, otherwise it could trigger a reset every startup.

**VCC_RF**

This is pin for supplying voltage of external Active Antenna or LNA.

**RF_IN**

The Module supports passive & active antennas. The line on the PCB from the antenna(or antenna connector)has to be a controlled line (Micro strip at 50Ω @ GPS/Galileo signal).

**VBAT**

This is the battery backup supply that powers the SRAM and RTC when main power is removed. Without an external backup battery or on board battery, engine board will execute a cold start after every turn on. To achieve the faster start-up offered by a hot or warm start, either a backup battery must be connected or battery installed on board.

**I2C(SDA & SCL)**

The I2C protocol and electrical interface in UGL-1612M10 are fully compatible with Fast-mode of the I2C industry standard, The interface allows communication an external host CPU or u-blox cellular modules with a maximum transfer rate of 400kb/s(External pull-up resistors may be needed to achieve 400kbit/s communication speed, as the internal pull-up resistance can be very large). UGL-1612M10 operates in slave mode.

**SAFEBOOT**

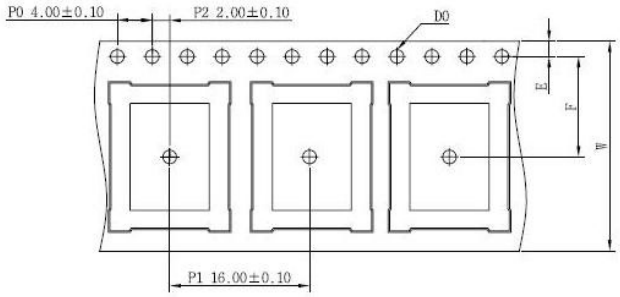
The safeboot mode is used in production to set the low level configuration in the OTP memory. UGL-1612M10 enters safeboot mode if this pin is low at start up.

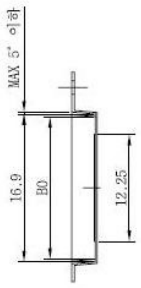
The SAFEBOOT is shared with PPS, having a 1k ohm resistor in front to prevent high current flow in case it is accidentally driven. In normal operation, the SAFEBOOT_N is used at PPS by default.

Leave open for normal operation.

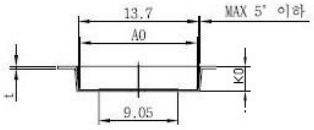
## Packing Information

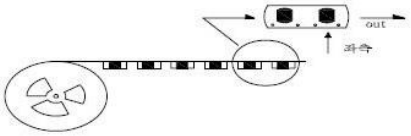
1. Carrier Tape Dimension



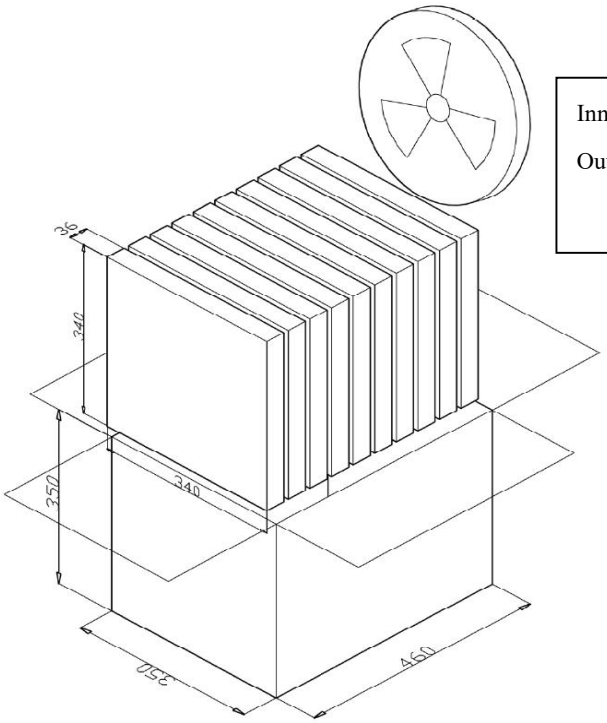

Taping style




| | | | |
|---|---|---|---|
| A0 | 13.40±0.10 | E | 1.75±0.10 |
| B0 | 16.60±0.10 | F | 11.50±0.10 |
| K0 | 2.70±0.10 | t | 0.30±0.05 |
| D0 | 1.55±0.05 | w | 24.00±0.30 |

2. Inner & Out Box (Carton Box )




Inner Box : 1,500pcs by one Tape & Reel packing

Out Box : Contained 10sets of Inner Boxes.

(Total 15,000pcs )

## GNSS Receiver User's Tip

1. GNSS signal will be affected by weather and environment conditions, thus suggest to use the GNSS receiver under less shielding environments to ensure GNSS receiver has better receiving performance.
2. When GNSS receiver is moving, it will prolong the time to fix the position, so suggest to wait for the satellite signals to be locked at a fixed point when first power-on the GNSS receiver to ensure to lock the GNSS signal at the shortest time.
3. The following situation will affect the GNSS receiving performance:
   a. Solar control filmed windows.
   b. Metal shielded, such as umbrella, or in vehicle.
   c. Among high buildings.
   d. Under bridges or tunnels.
   e. Under high voltage cables or nearby radio wave sources, such as mobile phone base stations.
   f. Bad or heavy cloudy weather.
4. If the satellite signals cannot be locked or encounter receiving problem (while in the urban area), the following steps are suggested:
   a. Move to another open space or reposition GNSS receiver toward the direction with fewer blockages.
   b. Move the GNSS receiver away from the interference resources.
   c. Wait until the weather condition is improved.

While a GNSS with a backup battery, the GNSS receiver can fix a position immediately at next power-on if the build-in backup battery is full-recharged.

## Contact Information Section

Contact : knc3@knctek.co.kr

Web Site: www.knctek.co.kr

Headquarter :

**6F03, Ace High-End Tower 6th, 60-25,**
**Gasan-dong, Geumcheon-gu**
**SEOUL, KOREA**
**TEL: 82-2-839-5701**
**FAX: 82-2-830-5703**

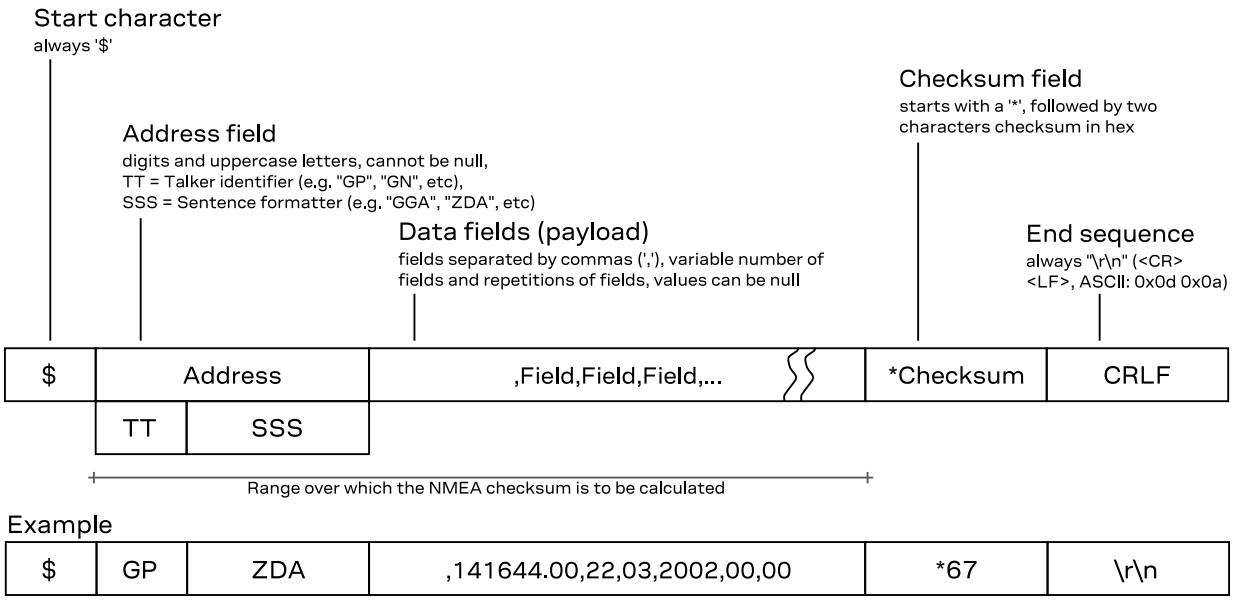
# 2 NMEA protocol

The following sections give an overview of the NMEA messages used by u-blox positioning receivers.

By default, the NMEA messages sent by u-blox positioning receivers are based on the NMEA 0183 version 4.11 standard. For further information on the NMEA standard, refer to the *NMEA 0183 Standard for Interfacing Marine Electronic Devices*, Version 4.11, November 2018, which is available on http://www.nmea.org/.

## 2.1 NMEA frame structure

The following figure shows the structure of a NMEA protocol message (called "sentences" in the standard).




## 2.2 NMEA protocol configuration

The NMEA protocol on u-blox receivers can be configured for customer applications by using the Configuration interface (CFG-NMEA-* items).

Several NMEA standard versions are supported. Version 4.11 (not in all products), 4.10, 4.00, 2.3, or 2.1 can be configured. See Configuration defaults for the default version. See CFG-NMEA-PROTVER to configure the version. See NMEA multi-GNSS operation and NMEA data fields for details on how this affects the output.

The following filtering flags can be used to configure the output of some NMEA message fields:

| Filter | Configuration Item | Description |
|---|---|---|
| Position filtering | CFG-NMEA-OUT_INVFIX | Enable to permit positions from failed or invalid fixes to be reported (with the "V" status flag to indicate that the data is not valid). |
| Valid position filtering | CFG-NMEA-OUT_MSKFIX | Enable to permit positions from invalid fixes to be reported (with the "V" status flag to indicate that the data is not valid). |
| Time filtering | CFG-NMEA-OUT_INVTIME | Enable to permit the receiver's best knowledge of time to be output, even though it might be wrong. |

| Filter | Configuration Item | Description |
|---|---|---|
| Date filtering | CFG-NMEA-OUT_INVDATE | Enable to permit the receiver's best knowledge of date to be output, even though it might be wrong. |
| GPS-only filtering | CFG-NMEA-OUT_ONLYGPS | Enable to restrict output to only report GPS satellites. |
| Track filtering | CFG-NMEA-OUT_FROZENCOG | Enable to permit course over ground (COG) to be reported even when it would otherwise be frozen. |

The following filtering flags can be used to configure the output of some NMEA message flags:

| Mode | Configuration Item | Description |
|---|---|---|
| Compatibility mode | CFG-NMEA-COMPAT | Some older NMEA applications expect the NMEA output to be formatted in a specific way, for example, they will only work if the latitude and longitude have exactly four digits behind the decimal point. u-blox receivers offer a compatibility mode to support these legacy applications. |
| Consideration mode | CFG-NMEA-CONSIDER | u-blox receivers use a sophisticated signal quality detection scheme, in order to produce the best possible position output. This algorithm considers all SV measurements, and may eventually decide to only use a subset thereof, if it improves the overall position accuracy. If consideration mode is enabled, all satellites, which were considered for navigation, are communicated as being used for the position determination. If consideration mode is disabled, only those satellites which after the consideration step remained in the position output are marked as being used. |
| Limit length mode | CFG-NMEA-LIMIT82 | Enabling this mode will limit the NMEA sentence length to a maximum of 82 characters. |
| High precision mode | CFG-NMEA-HIGHPREC | Enabling this mode increases precision of the position output. Latitude and longitude then have seven digits after the decimal point, and altitude has three digits after the decimal point. Note: The high precision mode cannot be set in conjunction with either compatibility mode or Limit82 mode. |

The following extended configuration options are available:

| Option | Configuration Item(s) | Description |
|---|---|---|
| GNSS to filter | CFG-NMEA-FILT_GPS etc. | Filters satellites based on the GNSS they belong to. |
| Satellite numbering | CFG-NMEA-SVNUMBERING | This field configures the display of satellites that do not have an NMEA-defined value. Note: this does not apply to satellites with an unknown ID. See also Satellite identifiers. |
| Main Talker ID | CFG-NMEA-MAINTALKERID | By default the main Talker ID (i.e. the Talker ID used for all messages other than GSV) is determined by the GNSS assignment of the receiver's channels (see configuration items CFG-SIGNAL-*). This field enables the main Talker ID to be overridden. See also NMEA Talker ID. |
| GSV Talker ID | CFG-NMEA-GSVTALKERID | By default the Talker ID for GSV messages is GNSS-specific (as defined by NMEA). This field enables the GSV Talker ID to be overridden. |
| BDS Talker ID | CFG-NMEA-BDSTALKERID | By default the Talker ID for BeiDou is "GB". This field enables the BeiDou Talker ID to be overridden. |

## 2.3 NMEA-proprietary messages

The NMEA standard allows for proprietary, manufacturer-specific messages to be added. These shall be marked with a manufacturer mnemonic. The mnemonic assigned to u-blox is UBX and is used for all non-standard messages. These proprietary NMEA messages therefore have the address field set to PUBX. The first data field in a PUBX message identifies the message number with two digits.

## 2.4 NMEA multi-GNSS operation

Many applications that process NMEA messages assume that only a single GNSS is active. However, when multiple GNSS are configured, the NMEA specification requires the output to change in the following ways:

**Main Talker ID** The main NMEA Talker ID will be "GN" (e.g. instead of "GP" for a GPS-only receiver).

**GSV Talker IDs** The GSV message reports the signal strength of the visible satellites. However, the Talker ID it uses is specific to the GNSS it is reporting information for, so for a multi-GNSS receiver it will not be the same as the main Talker ID. While other messages use the "GN" Talker ID, the GSV message will use GNSS-specific Talker IDs. See also NMEA protocol configuration.

**Multiple GSA and GRS messages** Multiple GSA and GRS messages are output for each fix, one for each GNSS. This may confuse applications that assume they are output only once per position fix (as is the case for a single GNSS receiver).

**GGA Talker IDs** The NMEA specification indicates that the GGA message is GPS-specific. However, u-blox receivers support the output of a GGA message for each of the Talker IDs.

**BeiDou and Galileo** Only NMEA version 4.10 and later have support for these systems.

**QZSS** Only NMEA version 4.11 and later have support for this system.

**Extended satellite numbering** In order to support some GNSS (e.g. BeiDou, Galileo, QZSS) that are not supported by some or all NMEA protocol versions, an "extended" SV numbering scheme can be enabled. This uses the NMEA-defined numbers where possible, but adds other number ranges to support other GNSS. Note however that these non-standard extensions require 3-digit numbers, which may not be supported by some NMEA parsing software. For example, QZSS satellites use numbers in the range 193 to 202. See NMEA protocol configuration and Satellite identifiers.

## 2.5 NMEA data fields

Various data fields in NMEA messages depend on NMEA protocol configuration or require a definition for their interpretation.

### 2.5.1 NMEA Talker ID

One of the ways the NMEA standard differs depending on the GNSS is by using a two-letter message identifier, the "Talker ID". The specific Talker ID used by a u-blox receiver will depend on the product and its configuration. The table below shows the Talker ID that will be used for various GNSS configurations by default.

| GNSS | Talker ID | Comments |
|---|---|---|
| GPS, SBAS | GP | NMEA 2.3+ |
| GLONASS | GL | NMEA 2.3+ |
| Galileo | GA | NMEA 4.10+ |
| BeiDou | GB | NMEA 4.10+ (official NMEA only since 4.11) |
| NavIC | GI | NMEA 4.11+ |
| QZSS | GQ | NMEA 4.11+ (GP for NMEA 2.3 - 4.10) |
| Any combination of GNSS | GN | |

### 2.5.2 NMEA extra fields

The following extra fields are available in NMEA 4.10 and later.

| Message | Extra fields |
|---|---|
| NMEA-Standard-GBS | `systemId` and `signalId` |
| NMEA-Standard-GNS | `navStatus` |
| NMEA-Standard-GRS | `systemId` and `signalId` |
| NMEA-Standard-GSA | `systemId` |
| NMEA-Standard-GSV | `signalId` |
| NMEA-Standard-RMC | `navStatus` |

### 2.5.3 NMEA latitude and longitude format

According to the NMEA standard, latitude and longitude are output in the format *degrees, minutes and (decimal) fractions of minutes*. To convert to *degrees and fractions of degrees*, or *degrees, minutes, seconds and fractions of seconds*, the *minutes* and *fractional minutes* parts need to be converted. For example:

| Format | Latitude | Longitude |
|---|---|---|
| Receiver output | `$GNRMC,014230.00,A,4722.80340,N,00831.68218,E,0.000,,120477,,,A,V*14` | |
| (d)ddmm.mmmmm | 4722.80340 North | 00831.68218 East |
| Degrees and minutes | 47 degrees, 22.80340 minutes | 8 degrees, 31.68218 minutes |
| Degrees | 47.38005667 degrees | 8.52803633 degrees |
| Degrees, minutes and seconds | 47 degrees, 22 minutes, 48.2040 seconds | 8 degrees, 31 minutes, 40.9308 seconds |

### 2.5.4 NMEA GNSS, satellite, and signal numbering

See GNSS, satellite, and signal identifiers for details on how GNSS, satellites and signals are numbered in the NMEA protocol.

NMEA defines satellite numbering systems for some, but not all GNSS. The exact behavior depends on the configured NMEA protocol version and ("extended" or "strict") mode. See NMEA protocol configuration for details.

### 2.5.5 NMEA position fix flags

This section shows how u-blox positioning receivers implement the NMEA protocol and the conditions determining how flags are set.

The following flags are used in NMEA 4.10 and later.

| NMEA Message | GLL, RMC | GGA | GLL, VTG | RMC, GNS |
|---|---|---|---|---|
| **Field** | **status**[5] | **quality**[6] | **posMode**[7] | **posMode**[7] |
| No position fix (at power-up, after losing satellite lock) | V | 0 | N | N |
| GNSS fix, but user limits exceeded | V | 0 | N | N |
| Dead reckoning fix, but user limits exceeded | V | 6 | E | E |
| Dead reckoning fix | A | 6 | E | E |
| RTK float | A | 5 | D | F |
| RTK fixed | A | 4 | D | R |

5 Possible *status* values: V = data invalid, A = data valid

6 Possible values for *quality*: 0 = No fix, 1 = autonomous GNSS fix, 2 = differential GNSS fix, 4 = RTK fixed, 5 = RTK float, 6 = estimated/dead reckoning fix

7 Possible values for *posMode*: N = No fix, E = estimated/dead reckoning fix, A = autonomous GNSS fix, D = differential GNSS fix, F = RTK float, R = RTK fixed

| NMEA Message | GLL, RMC | GGA | GLL, VTG | RMC, GNS |
|---|---|---|---|---|
| **Field** | **status**[5] | **quality**[6] | **posMode**[7] | **posMode**[7] |
| 2D GNSS fix | A | 1 / 2 | A / D | A / D |
| 3D GNSS fix | A | 1 / 2 | A / D | A / D |
| Combined GNSS/dead reckoning fix | A | 1 / 2 | A / D | A / D |

In high precision GNSS (HPG) products it is recommended to select NMEA version 4.10 or above. Earlier versions do not support the float RTK (F) and real time kinematic (R) mode indicator flags in all messages.

The following flags are used in NMEA 2.3 - 4.0.

| NMEA Message | GLL, RMC | GGA | GSA | GLL, VTG, RMC, GNS |
|---|---|---|---|---|
| **Field** | **status**[8] | **quality**[9] | **navMode**[10] | **posMode**[11] |
| No position fix (at power-up, after losing satellite lock) | V | 0 | 1 | N |
| GNSS fix, but user limits exceeded | V | 0 | 1 | N |
| Dead reckoning fix, but user limits exceeded | V | 6 | 2 | E |
| Dead reckoning fix | A | 6 | 2 | E |
| 2D GNSS fix | A | 1 / 2 | 2 | A / D |
| 3D GNSS fix | A | 1 / 2 | 3 | A / D |
| Combined GNSS/dead reckoning fix | A | 1 / 2 | 3 | A / D |

The flags in NMEA 2.1 and earlier are the same as NMEA 2.3 but with the following differences:

- The *posMode* field is not output for GLL, RMC and VTG messages (each message has one field less).
- The GGA *quality* field is set to 1 (instead of 6) for both types of dead reckoning fix.

### 2.5.6 NMEA output of invalid or unknown data

By default the receiver will not output invalid data. In such cases, it will output empty fields. See NMEA protocol configuration for options to adjust this behavior.

A valid position fix is reported as follows:

```
$GPGLL,4717.11634,N,00833.91297,E,124923.00,A,A*6E
```

An invalid position fix (but valid time) is reported as follows:

```
$GPGLL,,,,,124924.00,V,N*42
```

If the time is unknown (e.g. during a cold start):

```
$GPGLL,,,,,,V,N*64
```

Unlike the NMEA standard behavior to invalid data, dead reckoning products always report a position. It is marked as invalid (V) when the user limits are exceeded or valid (A) if the user limits are met.

8 Possible values for *status*: V = data invalid, A = data valid

9 Possible values for *quality*: 0 = no fix, 1 = autonomous GNSS fix, 2 = differential GNSS fix, 4 = RTK fixed, 5 = RTK float, 6 = estimated/dead reckoning fix

10 Possible values for *navMode*: 1 = No fix, 2 = 2D fix, 3 = 3D fix

11 Possible values for *posMode*: N = No fix, E = estimated/dead reckoning fix, A = autonomous GNSS fix, D = differential GNSS fix

## 2.6 NMEA messages overview

| *Message* | *Class/ID* | *Description (Type)* |
|---|---|---|
| **NMEA-Standard – Standard NMEA messages** | | |
| NMEA-Standard-DTM | 0xf0 0x0a | • Datum reference (Output) |
| NMEA-Standard-GAQ | 0xf0 0x45 | • Poll a standard message (Talker ID GA) (Poll request) |
| NMEA-Standard-GBQ | 0xf0 0x44 | • Poll a standard message (Talker ID GB) (Poll request) |
| NMEA-Standard-GBS | 0xf0 0x09 | • GNSS satellite fault detection (Output) |
| NMEA-Standard-GGA | 0xf0 0x00 | • Global positioning system fix data (Output) |
| NMEA-Standard-GLL | 0xf0 0x01 | • Latitude and longitude, with time of position fix and status (Output) |
| NMEA-Standard-GLQ | 0xf0 0x43 | • Poll a standard message (Talker ID GL) (Poll request) |
| NMEA-Standard-GNQ | 0xf0 0x42 | • Poll a standard message (Talker ID GN) (Poll request) |
| NMEA-Standard-GNS | 0xf0 0x0d | • GNSS fix data (Output) |
| NMEA-Standard-GPQ | 0xf0 0x40 | • Poll a standard message (Talker ID GP) (Poll request) |
| NMEA-Standard-GQQ | 0xf0 0x47 | • Poll a standard message (Talker ID GQ) (Poll request) |
| NMEA-Standard-GRS | 0xf0 0x06 | • GNSS range residuals (Output) |
| NMEA-Standard-GSA | 0xf0 0x02 | • GNSS DOP and active satellites (Output) |
| NMEA-Standard-GST | 0xf0 0x07 | • GNSS pseudorange error statistics (Output) |
| NMEA-Standard-GSV | 0xf0 0x03 | • GNSS satellites in view (Output) |
| NMEA-Standard-RLM | 0xf0 0x0b | • Return link message (RLM) (Output) |
| NMEA-Standard-RMC | 0xf0 0x04 | • Recommended minimum data (Output) |
| NMEA-Standard-TXT | 0xf0 0x41 | • Text transmission (Output) |
| NMEA-Standard-VLW | 0xf0 0x0f | • Dual ground/water distance (Output) |
| NMEA-Standard-VTG | 0xf0 0x05 | • Course over ground and ground speed (Output) |
| NMEA-Standard-ZDA | 0xf0 0x08 | • Time and date (Output) |
| **NMEA-PUBX – u-blox proprietary NMEA messages** | | |
| NMEA-PUBX-CONFIG | 0xf1 0x41 | • Set protocols and baud rate (Set) |
| NMEA-PUBX-POSITION | 0xf1 0x00 | • Poll a PUBX,00 message (Poll request)<br>• Lat/Long position data (Output) |
| NMEA-PUBX-RATE | 0xf1 0x40 | • Set NMEA message output rate (Set) |
| NMEA-PUBX-SVSTATUS | 0xf1 0x03 | • Poll a PUBX,03 message (Poll request)<br>• Satellite status (Output) |
| NMEA-PUBX-TIME | 0xf1 0x04 | • Poll a PUBX,04 message (Poll request)<br>• Time of day and clock information (Output) |

## 2.7 Standard messages

Standard NMEA messages as defined by the NMEA 0183 standard. See NMEA protocol for details.

### 2.7.1 DTM

#### 2.7.1.1 Datum reference

| *Message* | **NMEA-Standard-DTM**<br>**Datum reference** |
|---|---|
| *Type* | Output |
| *Comment* | This message gives the difference between the current datum and the reference datum.<br>The current datum is set to WGS84 by default. |

The reference datum cannot be changed and is always set to WGS84.

| | |
|---|---|
| *Information* | *Class/ID:* 0xf0 0x0a *Number of fields:* 11 |
| *Structure* | `$xxDTM,datum,subDatum,lat,NS,lon,EW,alt,refDatum*cs\r\n` |
| *Examples* | `$GPDTM,W84,,0.0,N,0.0,E,0.0,W84*6F\r\n`<br>`$GPDTM,999,,0.08,N,0.07,E,-47.7,W84*1C\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | `xxDTM` | string | - | $GPDTM | DTM Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | `datum` | string | - | W84 | Local datum code: W84 = WGS84, P90 = PZ90, 999 = user-defined |
| 2 | `subDatum` | string | - | - | A null field (or a string describing the currently selected datum for protocol versions less than 14.00) |
| 3 | `lat` | numeric | min | 0.08 | Offset in Latitude |
| 4 | `NS` | character | - | S | North/South indicator |
| 5 | `lon` | numeric | min | 0.07 | Offset in Longitude |
| 6 | `EW` | character | - | E | East/West indicator |
| 7 | `alt` | numeric | m | -2.8 | Offset in altitude |
| 8 | `refDatum` | string | - | W84 | Reference datum code: W84 (WGS 84, fixed field) |
| 9 | `cs` | hexadecimal | - | *67 | Checksum |
| 10 | `CRLF` | character | - | - | Carriage return and line feed |

## 2.7.2 GAQ

### 2.7.2.1 Poll a standard message (Talker ID GA)

| ***Message*** | **NMEA-Standard-GAQ**<br>**Poll a standard message (Talker ID GA)** |
|---|---|
| *Type* | Poll request |
| *Comment* | Polls a standard NMEA message if the current Talker ID is GA. |
| *Information* | *Class/ID:* 0xf0 0x45 *Number of fields:* 4 |
| *Structure* | `$xxGAQ,msgId*cs\r\n` |
| *Example* | `$EIGAQ,RMC*2B\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | `xxGAQ` | string | - | $EIGAQ | GAQ Message ID (xx = Talker ID of the device requesting the poll) |
| 1 | `msgId` | string | - | RMC | Message ID of the message to be polled |
| 2 | `cs` | hexadecimal | - | *2B | Checksum |
| 3 | `CRLF` | character | - | - | Carriage return and line feed |

## 2.7.3 GBQ

### 2.7.3.1 Poll a standard message (Talker ID GB)

| ***Message*** | **NMEA-Standard-GBQ**<br>**Poll a standard message (Talker ID GB)** |
|---|---|
| *Type* | Poll request |

| | |
|---|---|
| *Comment* | Polls a standard NMEA message if the current Talker ID is GB |
| *Information* | *Class/ID:* 0xf0 0x44 *Number of fields:* 4 |
| *Structure* | `$xxGBQ,msgId*cs\r\n` |
| *Example* | `$EIGBQ,RMC*28\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | `xxGBQ` | string | - | $EIGBQ | GBQ Message ID (xx = Talker ID of the device requesting the poll) |
| 1 | `msgId` | string | - | RMC | Message ID of the message to be polled |
| 2 | `cs` | hexadecimal | - | *28 | Checksum |
| 3 | `CRLF` | character | - | - | Carriage return and line feed |

## 2.7.4 GBS

### 2.7.4.1 GNSS satellite fault detection

| ***Message*** | **NMEA-Standard-GBS**<br>**GNSS satellite fault detection** |
|---|---|
| *Type* | Output |
| *Comment* | This message outputs the results of the Receiver Autonomous Integrity Monitoring Algorithm (RAIM).<br>• The fields **errLat**, **errLon** and **errAlt** output the standard deviation of the position calculation, using all satellites that pass the RAIM test successfully.<br>• The fields **errLat**, **errLon** and **errAlt** are only output if the RAIM process passed successfully (i.e. no or successful edits happened). These fields are never output if 4 or fewer satellites are used for the navigation calculation (because, in such cases, integrity cannot be determined by the receiver autonomously).<br>• The fields **prob**, **bias** and **stdev** are only output if at least one satellite failed in the RAIM test.<br>If more than one satellites fail the RAIM test, only the information for the worst satellite is output in this message. |
| *Information* | *Class/ID:* 0xf0 0x09 *Number of fields:* 13 |
| *Structure* | `$xxGBS,time,errLat,errLon,errAlt,svid,prob,bias,stddev,systemId,signalId*cs\r\n` |
| *Examples* | `$GPGBS,235503.00,1.6,1.4,3.2,,,,,,*40\r\n`<br>`$GPGBS,235458.00,1.4,1.3,3.1,03,,-21.4,3.8,1,0*5B\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | `xxGBS` | string | - | $GPGBS | GBS Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | `time` | hhmmss.ss | - | 235503.00 | UTC time to which this RAIM sentence belongs. See section UTC representation in the integration manual for details. |
| 2 | `errLat` | numeric | m | 1.6 | Expected error in latitude |
| 3 | `errLon` | numeric | m | 1.4 | Expected error in longitude |
| 4 | `errAlt` | numeric | m | 3.2 | Expected error in altitude |
| 5 | `svid` | numeric | - | 03 | Satellite ID of most likely failed satellite |
| 6 | `prob` | numeric | - | - | Probability of missed detection: null (not supported, fixed field) |
| 7 | `bias` | numeric | m | -21.4 | Estimated bias of most likely failed satellite (a priori residual) |
| 8 | `stddev` | numeric | m | 3.8 | Standard deviation of estimated bias |

| | | | | | |
|---|---|---|---|---|---|
| 9 | systemId | hexadecimal | - | 1 | NMEA-defined GNSS system ID, see Signal Identifiers table (only available in NMEA 4.10 and later) |
| 10 | signalId | hexadecimal | - | - | NMEA-defined GNSS signal ID, see Signal Identifiers table (only available in NMEA 4.10 and later) |
| 11 | cs | hexadecimal | - | *5B | Checksum |
| 12 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.5 GGA

### 2.7.5.1 Global positioning system fix data

| ***Message*** | **NMEA-Standard-GGA**<br>**Global positioning system fix data** |
|---|---|
| *Type* | Output |
| *Comment* | Time and position, together with GPS fixing-related data (number of satellites in use, and the resulting HDOP, age of differential data if in use, etc.).<br>☞ The output of this message is dependent on the currently selected datum (default: WGS84). The NMEA specification indicates that the GGA message is GPS-specific. However, when the receiver is configured for multi-GNSS, the GGA message contents will be generated from the multi-GNSS solution. For multi-GNSS use, it is recommended that the NMEA-GNS message is used instead. |
| *Information* | *Class/ID:* 0xf0 0x00 *Number of fields:* 17 |
| *Structure* | `$xxGGA,time,lat,NS,lon,EW,quality,numSV,HDOP,alt,altUnit,sep,sepUnit,diffAge,diffSta ↵ tion*cs\r\n` |
| *Example* | `$GPGGA,092725.00,4717.11399,N,00833.91590,E,1,08,1.01,499.6,M,48.0,M,,*5B\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | xxGGA | string | - | $GPGGA | GGA Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | time | hhmmss.ss | - | 092725.00 | UTC time. See section UTC representation in the integration manual for details. |
| 2 | lat | ddmm.mmmmm | - | 4717.11399 | Latitude (degrees and minutes), see format description |
| 3 | NS | character | - | N | North/South indicator |
| 4 | lon | dddmm.mmmmm | - | 00833.91590 | Longitude (degrees and minutes), see format description |
| 5 | EW | character | - | E | East/West indicator |
| 6 | quality | digit | - | 1 | Quality indicator for position fix, see position fix flags description |
| 7 | numSV | numeric | - | 08 | Number of satellites used (range: 0-12) |
| 8 | HDOP | numeric | - | 1.01 | Horizontal Dilution of Precision |
| 9 | alt | numeric | m | 499.6 | Altitude above mean sea level |
| 10 | altUnit | character | - | M | Altitude units: M (meters, fixed field) |
| 11 | sep | numeric | m | 48.0 | Geoid separation: difference between ellipsoid and mean sea level |
| 12 | sepUnit | character | - | M | Geoid separation units: M (meters, fixed field) |
| 13 | diffAge | numeric | s | - | Age of differential corrections (null when DGPS is not used) |
| 14 | diffStation | numeric | - | - | ID of station providing differential corrections (null when DGPS is not used) |

| | | | | | |
|---|---|---|---|---|---|
| 15 | cs | hexadecimal | - | *5B | Checksum |
| 16 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.6 GLL

### 2.7.6.1 Latitude and longitude, with time of position fix and status

| ***Message*** | **NMEA-Standard-GLL**<br>**Latitude and longitude, with time of position fix and status** |
|---|---|
| *Type* | Output |
| *Comment* | ☞ The output of this message is dependent on the currently selected datum (default: WGS84) |
| *Information* | *Class/ID:* 0xf0 0x01 *Number of fields:* 10 |
| *Structure* | `$xxGLL,lat,NS,lon,EW,time,status,posMode*cs\r\n` |
| *Example* | `$GPGLL,4717.11364,N,00833.91565,E,092321.00,A,A*60\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | xxGLL | string | - | $GPGLL | GLL Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | lat | ddmm.mmmmm | - | 4717.11364 | Latitude (degrees and minutes), see format description |
| 2 | NS | character | - | N | North/South indicator |
| 3 | lon | dddmm.mmmmm | - | 00833.91565 | Longitude (degrees and minutes), see format description |
| 4 | EW | character | - | E | East/West indicator |
| 5 | time | hhmmss.ss | - | 092321.00 | UTC time. See section UTC representation in the integration manual for details. |
| 6 | status | character | - | A | Data validity status, see position fix flags description |
| 7 | posMode | character | - | A | Positioning mode, see position fix flags description (only available in NMEA 2.3 and later) |
| 8 | cs | hexadecimal | - | *60 | Checksum |
| 9 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.7 GLQ

### 2.7.7.1 Poll a standard message (Talker ID GL)

| ***Message*** | **NMEA-Standard-GLQ**<br>**Poll a standard message (Talker ID GL)** |
|---|---|
| *Type* | Poll request |
| *Comment* | Polls a standard NMEA message if the current Talker ID is GL |
| *Information* | *Class/ID:* 0xf0 0x43 *Number of fields:* 4 |
| *Structure* | `$xxGLQ,msgId*cs\r\n` |
| *Example* | `$EIGLQ,RMC*3A\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | xxGLQ | string | - | $EIGLQ | GLQ Message ID (xx = Talker ID of the device requesting the poll) |
| 1 | msgId | string | - | RMC | Message ID of the message to be polled |

| | | | | | |
|---|---|---|---|---|---|
| 2 | cs | hexadecimal | - | *3A | Checksum |
| 3 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.8 GNQ

### 2.7.8.1 Poll a standard message (Talker ID GN)

| ***Message*** | **NMEA-Standard-GNQ**<br>**Poll a standard message (Talker ID GN)** |
|---|---|
| *Type* | Poll request |
| *Comment* | Polls a standard NMEA message if the current Talker ID is GN |
| *Information* | *Class/ID:* 0xf0 0x42 *Number of fields:* 4 |
| *Structure* | `$xxGNQ,msgId*cs\r\n` |
| *Example* | `$EIGNQ,RMC*3A\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | xxGNQ | string | - | $EIGNQ | GNQ Message ID (xx = Talker ID of the device requesting the poll) |
| 1 | msgId | string | - | RMC | Message ID of the message to be polled |
| 2 | cs | hexadecimal | - | *3A | Checksum |
| 3 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.9 GNS

### 2.7.9.1 GNSS fix data

| ***Message*** | **NMEA-Standard-GNS**<br>**GNSS fix data** |
|---|---|
| *Type* | Output |
| *Comment* | Time and position, together with GNSS fixing-related data (number of satellites in use, and the resulting HDOP, age of differential data if in use, etc.).<br>☞ The output of this message is dependent on the currently selected datum (default: WGS84) |
| *Information* | *Class/ID:* 0xf0 0x0d *Number of fields:* 16 |
| *Structure* | `$xxGNS,time,lat,NS,lon,EW,posMode,numSV,HDOP,alt,sep,diffAge,diffStation,navStatus*cs\r\n` |
| *Examples* | `$GNGNS,103600.01,5114.51176,N,00012.29380,W,ANNN,07,1.18,111.5,45.6,,,V*00\r\n`<br>`$GNGNS,122310.2,3722.425671,N,12258.856215,W,DAAA,14,0.9,1005.543,6.5,,,V*0E\r\n`<br>`$GPGNS,122310.2,,,,,,07,,,,5.2,23,V*02\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | xxGNS | string | - | $GPGNS | GNS Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | time | hhmmss.ss | - | 091547.00 | UTC time. See section UTC representation in the integration manual for details. |
| 2 | lat | ddmm.mmmmm | - | 5114.50897 | Latitude (degrees and minutes), see format description |
| 3 | NS | character | - | N | North/South indicator |
| 4 | lon | dddmm.mmmmm | - | 00012.28663 | Longitude (degrees and minutes), see format description |
| 5 | EW | character | - | E | East/West indicator |

| | | | | | |
|---|---|---|---|---|---|
| 6 | posMode | character | - | AAAA | Positioning mode, see position fix flags description. First character for GPS, second character for GLONASS, third character for Galileo, fourth character for BeiDou |
| 7 | numSV | numeric | - | 10 | Number of satellites used (range: 0-99) |
| 8 | HDOP | numeric | - | 0.83 | Horizontal Dilution of Precision |
| 9 | alt | numeric | m | 111.1 | Altitude above mean sea level |
| 10 | sep | numeric | m | 45.6 | Geoid separation: difference between ellipsoid and mean sea level |
| 11 | diffAge | numeric | s | - | Age of differential corrections (null when DGPS is not used) |
| 12 | diffStation | numeric | - | - | ID of station providing differential corrections (null when DGPS is not used) |
| 13 | navStatus | character | - | V | Navigational status indicator: V (Equipment is not providing navigational status information, fixed field, only available in NMEA 4.10 and later) |
| 14 | cs | hexadecimal | - | *71 | Checksum |
| 15 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.10 GPQ

### 2.7.10.1 Poll a standard message (Talker ID GP)

| ***Message*** | **NMEA-Standard-GPQ**<br>**Poll a standard message (Talker ID GP)** |
|---|---|
| *Type* | Poll request |
| *Comment* | Polls a standard NMEA message if the current Talker ID is GP |
| *Information* | *Class/ID:* 0xf0 0x40 *Number of fields:* 4 |
| *Structure* | $xxGPQ,msgId*cs\r\n |
| *Example* | $EIGPQ,RMC*3A\r\n |
| *Payload:* | |

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | xxGPQ | string | - | $EIGPQ | GPQ Message ID (xx = Talker ID of the device requesting the poll) |
| 1 | msgId | string | - | RMC | Message ID of the message to be polled |
| 2 | cs | hexadecimal | - | *3A | Checksum |
| 3 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.11 GQQ

### 2.7.11.1 Poll a standard message (Talker ID GQ)

| ***Message*** | **NMEA-Standard-GQQ**<br>**Poll a standard message (Talker ID GQ)** |
|---|---|
| *Type* | Poll request |
| *Comment* | Polls a standard NMEA message if the current Talker ID is GQ |
| *Information* | *Class/ID:* 0xf0 0x47 *Number of fields:* 4 |
| *Structure* | $xxGQQ,msgId*cs\r\n |
| *Example* | $EIGQQ,RMC*3A\r\n |
| *Payload:* | |

| Field | Name | Format | Unit | Example | Description |
|---|---|---|---|---|---|
| 0 | xxGQQ | string | - | $EIGQQ | GQQ Message ID (xx = Talker ID of the device requesting the poll) |
| 1 | msgId | string | - | RMC | Message ID of the message to be polled |
| 2 | cs | hexadecimal | - | *3A | Checksum |
| 3 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.12 GRS

### 2.7.12.1 GNSS range residuals

| **Message** | **NMEA-Standard-GRS**<br>**GNSS range residuals** |
|---|---|
| *Type* | Output |
| *Comment* | If less than 12 SVs are available, the remaining fields are output empty. If more than 12 SVs are used, only the residuals of the first 12 SVs are output, in order to remain consistent with the NMEA standard.<br>**In a multi-GNSS system this message will be output multiple times, once for each GNSS.**<br>☞ This message relates to associated GGA and GSA messages. |
| *Information* | *Class/ID:* 0xf0 0x06 *Number of fields:* 19 |
| *Structure* | `$xxGRS,time,mode{,residual},systemId,signalId*cs\r\n` |
| *Examples* | `$GNGRS,104148.00,1,2.6,2.2,-1.6,-1.1,-1.7,-1.5,5.8,1.7,,,,,1,1*52\r\n`<br>`$GNGRS,104148.00,1,,0.0,2.5,0.0,,2.8,,,,,,,1,5*52\r\n` |

*Payload:*

| Field | Name | Format | Unit | Example | Description |
|---|---|---|---|---|---|
| 0 | xxGRS | string | - | $GPGRS | GRS Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | time | hhmmss.ss | - | 082632.00 | UTC time of associated position fix. See section UTC representation in the integration manual for details. |
| 2 | mode | digit | - | 1 | Computation method used:<br>• 1 = Residuals were recomputed after the GGA position was computed (fixed) |
| *Start of repeated group (12 times)* | | | | | |
| 3 + n | residual | numeric | m | 0.54 | Range residuals for SVs used in navigation. The SV order matches the order from the GSA sentence |
| *End of repeated group (12 times)* | | | | | |
| 15 | systemId | hexadecimal | - | 1 | NMEA-defined GNSS system ID, see Signal Identifiers table (only available in NMEA 4.10 and later) |
| 16 | signalId | hexadecimal | - | - | NMEA-defined GNSS signal ID, see Signal Identifiers table (only available in NMEA 4.10 and later) |
| 17 | cs | hexadecimal | - | *70 | Checksum |
| 18 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.13 GSA

### 2.7.13.1 GNSS DOP and active satellites

| **Message** | **NMEA-Standard-GSA**<br>**GNSS DOP and active satellites** |
|---|---|
| *Type* | Output |
| *Comment* | The GNSS receiver operating mode, satellites used for navigation, and DOP values. |

- If less than 12 SVs are used for navigation, the remaining fields are left empty. If more than 12 SVs are used for navigation, only the IDs of the first 12 are output.
- The SV numbers (fields 'svid') are in the range of 1 to 32 for GPS satellites, and 33 to 64 for SBAS satellites (33 = SBAS PRN 120, 34 = SBAS PRN 121, and so on)

**In a multi-GNSS system this message will be output multiple times, once for each GNSS.**

| | | | | | |
|---|---|---|---|---|---|
| *Information* | *Class/ID:* 0xf0 0x02 | | *Number of fields:* 21 | | |
| *Structure* | `$xxGSA,opMode,navMode{,svid},PDOP,HDOP,VDOP,systemId*cs\r\n` | | | | |
| *Example* | `$GPGSA,A,3,23,29,07,08,09,18,26,28,,,,,1.94,1.18,1.54,1*0D\r\n` | | | | |
| *Payload:* | | | | | |
| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
| 0 | `xxGSA` | string | - | $GPGSA | GSA Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | `opMode` | character | - | A | Operation mode:<br>• M = Manually set to operate in 2D or 3D mode<br>• A = Automatically switching between 2D or 3D mode |
| 2 | `navMode` | digit | - | 3 | Navigation mode, see position fix flags description |
| *Start of repeated group (12 times)* | | | | | |
| 3 + n | `svid` | numeric | - | 29 | Satellite number |
| *End of repeated group (12 times)* | | | | | |
| 15 | `PDOP` | numeric | - | 1.94 | Position dilution of precision |
| 16 | `HDOP` | numeric | - | 1.18 | Horizontal dilution of precision |
| 17 | `VDOP` | numeric | - | 1.54 | Vertical dilution of precision |
| 18 | `systemId` | hexadecimal | - | 1 | NMEA-defined GNSS system ID, see Signal Identifiers table (only available in NMEA 4.10 and later) |
| 19 | `cs` | hexadecimal | - | *0D | Checksum |
| 20 | `CRLF` | character | - | - | Carriage return and line feed |

## 2.7.14 GST

### 2.7.14.1 GNSS pseudorange error statistics

| ***Message*** | **NMEA-Standard-GST**<br>**GNSS pseudorange error statistics** | | | | |
|---|---|---|---|---|---|
| *Type* | Output | | | | |
| *Comment* | This message reports statistical information on the quality of the position solution. | | | | |
| *Information* | *Class/ID:* 0xf0 0x07 | | *Number of fields:* 11 | | |
| *Structure* | `$xxGST,time,rangeRms,stdMajor,stdMinor,orient,stdLat,stdLong,stdAlt*cs\r\n` | | | | |
| *Example* | `$GPGST,082356.00,1.8,,,,1.7,1.3,2.2*7E\r\n` | | | | |
| *Payload:* | | | | | |
| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
| 0 | `xxGST` | string | - | $GPGST | GST Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | `time` | hhmmss.ss | - | 082356.00 | UTC time of associated position fix. See section UTC representation in the integration manual for details. |
| 2 | `rangeRms` | numeric | m | 1.8 | RMS value of the standard deviation of the ranges |
| 3 | `stdMajor` | numeric | m | - | Standard deviation of semi-major axis |
| 4 | `stdMinor` | numeric | m | - | Standard deviation of semi-minor axis |

| | | | | | |
|---|---|---|---|---|---|
| 5 | orient | numeric | deg | - | Orientation of semi-major axis |
| 6 | stdLat | numeric | m | 1.7 | Standard deviation of latitude error |
| 7 | stdLong | numeric | m | 1.3 | Standard deviation of longitude error |
| 8 | stdAlt | numeric | m | 2.2 | Standard deviation of altitude error |
| 9 | cs | hexadecimal | - | *7E | Checksum |
| 10 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.15 GSV

### 2.7.15.1 GNSS satellites in view

| ***Message*** | **NMEA-Standard-GSV**<br>**GNSS satellites in view** |
|---|---|
| *Type* | Output |
| *Comment* | The number of satellites in view, together with each SV ID, elevation azimuth, and signal strength (C/No) value. Only four satellite details are transmitted in one message.<br>**In a multi-GNSS system sets of GSV messages will be output multiple times, one set for each GNSS.** |
| *Information* | *Class/ID:* 0xf0 0x03 *Number of fields:* 7 + [1..4]·4 |
| *Structure* | `$xxGSV,numMsg,msgNum,numSV{,svid,elv,az,cno},signalId*cs\r\n` |
| *Examples* | `$GPGSV,3,1,09,09,,,17,10,,,40,12,,,49,13,,,35,1*6F\r\n`<br>`$GPGSV,3,2,09,15,,,44,17,,,45,19,,,44,24,,,50,1*64\r\n`<br>`$GPGSV,3,3,09,25,,,40,1*6E\r\n`<br>`$GPGSV,1,1,03,12,,,42,24,,,47,32,,,37,5*66\r\n`<br>`$GAGSV,1,1,00,2*76\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | xxGSV | string | - | $GPGSV | GSV Message ID (xx = GSV Talker ID, see NMEA Talker IDs table). Talker ID GN shall not be used. |
| 1 | numMsg | digit | - | 3 | Number of messages, total number of GSV messages being output (range: 1-9) |
| 2 | msgNum | digit | - | 1 | Number of this message (range: 1-numMsg) |
| 3 | numSV | numeric | - | 10 | Number of known satellites in view regarding both the talker ID and the signalId |
| *Start of repeated group (1...4 times)* | | | | | |
| 4 + n·4 | svid | numeric | - | 23 | Satellite ID |
| 5 + n·4 | elv | numeric | deg | 38 | Elevation (<= 90) |
| 6 + n·4 | az | numeric | deg | 230 | Azimuth (range: 0-359) |
| 7 + n·4 | cno | numeric | dBHz | 44 | Signal strength (C/N0, range: 0-99), null when not tracking |
| *End of repeated group (1...4 times)* | | | | | |
| 4 + N·4 | signalId | hexadecimal | - | - | NMEA-defined GNSS signal ID, see Signal Identifiers table (only available in NMEA 4.10 and later) |
| 5 + N·4 | cs | hexadecimal | - | *7F | Checksum |
| 6 + N·4 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.16 RLM

### 2.7.16.1 Return link message (RLM)

| ***Message*** | **NMEA-Standard-RLM**<br>**Return link message (RLM)** |
|---|---|
| *Type* | Output |
| *Comment* | The RLM sentence is used to transfer a Return link message from a Cospas-Sarsat recognized Return link service provider (RLSP).<br>The RLM sentence supports communications to an emitting beacon once a distress alert has been detected, located and confirmed. The communications may include acknowledgement of the alert to the emitting beacon as well as optional text messages, and may also include remote beacon configuration and testing. |
| *Information* | *Class/ID:* 0xf0 0x0b *Number of fields:* 7 |
| *Structure* | `$xxRLM,beacon,time,code,body*cs\r\n` |
| *Examples* | `$GARLM,00000078A9FBAD5,083559.00,3,C45B*57\r\n`<br>`$GARLM,F7129D41BC6A78C,034433.02,3,B63CA732AFD419D2*57\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | `xxRLM` | string | - | $GARLM | RLM message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | `beacon` | hexadecimal | - | 00000078A9FBAD5 | Beacon ID, identifies beacon intended to receive this message (fixed length 15 hexadecimal character field) |
| 2 | `time` | hhmmss.ss | - | 083559.00 | Time of reception field to indicate RLM timestamp in UTC. See section UTC representation in the integration manual for details. |
| 3 | `code` | character | - | 3 | Message code field to identify type of RLM Message Service:<br>• 0 = Reserved for future RLM services<br>• 1 = Acknowledgement service RLM<br>• 2 = Command service RLM<br>• 3 = Message service RLM<br>• 4-E = Reserved for future RLM services<br>• F = Test service RLM (currently used only by the Galileo program) |
| 4 | `body` | hexadecimal | - | C45B | Message body encapsulates the data parameters provided by the RLSP into hexadecimal format. |
| 5 | `cs` | hexadecimal | - | *57 | Checksum |
| 6 | `CRLF` | character | - | - | Carriage return and line feed |

## 2.7.17 RMC

### 2.7.17.1 Recommended minimum data

| ***Message*** | **NMEA-Standard-RMC**<br>**Recommended minimum data** |
|---|---|
| *Type* | Output |
| *Comment* | The recommended minimum sentence defined by NMEA for GNSS system data.<br>☞ The output of this message is dependent on the currently selected datum (default: WGS84) |
| *Information* | *Class/ID:* 0xf0 0x04 *Number of fields:* 16 |
| *Structure* | `$xxRMC,time,status,lat,NS,lon,EW,spd,cog,date,mv,mvEW,posMode,navStatus*cs\r\n` |
| *Example* | `$GPRMC,083559.00,A,4717.11437,N,00833.91522,E,0.004,77.52,091202,,,A,V*57\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 0 | xxRMC | string | - | $GPRMC | RMC Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | time | hhmmss.ss | - | 083559.00 | UTC time. See section UTC representation in the integration manual for details. |
| 2 | status | character | - | A | Data validity status, see position fix flags description |
| 3 | lat | ddmm.mmmmm | - | 4717.11437 | Latitude (degrees and minutes), see format description |
| 4 | NS | character | - | N | North/South indicator |
| 5 | lon | dddmm.mmmmm | - | 00833.91522 | Longitude (degrees and minutes), see format description |
| 6 | EW | character | - | E | East/West indicator |
| 7 | spd | numeric | knots | 0.004 | Speed over ground |
| 8 | cog | numeric | deg | 77.52 | Course over ground |
| 9 | date | ddmmyy | - | 091202 | Date in day, month, year format. See section UTC representation in the integration manual for details. |
| 10 | mv | numeric | deg | - | Magnetic variation value |
| 11 | mvEW | character | - | - | Magnetic variation E/W indicator |
| 12 | posMode | character | - | A | Mode Indicator, see position fix flags description (only available in NMEA 2.3 and later) |
| 13 | navStatus | character | - | V | Navigational status indicator: V (Equipment is not providing navigational status information, fixed field, only available in NMEA 4.10 and later) |
| 14 | cs | hexadecimal | - | *57 | Checksum |
| 15 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.18 TXT

### 2.7.18.1 Text transmission

| ***Message*** | **NMEA-Standard-TXT**<br>**Text transmission** |
|---|---|
| *Type* | Output |
| *Comment* | This message outputs various information on the receiver, such as power-up screen, software version etc. This message can be configured using the CFG-INFMSG configuration group. |
| *Information* | *Class/ID:* 0xf0 0x41 *Number of fields:* 7 |
| *Structure* | `$xxTXT,numMsg,msgNum,msgType,text*cs\r\n` |
| *Examples* | `$GPTXT,01,01,02,u-blox ag - www.u-blox.com*50\r\n`<br>`$GPTXT,01,01,02,ANTARIS ATR0620 HW 00000040*67\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | xxTXT | string | - | $GPTXT | TXT Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | numMsg | numeric | - | 01 | Total number of messages in this transmission (range: 1-99) |
| 2 | msgNum | numeric | - | 01 | Message number in this transmission (range: 1-numMsg) |

| | | | | | |
|---|---|---|---|---|---|
| 3 | msgType | numeric | - | 02 | Text identifier (u-blox receivers specify the type of the message with this number):<br>• 00 = Error<br>• 01 = Warning<br>• 02 = Notice<br>• 07 = User |
| 4 | text | string | - | www.u-blox.com | Any ASCII text |
| 5 | cs | hexadecimal | - | *67 | Checksum |
| 6 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.19 VLW

### 2.7.19.1 Dual ground/water distance

| ***Message*** | **NMEA-Standard-VLW**<br>**Dual ground/water distance** |
|---|---|
| *Type* | Output |
| *Comment* | The distance traveled, relative to the water and over the ground. This message relates to the odometer feature detailed in the integration manual. |
| *Information* | *Class/ID:* 0xf0 0x0f *Number of fields:* 11 |
| *Structure* | `$xxVLW,twd,twdUnit,wd,wdUnit,tgd,tgdUnit,gd,gdUnit*cs\r\n` |
| *Example* | `$GPVLW,,N,,N,15.8,N,1.2,N*06\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | xxVLW | string | - | $GPVLW | VLW Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | twd | numeric | nmi | - | Total cumulative water distance: null (fixed field) |
| 2 | twdUnit | character | - | N | Total cumulative water distance units: N (nautical miles, fixed field) |
| 3 | wd | numeric | nmi | - | Water distance since reset: null (fixed field) |
| 4 | wdUnit | character | - | N | Water distance since reset units: N (nautical miles, fixed field) |
| 5 | tgd | numeric | nmi | 15.8 | Total cumulative ground distance (only available in NMEA 4.00 and later) |
| 6 | tgdUnit | character | - | N | Total cumulative ground distance units: N (nautical miles, fixed field, only available in NMEA 4.00 and later) |
| 7 | gd | numeric | nmi | 1.2 | Ground distance since reset (only available in NMEA 4.00 and later) |
| 8 | gdUnit | character | - | N | Ground distance since reset units: N (nautical miles, fixed field, only available in NMEA 4.00 and later) |
| 9 | cs | hexadecimal | - | *06 | Checksum |
| 10 | CRLF | character | - | - | Carriage return and line feed |

## 2.7.20 VTG

### 2.7.20.1 Course over ground and ground speed

| ***Message*** | **NMEA-Standard-VTG**<br>**Course over ground and ground speed** |
|---|---|
| *Type* | Output |
| *Comment* | Velocity is given as course over ground (COG) and speed over ground (SOG). |
| *Information* | *Class/ID:* 0xf0 0x05 *Number of fields:* 12 |
| *Structure* | `$xxVTG,cogt,cogtUnit,cogm,cogmUnit,sogn,sognUnit,sogk,sogkUnit,posMode*cs\r\n` |
| *Example* | `$GPVTG,77.52,T,,M,0.004,N,0.008,K,A*06\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | `xxVTG` | string | - | $GPVTG | VTG Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | `cogt` | numeric | degrees | 77.52 | Course over ground (true) |
| 2 | `cogtUnit` | character | - | T | Course over ground units: T (degrees true, fixed field) |
| 3 | `cogm` | numeric | degrees | - | Course over ground (magnetic) |
| 4 | `cogmUnit` | character | - | M | Course over ground units: M (degrees magnetic, fixed field) |
| 5 | `sogn` | numeric | knots | 0.004 | Speed over ground |
| 6 | `sognUnit` | character | - | N | Speed over ground units: N (knots, fixed field) |
| 7 | `sogk` | numeric | km/h | 0.008 | Speed over ground |
| 8 | `sogkUnit` | character | - | K | Speed over ground units: K (kilometers per hour, fixed field) |
| 9 | `posMode` | character | - | A | Mode indicator, see position fix flags description (only available in NMEA 2.3 and later) |
| 10 | `cs` | hexadecimal | - | *06 | Checksum |
| 11 | `CRLF` | character | - | - | Carriage return and line feed |

## 2.7.21 ZDA

### 2.7.21.1 Time and date

| ***Message*** | **NMEA-Standard-ZDA**<br>**Time and date** |
|---|---|
| *Type* | Output |
| *Comment* | UTC, day, month, year and local time zone. |
| *Information* | *Class/ID:* 0xf0 0x08 *Number of fields:* 9 |
| *Structure* | `$xxZDA,time,day,month,year,ltzh,ltzn*cs\r\n` |
| *Example* | `$GPZDA,082710.00,16,09,2002,00,00*64\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | `xxZDA` | string | - | $GPZDA | ZDA Message ID (xx = current Talker ID, see NMEA Talker IDs table) |
| 1 | `time` | hhmmss.ss | - | 082710.00 | UTC Time. See section UTC representation in the integration manual for details. |
| 2 | `day` | dd | day | 16 | UTC day (range: 1-31) |
| 3 | `month` | mm | month | 09 | UTC month (range: 1-12) |
| 4 | `year` | yyyy | year | 2002 | UTC year |

| | | | | | |
|---|---|---|---|---|---|
| 5 | ltzh | xx | - | 00 | Local time zone hours (fixed field, always 00) |
| 6 | ltzn | zz | - | 00 | Local time zone minutes (fixed field, always 00) |
| 7 | cs | hexadecimal | - | *64 | Checksum |
| 8 | CRLF | character | - | - | Carriage return and line feed |

# 2.8 PUBX messages

Proprietary NMEA messages for u-blox positioning receivers. See also NMEA-proprietary messages.

## 2.8.1 CONFIG (PUBX,41)

### 2.8.1.1 Set protocols and baud rate

| ***Message*** | **NMEA-PUBX-CONFIG**<br>**Set protocols and baud rate** |
|---|---|
| *Type* | Set |
| *Comment* | |
| *Information* | *Class/ID:* 0xf1 0x41 *Number of fields:* 9 |
| *Structure* | `$PUBX,41,portId,inProto,outProto,baudrate,autobauding*cs\r\n` |
| *Example* | `$PUBX,41,1,0007,0003,19200,0*25\r\n` |

*Payload:*

| *Field* | *Name* | *Format* | *Unit* | *Example* | *Description* |
|---|---|---|---|---|---|
| 0 | PUBX | string | - | $PUBX | Message ID, UBX protocol header, proprietary sentence |
| 1 | msgId | numeric | - | 41 | Proprietary message identifier |
| 2 | portId | numeric | - | 1 | ID of communication port. See section Communication ports in the integration manual for details. |
| 3 | inProto | hexadecimal | - | 0007 | Input protocol mask. Bitmask, specifying which protocols(s) are allowed for input. See section Communication ports in the integration manual for details. |
| 4 | outProto | hexadecimal | - | 0003 | Output protocol mask. Bitmask, specifying which protocols(s) are allowed for input. See section Communication ports in the integration manual for details. |
| 5 | baudrate | numeric | bits/s | 19200 | Baud rate |
| 6 | autobauding | numeric | - | - | Autobauding: 1=enable, 0=disable (not supported on u-blox 5, set to 0) |
| 7 | cs | hexadecimal | - | *25 | Checksum |
| 8 | CRLF | character | - | - | Carriage return and line feed |

## 2.8.2 POSITION (PUBX,00)

### 2.8.2.1 Poll a PUBX,00 message

| ***Message*** | **NMEA-PUBX-POSITION**<br>**Poll a PUBX,00 message** |
|---|---|
| *Type* | Poll request |
| *Comment* | A PUBX,00 message is polled by sending the PUBX,00 message without any data fields. |
| *Information* | *Class/ID:* 0xf1 0x00 *Number of fields:* 4 |
| *Structure* | `$PUBX,00*33\r\n` |