



# u-blox F10 TIM 3.01

## u-blox F10 GNSS timing receiver

### Interface description



### Abstract

This document describes the interface (version 42.01) of the u-blox F10 GNSS timing firmware TIM 3.01.

## Document information

<b>Title</b>	<b>u-blox F10 TIM 3.01</b>	
<b>Subtitle</b>	u-blox F10 GNSS timing receiver	
<b>Document type</b>	Interface description	
<b>Document number</b>	UBX-23003447	
<b>Revision and date</b>	R02	18-Dec-2024
<b>Disclosure restriction</b>	C1-Public	

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# 1 General information

## 1.1 Document overview

This document describes the interface of the u-blox F10 GNSS timing receiver. The interface consists of the following parts:

- [NMEA protocol](#)
- [UBX protocol](#)
- [Configuration interface](#)



Some of the features described here may not be available in the receiver, and some may require specific configurations to be enabled. See the applicable data sheet for availability of the features and the integration manual for instructions for enabling them.



Previous versions of u-blox receiver documentation combined general receiver description and interface specification. In the current documentation the receiver description is included in the integration manual.

See also [Related documents](#).

## 1.2 Firmware and protocol versions

u-blox receivers execute firmware from internal ROM or load an external image and execute it from internal code-RAM.

- If the product does not have internal code-RAM, the firmware runs from the ROM.
- If the product has internal code-RAM but an external image is not available, the firmware runs from the ROM. Some products have only limited ROM and enter boot mode with no GNSS function if an external image is not available.
- If the external firmware image is stored in a flash memory, it is loaded into the code-RAM before execution.
- In some products, the firmware image can be stored in the host system and loaded into the code-RAM from there.

The location and the version of the currently running firmware can be found in the boot screen and in the [UBX-MON-VER](#) message. If the firmware has been loaded from the flash memory or from the host processor, it is indicated by text "EXT", whereas running the firmware from the internal ROM is indicated by text "ROM".

The u-blox receivers output the boot screen automatically upon receiver start or after hardware reset over the serial interfaces in [UBX-INF-NOTICE](#) or [NMEA-Standard-TXT](#) messages if configured using [CFG-INFMSG](#). The UBX-MON-VER message can be polled using the [UBX polling mechanism](#). An example of the boot screen and the firmware version information in u-center 2 is shown in [Figure 1](#).




Time	Message	UBX-MON-VER	
07:37:44	R→ \$GNTXT,01,01,02,u-blox AG - www.u-blox.com*4E..	Field	Value
07:37:44	R→ \$GNTXT,01,01,02,HW UBX 10 000A0000*53..	swVersion	ROM SPG 5.10 (7b202e)
07:37:44	R→ \$GNTXT,01,01,02,ROM SPG 5.10 (7b202e)*7C..	hwVersion	000A0000
07:37:44	R→ \$GNTXT,01,01,02,FWVER=SPG 5.10*40..	group1 ▾	
07:37:44	R→ \$GNTXT,01,01,02,PROTVER=34.10*1E..	extension	
07:37:44	R→ \$GNTXT,01,01,02,CHIPID=000000E9BC858F4254*78..	FWVER=SPG 5.10	
07:37:44	R→ \$GNTXT,01,01,02,MOD=EVK-M101*20..	PROTVER=34.10	
07:37:44	R→ \$GNTXT,01,01,02,GPS;GLO;GAL;BDS*77..	MOD=EVK-M101	
07:37:44	R→ \$GNTXT,01,01,02,SBAS;QZSS*60..	GPS;GLO;GAL;BDS	
07:37:44	R→ \$GNTXT,01,01,02,ANTSUPERV=*22..	SBAS;QZSS	
07:37:44	R→ \$GNTXT,01,01,02,ANTSTATUS=DONTKNOW*2D..		
07:37:44	R→ \$GNTXT,01,01,02,PF=F7FFB*4B..		
07:37:44	R→ \$GNTXT,01,01,02,Starting GNSS*5A..		

Figure 1: An example of u-center 2 showing the Text console with the boot screen output on the left and the Message view with the UBX-MON-VER version information on the right

The following information is available (✓) from the boot screen (**B**) and the UBX-MON-VER message (**M**):

B	M	Example	Information
✓		u-blox AG - www.u-blox.com	Start of the boot screen.
✓		HW UBX 10 00000000	Hardware version of the u-blox receiver.
	✓	00000000	
✓	✓	ROM SPG 5.10 (000000)	Firmware version and revision identifier.
✓	✓	ROM BASE 0x118B2060	Revision of the underlying boot loader firmware in ROM.
✓	✓	FWVER=SPG 5.10	Product firmware version, where: <ul style="list-style-type: none"> <li>• SPG = Standard precision GNSS product</li> <li>• HPG = High precision GNSS product</li> <li>• ADR = Automotive dead reckoning product</li> <li>• TIM = Time sync product</li> <li>• LAP = Lane accurate positioning product</li> <li>• HPS = High precision sensor fusion product</li> <li>• DBS = Dual band standard precision</li> <li>• MDR = Multi-mode dead reckoning product</li> <li>• PMP = L-Band Inmarsat point-to-multipoint receiver</li> <li>• QZS = QZSS L6 centimeter level augmentation service (CLAS) message receiver</li> <li>• DBD = Dual band dead reckoning product</li> <li>• ASP = Automotive standard precision</li> <li>• LDR = ROM bootloader, no GNSS functionality</li> </ul>
✓	✓	PROTVER=34.00	Supported protocol version.
✓		CHIPID=000000D0D69D0F7A54	Unique chip identification number.
✓	✓	MOD=EVK-M101	Module name.
✓	✓	GPS;GLO;GAL;BDS	List of supported major GNSS (see <a href="#">GNSS identifiers</a> ).
✓	✓	SBAS;QZSS	List of supported augmentation systems (see <a href="#">GNSS identifiers</a> ).
✓	✓	NAVIC	Extended list of supported GNSS (see <a href="#">GNSS identifiers</a> ).

B	M Example	Information
✓	ANTSUPERV=AC SD PDoS SR	Configuration of the antenna supervisor, where: <ul style="list-style-type: none"> <li>AC = Active antenna control enabled</li> <li>SD = Short circuit detection enabled</li> <li>OD = Open circuit detection enabled</li> <li>PDoS = Short circuit power down logic enabled</li> <li>SR = Automatic recovery from short state enabled</li> </ul>
✓	PF=FFF79	Product configuration.
✓	BD=E01C	GNSS band configuration.

-  The "FWVER" product firmware version indicates which firmware is currently running. This is referred to as "firmware version" in this and other documents.
-  The version and revision numbers should only be used to identify a known firmware version. They are not necessarily numeric nor are they guaranteed to increase with later firmware versions.
-  All u-blox receivers output the start text, hardware version, and firmware version and revision. Some of the other entries in the boot screen example may be omitted.

The product firmware version and revision relate to the protocol version:



Firmware version	Version and revision identifier	Protocol version
TIM 3.01	EXT TIM 1.00 (efa2b7)	42.01

## 1.3 Receiver configuration

u-blox positioning receivers are fully configurable with UBX protocol messages. The configuration used by the receiver during normal operation is called the "current configuration". The current configuration can be changed during normal operation by sending [UBX-CFG-VALSET](#) messages over any I/O port. The receiver changes its current configuration immediately after receiving a configuration message. The receiver always uses the current configuration only.

The current configuration is loaded from permanent configuration hard-coded in the receiver firmware (the defaults) and from non-volatile memory (user configuration) on startup of the receiver. Changes made to the current configuration at run-time will be lost when there is a power cycle, a hardware reset or a (complete) controlled software reset (see [Configuration reset behavior](#)).

See [Configuration interface](#) for a detailed description of the receiver configuration system, the explanation of the configuration concept and its principles and interfaces.

-  The configuration interface has changed from earlier u-blox positioning receivers. There is some backwards compatibility provided in UBX-CFG configuration messages. Users are strongly advised to only use the [Configuration interface](#). See also [Legacy UBX message fields reference](#).
-  See the integration manual for a basic receiver configuration most commonly used.

## 1.4 Message naming

Message names are written in full with the parts of the name separated by hyphens ("-"). The full message name consists of the protocol name (e.g. *UBX*), the class name (e.g. *NAV*) and the message name (e.g. *PVT*). For example, the receiver software version information message is referred to as *UBX-MON-VER*. Similarly, the *NMEA-Standard-GGA* is the NMEA standard message (sentence) with the global positioning fix data.

References to fields of the message add the field name separated by a dot ("."), e.g. *UBX-MON-VER.swVersion*.

Some messages use a fourth level of naming, called the message version. One example is the *UBX-MGA-GPS* message for GPS assistance data, which exists in versions for ephemerides (*UBX-MGA-GPS-EPH*) and almanacs (*UBX-MGA-GPS-ALM*).

Names of configuration items are of the form *CFG-GROUP-ITEM*. For example, *CFG-NAVSPG-DYNMODEL* refers to the navigation dynamic platform model the receiver uses. Constants add a fourth level to the item name, such as *CFG-NAVSPG-DYNMODEL-AUTOMOT* for the automotive platform model. In the context of describing an item's value, only the last part of the constant name can be used (e.g. "set *CFG-NAVSPG-DYNMODEL* to *PORT* for portable applications").

## 1.5 GNSS, satellite, and signal identifiers

### 1.5.1 Overview

Many [UBX protocol](#) messages contain information about specific satellites. Any single satellite can be identified by a `gnssId` field indicating the GNSS the satellite is part of and an `svId` (SV for space vehicle) field indicating the number of the satellite in that system. Usually, the `svId` is the native number associated with the satellite in the specific GNSS. For example, the Galileo SV4 is identified as `gnssId 2`, `svId 4`, while the GPS SV4 is `gnssId 0`, `svId 4`.

Some legacy UBX protocol messages combine both the satellite number and the GNSS identification into a one-byte (type U1) field. See the single `svId` mapping in [Satellite identifiers](#) to identify the corresponding GNSS and satellite.

GLONASS satellites can be tracked before they have been identified. In UBX messages, the unknown satellites are reported with `svId 255`. In NMEA messages, the unknown satellites are null (empty) fields. Product-related documentation and u-center use R? to label unidentified GLONASS satellites.

Signal identifiers are used when different signals from the same GNSS satellite need to be distinguished (e.g. in the *UBX-NAV-SIG* message). A separate `sigId` field identifies the signal. These signal identifiers are only valid when combined with a GNSS identifier (`gnssId` field).

The [NMEA protocol](#) (version 4.10 and later) identifies GNSS satellites with a one-digit system ID and a two-digit satellite number. u-blox receivers support this method in their NMEA output when "strict" SV numbering is selected. In most cases this is the default setting, but it can be checked or changed using the [Configuration interface](#) (see also [NMEA GNSS, satellite, and signal numbering](#)).

In order to support some GNSS (e.g. BeiDou, Galileo, QZSS), which 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.

The NMEA standard defines signal identifiers to distinguish different signals sent by a single GNSS satellite (e.g. L2 CL and CM). u-blox positioning receivers use those identifiers for signal identification, as far as the corresponding standard is supported in a particular product.



Note that the following sections are a generic overview for different u-blox positioning receivers. A particular product may not support all of the described GNSS identifiers, satellite numbers, signal identifiers or combinations thereof.

## 1.5.2 GNSS identifiers

Table 1 lists each GNSS along with the GNSS identifier ([UBX protocol](#)), the NMEA system identifiers ([NMEA protocol](#)), and abbreviations used in this document:

GNSS	Abbreviations		UBX gnssId	NMEA system ID		
				2.3 - 4.0	4.10	4.11
GPS	GPS	G	0	1	1	1
SBAS	SBAS	S	1	1	1	1
Galileo	GAL	E	2	n/a	3	3
BeiDou	BDS	B	3	n/a	(4) <sup>1</sup>	4
QZSS	QZSS	Q	5	n/a	(1) <sup>1</sup>	5
GLONASS	GLO	R	6	2	2	2
NavIC	NavIC	N	7	n/a	n/a	6

Table 1: GNSS identifiers

See also [NMEA Talker ID](#).

## 1.5.3 Satellite identifiers

The satellite numbering scheme for the [UBX protocol](#) is provided in [Table 2](#). The satellite numbering scheme for the [NMEA protocol](#) is provided in [Table 3](#).

GNSS	SV Range	gnssId:svId	single svid
GPS	G1-G32	0:1-32	1-32
SBAS	S120-S158	1:120-158	120-158
Galileo	E1-E36	2:1-36	211-246
BeiDou	B1-B5	3:1-5	159-163
	B6-B37	3:6-37	33-64
	B38-B63	3:38-63	n/a
QZSS	Q1-Q10	5:1-10	193-202
GLONASS	R1-R32	6:1-32	65-96
	R?	6:255	255
NavIC	N1-N7	7:1-7	247-253
	N8-N14	7:8-14	n/a

Table 2: UBX protocol satellite numbering scheme

GNSS	SV Range	NMEA 2.3 - 4.0		NMEA 4.10		NMEA 4.11	
		strict	extended	strict	extended	strict	extended
GPS	G1-G32	1-32	1-32	1-32	1-32	1-32	1-32
SBAS	S120-S158	33-64	33-64, 152-158	33-64	33-64, 152-158	33-64	33-64, 152-158
Galileo	E1-E36	n/a	301-336	1-36	1-36	1-36	1-36
BeiDou	B1-B5	n/a	401-405	1-5	1-5	1-5	1-5
	B6-B37	n/a	406-437	6-37	6-37	6-37	6-37

<sup>1</sup> While not defined by NMEA 4.10, in this mode, u-blox receivers use system ID 4 for BeiDou and, if extended satellite numbering is enabled, system ID 1 for QZSS.

GNSS	SV Range	NMEA 2.3 - 4.0		NMEA 4.10		NMEA 4.11	
		strict	extended	strict	extended	strict	extended
	B38-B63	n/a	438-463	38-63	38-63	38-63	38-63
QZSS	Q1-Q10	n/a	193-202	n/a	193-202	1-10	1-10
GLONASS	R1-R32	65-96	65-96	65-96	65-96	65-96	65-96
	R?	null	null	null	null	null	null
NavIC	N1-N7	n/a	n/a	n/a	n/a	1-7	1-7
	N8-N14	n/a	n/a	n/a	n/a	8-14	8-14

**Table 3: NMEA protocol satellite numbering scheme**

### 1.5.4 Signal identifiers

A summary of all the signal identification schemes used in the [NMEA protocol](#) and the [UBX protocol](#) is provided in the following table. (Only a subset of the signals is supported by each product.) In the NMEA protocol, system and signal identifiers are in hexadecimal format. An unknown signal identifier is presented as 0 in the NMEA protocol.

Signal	UBX Protocol		NMEA Protocol 4.10		NMEA Protocol 4.11	
	gnssId	sigId	System ID	Signal ID	System ID	Signal ID
GPS L1C/A <sup>2</sup>	0	0	1	1	1	1
GPS L2 CL	0	3	1	6	1	6
GPS L2 CM	0	4	1	5	1	5
GPS L5 I	0	6	1	7	1	7
GPS L5 Q	0	7	1	8	1	8
SBAS L1C/A <sup>2</sup>	1	0	1	1	1	1
Galileo E1 C <sup>2</sup>	2	0	3	7	3	7
Galileo E1 B <sup>2</sup>	2	1	3	7	3	7
Galileo E5 aI	2	3	3	1	3	1
Galileo E5 aQ	2	4	3	1	3	1
Galileo E5 bI	2	5	3	2	3	2
Galileo E5 bQ	2	6	3	2	3	2
Galileo E6 B	2	8	3	5	3	5
Galileo E6 C	2	9	3	5	3	5
Galileo E6 A	2	10	3	4	3	4
BeiDou B1I D1 <sup>2</sup>	3	0	(4) <sup>3</sup>	(1) <sup>4</sup>	4	1
BeiDou B1I D2 <sup>2</sup>	3	1	(4) <sup>3</sup>	(1) <sup>4</sup>	4	1
BeiDou B2I D1	3	2	(4) <sup>3</sup>	(3) <sup>4</sup>	4	B
BeiDou B2I D2	3	3	(4) <sup>3</sup>	(3) <sup>4</sup>	4	B
BeiDou B3I D1	3	4				
BeiDou B3I D2	3	10				
BeiDou B1 Cp (pilot)	3	5	(4) <sup>3</sup>	N/A	4	3

<sup>2</sup> UBX messages that do not have an explicit `sigId` field contain information about the subset of signals marked.

<sup>3</sup> While not defined by NMEA 4.10, in this mode, u-blox receivers use system ID 4 for BeiDou and, if extended satellite numbering is enabled, system ID 1 for QZSS.

<sup>4</sup> BeiDou and QZSS signal ID are not defined in the NMEA protocol version 4.10. Values shown in the table are only valid for u-blox products and, for QZSS signal ID, if extended satellite numbering is enabled.



Signal	UBX Protocol		NMEA Protocol 4.10		NMEA Protocol 4.11	
	gnssId	sigId	System ID	Signal ID	System ID	Signal ID
BeiDou B1 Cd (data)	3	6	(4) <sup>3</sup>	N/A	4	3
BeiDou B2 ap (pilot)	3	7	(4) <sup>3</sup>	N/A	4	5
BeiDou B2 ad (data)	3	8	(4) <sup>3</sup>	N/A	4	5
QZSS L1C/A <sup>2</sup>	5	0	(1) <sup>3</sup>	(1) <sup>4</sup>	5	1
QZSS L1S	5	1	(1) <sup>3</sup>	(4) <sup>4</sup>	5	4
QZSS L2 CM	5	4	(1) <sup>3</sup>	(5) <sup>4</sup>	5	5
QZSS L2 CL	5	5	(1) <sup>3</sup>	(6) <sup>4</sup>	5	6
QZSS L5 I	5	8	(1) <sup>3</sup>	N/A	5	7
QZSS L5 Q	5	9	(1) <sup>3</sup>	N/A	5	8
GLONASS L1 OF <sup>2</sup>	6	0	2	1	2	1
GLONASS L2 OF	6	2	2	3	2	3
NavIC L5 A <sup>2</sup>	7	0	N/A	N/A	6	1

**Table 4: Signal identifiers**

## 1.6 Message types

The following message types are defined:

Message type	Description
Input	Messages that are input to the receiver and never output. E.g. <a href="#">UBX-MGA-GPS-EPH</a> .
Output	Messages that are output by the receiver in no particular interval and never input. E.g. <a href="#">UBX-ACK-ACK</a> .
Input/output	Messages that can be output by or input to the receiver. E.g. <a href="#">UBX-MGA-DBD-DATA0</a> .
Periodic	Messages that are output in regular intervals but cannot be polled. E.g. <a href="#">UBX-NAV-EOE</a> .
Periodic/polled	Messages that are output in regular intervals and can be polled. E.g. <a href="#">UBX-NAV-PVT</a> .
Command	Messages that are a command to the receiver. Similar to type <i>Input</i> these are input-only. E.g. <a href="#">UBX-CFG-RST</a> .
Get	Output-only configuration or command messages. E.g. <a href="#">UBX-CFG-DAT</a> .
Set	Input-only configuration or command messages. E.g. <a href="#">UBX-CFG-VALDEL</a> .
Get/set	Input/output configuration or command messages. E.g. <a href="#">UBX-CFG-NAVX5</a> .
Polled	Non-periodic messages that can only be polled. E.g. <a href="#">UBX-MON-VER</a> .
Poll request	Poll request. E.g. <a href="#">UBX-MGA-DBD-POLL</a> .

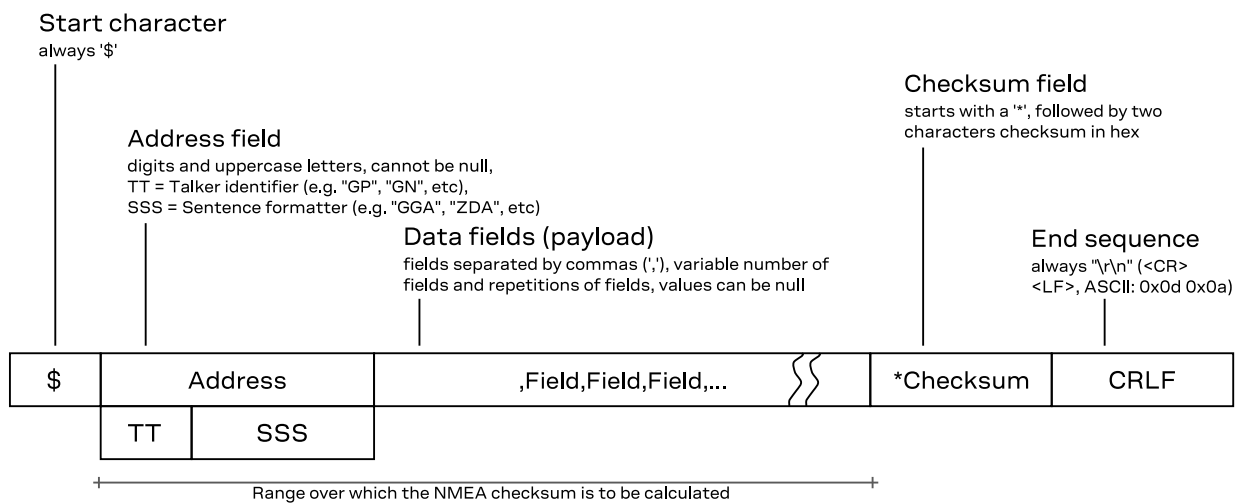
## 2 NMEA protocol

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).



#### Example

\$	GP	ZDA	,141644.00,22,03,2002,00,00	*67	\r\n
----	----	-----	-----------------------------	-----	------

### 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	<a href="#">CFG-NMEA-OUT_INVFIX</a>	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	<a href="#">CFG-NMEA-OUT_MSKFIX</a>	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	<a href="#">CFG-NMEA-OUT_INVTIME</a>	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	<a href="#">CFG-NMEA-OUT_INVDATE</a>	Enable to permit the receiver's best knowledge of date to be output, even though it might be wrong.
GPS-only filtering	<a href="#">CFG-NMEA-OUT_ONLYGPS</a>	Enable to restrict output to only report GPS satellites.
Track filtering	<a href="#">CFG-NMEA-OUT_FROZENCOG</a>	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	<a href="#">CFG-NMEA-COMPAT</a>	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	<a href="#">CFG-NMEA-CONSIDER</a>	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	<a href="#">CFG-NMEA-LIMIT82</a>	Enabling this mode will limit the NMEA sentence length to a maximum of 82 characters.
High precision mode	<a href="#">CFG-NMEA-HIGHPREC</a>	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	<a href="#">CFG-NMEA-FILT_GPS</a> etc.	Filters satellites based on the GNSS they belong to.
Satellite numbering	<a href="#">CFG-NMEA-SVNUMBERING</a>	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 <a href="#">Satellite identifiers</a> .
Main Talker ID	<a href="#">CFG-NMEA-MAINTALKERID</a>	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 <a href="#">CFG-SIGNAL-*</a> ). This field enables the main Talker ID to be overridden. See also <a href="#">NMEA Talker ID</a> .
GSV Talker ID	<a href="#">CFG-NMEA-GSVTALKERID</a>	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	<a href="#">CFG-NMEA-BDSTALKERID</a>	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](#) is "GN" (e.g. instead of "GP" for a GPS-only receiver).

**GSV Talker and Signal IDs** The [GSV](#) message reports the signal strength of the visible satellites. In multi-GNSS operation, other messages use the main Talker ID "GN" but the Talker ID in the GSV message is specific to the GNSS it is reporting information for.

The GSV messages are grouped by the Talker and Signal IDs. Separate sets of GSV messages are sent for each GNSS and signal. The Signal ID of a satellite may be unknown. Such satellites are presented in their own set with Signal ID 0. Grouping the GSV messages by the Signal ID is supported in protocol versions 27.12 and later.

**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)

GNSS	Talker ID	Comments
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 <sup>5</sup>	quality <sup>6</sup>	posMode <sup>7</sup>	posMode <sup>7</sup>
No position fix (at power-up, after losing satellite lock)	V	0	N	N

<sup>5</sup> Possible *status* values: V = data invalid, A = data valid

<sup>6</sup> 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

<sup>7</sup> 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. In NMEA GNS, u-blox uses a non-standard implementation where same single status is reported for all enabled and not filtered out constellations.

NMEA Message	GLL, RMC	GGA	GLL, VTG	RMC, GNS
Field	status <sup>5</sup>	quality <sup>6</sup>	posMode <sup>7</sup>	posMode <sup>7</sup>
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
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 <sup>8</sup>	quality <sup>9</sup>	navMode <sup>10</sup>	posMode <sup>11</sup>
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<sup>8</sup>

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
```

<sup>8</sup> Possible values for *status*: V = data invalid, A = data valid

<sup>9</sup> 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

<sup>10</sup> Possible values for *navMode*: 1 = No fix, 2 = 2D fix, 3 = 3D fix

<sup>11</sup> Possible values for *posMode*: N = No fix, E = estimated/dead reckoning fix, A = autonomous GNSS fix, D = differential GNSS fix. In NMEA GNS, u-blox uses a non-standard implementation where same single status is reported for all enabled and not filtered out constellations.

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.

## 2.6 NMEA messages overview

<b>Message</b>	<b>Class/ID</b>	<b>Description (Type)</b>
<b>NMEA-Standard – Standard NMEA messages</b>		
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-VTG	0xf0 0x05	• Course over ground and ground speed (Output)
NMEA-Standard-ZDA	0xf0 0x08	• Time and date (Output)
<b>NMEA-NAV2 – Secondary output NMEA messages</b>		
NMEA-NAV2-GGA	0xf7 0x00	• Global positioning system fix data (Output)
NMEA-NAV2-GLL	0xf7 0x01	• Latitude and longitude, with time of position fix and status. (Output)
NMEA-NAV2-GNS	0xf7 0x0d	• GNSS fix data (Output)
NMEA-NAV2-GSA	0xf7 0x02	• GNSS DOP and active satellites (Output)
NMEA-NAV2-RMC	0xf7 0x04	• Recommended minimum data (Output)
NMEA-NAV2-VTG	0xf7 0x05	• Course over ground and ground speed (Output)
NMEA-NAV2-ZDA	0xf7 0x08	• Time and date (Output)
<b>NMEA-PUBX – u-blox proprietary NMEA messages</b>		
NMEA-PUBX-CONFIG	0xf1 0x41	• Set protocols and baud rate (Set)
NMEA-PUBX-POSITION	0xf1 0x00	• Poll a PUBX,00 message (Poll request) • 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) • Satellite status (Output)
NMEA-PUBX-TIME	0xf1 0x04	• Poll a PUBX,04 message (Poll request)

Message	Class/ID	Description (Type)
		• 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 Datum reference				
Type	Output				
Comment	This message gives the difference between the current datum and the reference datum. 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 \$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 <a href="#">NMEA Talker IDs table</a> )
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 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 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				
<b>Payload:</b>					
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 GNSS satellite fault detection				
Type	Output				
Comment	This message outputs the results of the Receiver Autonomous Integrity Monitoring Algorithm (RAIM). <ul style="list-style-type: none"> <li>The fields <b>errLat</b>, <b>errLon</b> and <b>errAlt</b> output the standard deviation of the position calculation, using all satellites that pass the RAIM test successfully.</li> <li>The fields <b>errLat</b>, <b>errLon</b> and <b>errAlt</b> 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).</li> <li>The fields <b>prob</b>, <b>bias</b> and <b>stdev</b> are only output if at least one satellite failed in the RAIM test. If more than one satellites fail the RAIM test, only the information for the worst satellite is output in this message.</li> </ul>				
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 \$GPGBS,235458.00,1.4,1.3,3.1,03,,,-21.4,3.8,1,0*5B\r\n				
<b>Payload:</b>					
Field	Name	Format	Unit	Example	Description

0	xxGBS	string	-	\$GPGBS	GBS Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
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 <a href="#">Signal Identifiers table</a> (only available in NMEA 4.10 and later)
10	signalId	hexadecimal	-	-	NMEA-defined GNSS signal ID, see <a href="#">Signal Identifiers table</a> (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 Global positioning system fix data				
Type	Output				
Comment	<p>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.).</p> <p> 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 <a href="#">NMEA-GNS</a> message is used instead.</p>				
Information	Class/ID: 0xf0 0x00		Number of fields: 17		
Structure	\$xxGGA,time,lat,NS,lon,EW,quality,numSV,HDOP,alt,altUnit,sep,sepUnit,diffAge,diffStation*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 <a href="#">NMEA Talker IDs table</a> )
1	time	hhmmss.ss	-	092725.00	UTC time. See section UTC representation in the integration manual for details.
2	lat	ddmm. mmmm	-	4717.11399	Latitude (degrees and minutes), see <a href="#">format description</a>
3	NS	character	-	N	North/South indicator
4	lon	dddmm. mmmm	-	00833.91590	Longitude (degrees and minutes), see <a href="#">format description</a>
5	EW	character	-	E	East/West indicator

6	quality	digit	-	1	Quality indicator for position fix, see <a href="#">position fix flags description</a>
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

<b>Message</b>	<b>NMEA-Standard-GLL</b>				
	<b>Latitude and longitude, with time of position fix and status</b>				
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:					
<b>Field</b>	<b>Name</b>	<b>Format</b>	<b>Unit</b>	<b>Example</b>	<b>Description</b>
0	xxGLL	string	-	\$GPGLL	GLL Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
1	lat	ddmm. mmmm	-	4717.11364	Latitude (degrees and minutes), see <a href="#">format description</a>
2	NS	character	-	N	North/South indicator
3	lon	dddmm. mmmm	-	00833.91565	Longitude (degrees and minutes), see <a href="#">format description</a>
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 <a href="#">position fix flags description</a>
7	posMode	character	-	A	Positioning mode, see <a href="#">position fix flags description</a> (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)

<b>Message</b>	<b>NMEA-Standard-GLQ</b> <b>Poll a standard message (Talker ID GL)</b>				
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)

<b>Message</b>	<b>NMEA-Standard-GNQ</b> <b>Poll a standard message (Talker ID GN)</b>				
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

<b>Message</b>	<b>NMEA-Standard-GNS</b> <b>GNSS fix data</b>				
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.). <a href="#">🔗</a> 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  
 \$GNGNS,122310.2,3722.425671,N,12258.856215,W,DAAA,14,0.9,1005.543,6.5,,,V\*0E\r\n  
 \$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 <a href="#">NMEA Talker IDs table</a> )
1	time	hhmmss.ss	-	091547.00	UTC time. See section UTC representation in the integration manual for details.
2	lat	ddmm. mmmm	-	5114.50897	Latitude (degrees and minutes), see <a href="#">format description</a>
3	NS	character	-	N	North/South indicator
4	lon	dddmm. mmmm	-	00012.28663	Longitude (degrees and minutes), see <a href="#">format description</a>
5	EW	character	-	E	East/West indicator
6	posMode	character	-	AAAA	Positioning mode, see <a href="#">position fix flags description</a> . The first four characters indicate the status for GPS, GLONASS, Galileo and BeiDou. Note that the NMEA GNS message only reports a single status. It indicates the status for all enabled constellations that have not been filtered out. To obtain a more detailed status report, refer to the status provided in the UBX messages.
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 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				
<b>Payload:</b>					
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)

<b>Message</b>	<b>NMEA-Standard-GQQ</b> <b>Poll a standard message (Talker ID GQ)</b>				
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

<b>Message</b>	<b>NMEA-Standard-GRS</b> <b>GNSS range residuals</b>				
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. <b>In a multi-GNSS system this message will be output multiple times, once for each GNSS.</b>  This message relates to associated <a href="#">GGA</a> and <a href="#">GSA</a> messages.				
Information	Class/ID: 0xf0 0x06		Number of fields: 19		
Structure	\$xxGRS,time,mode{,residual},systemId,signalId*cs\r\n				
Examples	\$GNRS,104148.00,1,2.6,2.2,-1.6,-1.1,-1.7,-1.5,5.8,1.7,,,,,1,1*52\r\n \$GNRS,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 <a href="#">NMEA Talker IDs table</a> )
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: <ul style="list-style-type: none"> <li>1 = Residuals were recomputed after the <a href="#">GGA</a> position was computed (fixed)</li> </ul>

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 <a href="#">GSA</a> sentence
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End of repeated group (12 times)

15	systemId	hexadecimal	-	1	NMEA-defined GNSS system ID, see <a href="#">Signal Identifiers table</a> (only available in NMEA 4.10 and later)
16	signalId	hexadecimal	-	-	NMEA-defined GNSS signal ID, see <a href="#">Signal Identifiers table</a> (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

<b>Message</b>	<b>NMEA-Standard-GSA GNSS DOP and active satellites</b>				
<b>Type</b>	Output				
<b>Comment</b>	The GNSS receiver operating mode, satellites used for navigation, and DOP values. <ul style="list-style-type: none"> <li>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.</li> <li>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)</li> </ul> <b>In a multi-GNSS system this message will be output multiple times, once for each GNSS.</b>				
<b>Information</b>	Class/ID: 0xF0 0x02		Number of fields: 21		
<b>Structure</b>	\$xxGSA,opMode,navMode{,svid},PDOP,HDOP,VDOP,systemId*cs\r\n				
<b>Example</b>	\$GPGSA,A,3,23,29,07,08,09,18,26,28,,,,,1.94,1.18,1.54,1*0D\r\n				
<b>Payload:</b>					
<b>Field</b>	<b>Name</b>	<b>Format</b>	<b>Unit</b>	<b>Example</b>	<b>Description</b>
0	xxGSA	string	-	\$GPGSA	GSA Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
1	opMode	character	-	A	Operation mode: <ul style="list-style-type: none"> <li>M = Manually set to operate in 2D or 3D mode</li> <li>A = Automatically switching between 2D or 3D mode</li> </ul>
2	navMode	digit	-	3	Navigation mode, see <a href="#">position fix flags description</a>
<b>Start of repeated group (12 times)</b>					
3 + n	svid	numeric	-	29	Satellite number
<b>End of repeated group (12 times)</b>					
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 <a href="#">Signal Identifiers table</a> (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

<b>Message</b>		<b>NMEA-Standard-GST</b>			
		<b>GNSS pseudorange error statistics</b>			
<b>Type</b>	Output				
<b>Comment</b>	This message reports statistical information on the quality of the position solution.				
<b>Information</b>	Class/ID: 0xF0 0x07		Number of fields: 11		
<b>Structure</b>	\$xxGST,time,rangeRms,stdMajor,stdMinor,orient,stdLat,stdLong,stdAlt*cs\r\n				
<b>Example</b>	\$GPGST,082356.00,1.8,,,,1.7,1.3,2.2*7E\r\n				
<b>Payload:</b>					
Field	Name	Format	Unit	Example	Description
0	xxGST	string	-	\$GPGST	GST Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
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

<b>Message</b>		<b>NMEA-Standard-GSV</b>			
		<b>GNSS satellites in view</b>			
<b>Type</b>	Output				
<b>Comment</b>	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.  In a multi-GNSS system, sets of GSV messages will be output multiple times, one set for each GNSS.  The messages are grouped by the signal ID and separate messages are output for each signal ID. (supported for protocol versions 27.12 and later)  If a satellite is visible but not tracked, the signal ID is unknown and is presented as 0.				
<b>Information</b>	Class/ID: 0xF0 0x03		Number of fields: 7 + [1..4]·4		
<b>Structure</b>	\$xxGSV,numMsg,msgNum,numSV{,svid,elv,az,cno},signalId*cs\r\n				
<b>Examples</b>	\$GPGSV,3,1,09,09,,,17,10,,,40,12,,,49,13,,,35,1*6F\r\n \$GPGSV,3,2,09,15,,,44,17,,,45,19,,,44,24,,,50,1*64\r\n \$GPGSV,3,3,09,25,,,40,1*6E\r\n \$GPGSV,1,1,03,12,,,42,24,,,47,32,,,37,5*66\r\n \$GPGSV,1,1,01,03,05,218,,0*59\r\n \$GAGSV,1,1,00,2*76\r\n				
<b>Payload:</b>					
Field	Name	Format	Unit	Example	Description
0	xxGSV	string	-	\$GPGSV	GSV Message ID (xx = GSV Talker ID, see <a href="#">NMEA Talker IDs table</a> ). 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
<i>Start of repeated group (1...4 times)</i>					
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
<i>End of repeated group (1...4 times)</i>					
4 + N·4	signalId	hexadecimal	-	-	NMEA-defined GNSS signal ID, see <a href="#">Signal Identifiers table</a> (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)

<b>Message</b>	<b>NMEA-Standard-RLM Return link message (RLM)</b>				
<i>Type</i>	Output				
<i>Comment</i>	<p>The RLM sentence is used to transfer a Return link message from a Cospas-Sarsat recognized Return link service provider (RLSP).</p> <p>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.</p>				
<i>Information</i>	Class/ID: 0xf0 0x0b		Number of fields: 7		
<i>Structure</i>	\$xxRLM, beacon, time, code, body*cs\r\n				
<i>Examples</i>	<pre>\$GARLM, 00000078A9FBAD5, 083559.00, 3, C45B*57\r\n \$GARLM, F7129D41BC6A78C, 034433.02, 3, B63CA732AFD419D2*57\r\n</pre>				
<i>Payload:</i>					
<i>Field</i>	<i>Name</i>	<i>Format</i>	<i>Unit</i>	<i>Example</i>	<i>Description</i>
0	xxRLM	string	-	\$GARLM	RLM message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
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	<p>Message code field to identify type of RLM Message Service:</p> <ul style="list-style-type: none"> <li>• 0 = Reserved for future RLM services</li> <li>• 1 = Acknowledgement service RLM</li> <li>• 2 = Command service RLM</li> <li>• 3 = Message service RLM</li> <li>• 4-E = Reserved for future RLM services</li> <li>• F = Test service RLM (currently used only by the Galileo program)</li> </ul>

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

<b>Message</b>		<b>NMEA-Standard-RMC</b>			
		<b>Recommended minimum data</b>			
<b>Type</b>	Output				
<b>Comment</b>	The recommended minimum sentence defined by NMEA for GNSS system data. <a href="#">🔗</a> The output of this message is dependent on the currently selected datum (default: WGS84)				
<b>Information</b>	Class/ID: 0xF0 0x04		Number of fields: 16		
<b>Structure</b>	\$xxRMC,time,status,lat,NS,lon,EW,spd,cog,date,mv,mvEW,posMode,navStatus*cs\r\n				
<b>Example</b>	\$GPRMC,083559.00,A,4717.11437,N,00833.91522,E,0.004,77.52,091202,,A,V*57\r\n				
<b>Payload:</b>					
Field	Name	Format	Unit	Example	Description
0	xxRMC	string	-	\$GPRMC	RMC Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
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 <a href="#">position fix flags description</a>
3	lat	ddmm. mmmm	-	4717.11437	Latitude (degrees and minutes), see <a href="#">format description</a>
4	NS	character	-	N	North/South indicator
5	lon	dddmm. mmmm	-	00833.91522	Longitude (degrees and minutes), see <a href="#">format description</a>
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 <a href="#">position fix flags description</a> (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

<b>Message</b>		<b>NMEA-Standard-TXT</b>			
		<b>Text transmission</b>			
<b>Type</b>	Output				
<b>Comment</b>	This message outputs various information on the receiver, such as power-up screen, software version etc. This message can be configured using the <a href="#">CFG-INFMSG</a> configuration group.				
<b>Information</b>	<i>Class/ID:</i> 0xf0 0x41	<i>Number of fields:</i> 7			
<b>Structure</b>	\$xxTXT, numMsg, msgNum, msgType, text*cs\r\n				
<b>Examples</b>	\$GPTXT,01,01,02,u-blox ag - www.u-blox.com*50\r\n \$GPTXT,01,01,02,ANTARIS ATR0620 HW 00000040*67\r\n				
<b>Payload:</b>					
<i>Field</i>	<i>Name</i>	<i>Format</i>	<i>Unit</i>	<i>Example</i>	<i>Description</i>
0	xxTXT	string	-	\$GPTXT	TXT Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
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): <ul style="list-style-type: none"> <li>• 00 = Error</li> <li>• 01 = Warning</li> <li>• 02 = Notice</li> <li>• 07 = User</li> </ul>
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 VTG

#### 2.7.19.1 Course over ground and ground speed

<b>Message</b>		<b>NMEA-Standard-VTG</b>			
		<b>Course over ground and ground speed</b>			
<b>Type</b>	Output				
<b>Comment</b>	Velocity is given as course over ground (COG) and speed over ground (SOG).				
<b>Information</b>	<i>Class/ID:</i> 0xf0 0x05	<i>Number of fields:</i> 12			
<b>Structure</b>	\$xxVTG, cogt, cogtUnit, cogm, cogmUnit, sogn, sognUnit, sogk, sogkUnit, posMode*cs\r\n				
<b>Example</b>	\$GPVTG,77.52,T,M,0.004,N,0.008,K,A*06\r\n				
<b>Payload:</b>					
<i>Field</i>	<i>Name</i>	<i>Format</i>	<i>Unit</i>	<i>Example</i>	<i>Description</i>
0	xxVTG	string	-	\$GPVTG	VTG Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
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 <a href="#">position fix flags description</a> (only available in NMEA 2.3 and later)
10	cs	hexadecimal	-	*06	Checksum
11	CRLF	character	-	-	Carriage return and line feed

## 2.7.20 ZDA

### 2.7.20.1 Time and date

<b>Message</b>		<b>NMEA-Standard-ZDA</b>			
		<b>Time and date</b>			
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 <a href="#">NMEA Talker IDs table</a> )
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 Secondary output messages


Secondary output NMEA messages. These are NMEA messages prepended with an NMEA TAG block as defined by the NMEA 0183 standard. See [NMEA protocol](#) for details.

### 2.8.1 GGA

#### 2.8.1.1 Global positioning system fix data

<b>Message</b>		<b>NMEA-NAV2-GGA</b>			
		<b>Global positioning system fix data</b>			
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.).				

To identify the navigation data source for NMEA Secondary filter output, the alphanumeric string source-identification (s:) parameter is used in a TAG Block, in accordance to NMEA 0183 Standard.

 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.

<b>Information</b>	<b>Class/ID:</b> 0xf7 0x00	<b>Number of fields:</b> 21
<b>Structure</b>	\s:1*78\\$\xxGGA,time,lat,NS,lon,EW,quality,numSV,HDOP,alt,altUnit,sep,sepUnit,diffAge ↵ ,diffStation*cs\r\n	
<b>Example</b>	\s:1*78\\$\\$PGGA,092725.00,4717.11399,N,00833.91590,E,1,08,1.01,499.6,M,48.0,M,,*5B\r\n ↵ n	

**Payload:**

Field	Name	Format	Unit	Example	Description
0	tagStart	string	-	\s:	NMEA TAG block start and parameter
1	source	numeric	-	1	NMEA TAG block source value (1 for secondary output messages)
2	tagCs	hexadecimal	-	*78	NMEA TAG checksum
3	tagEnd	string	-	\	NMEA TAG block end character
4	xxGGA	string	-	\$PGGA	GGA Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
5	time	hhmmss.ss	-	092725.00	UTC time. See section UTC representation in the integration manual for details.
6	lat	ddmm. mmmm	-	4717.11399	Latitude (degrees and minutes), see <a href="#">format description</a>
7	NS	character	-	N	North/South indicator
8	lon	dddmm. mmmm	-	00833.91590	Longitude (degrees and minutes), see <a href="#">format description</a>
9	EW	character	-	E	East/West indicator
10	quality	digit	-	1	Quality indicator for position fix, see <a href="#">position fix flags description</a>
11	numSV	numeric	-	08	Number of satellites used (range: 0-12)
12	HDOP	numeric	-	1.01	Horizontal Dilution of Precision
13	alt	numeric	m	499.6	Altitude above mean sea level
14	altUnit	character	-	M	Altitude units: M (meters, fixed field)
15	sep	numeric	m	48.0	Geoid separation: difference between ellipsoid and mean sea level
16	sepUnit	character	-	M	Geoid separation units: M (meters, fixed field)
17	diffAge	numeric	s	-	Age of differential corrections (null when DGPS is not used)
18	diffStation	numeric	-	-	ID of station providing differential corrections (null when DGPS is not used)
19	cs	hexadecimal	-	*5B	Checksum
20	CRLF	character	-	-	Carriage return and line feed

## 2.8.2 GLL

### 2.8.2.1 Latitude and longitude, with time of position fix and status.

<b>Message</b>	<b>NMEA-NAV2-GLL</b> <b>Latitude and longitude, with time of position fix and status.</b>				
<b>Type</b>	Output				
<b>Comment</b>	<p>Geographic Position - Latitude/Longitude.</p> <p>To identify the navigation data source for NMEA Secondary filter output, the alphanumeric string source-identification (s:) parameter is used in a TAG Block, in respect to NMEA 0183 Standard.</p> <p> The output of this message is dependent on the currently selected datum (default: WGS84)</p>				
<b>Information</b>	Class/ID: 0xf7 0x01		Number of fields: 14		
<b>Structure</b>	\s:1*78\\$\xxGLL, lat, NS, lon, EW, time, status, posMode*cs\r\n				
<b>Example</b>	\s:1*78\\$\\$PGLL, 4717.11364, N, 00833.91565, E, 092321.00, A, A*60\r\n				
<b>Payload:</b>					
<b>Field</b>	<b>Name</b>	<b>Format</b>	<b>Unit</b>	<b>Example</b>	<b>Description</b>
0	tagStart	string	-	\s:	NMEA TAG block start and parameter
1	source	numeric	-	1	NMEA TAG block source value (1 for secondary output messages)
2	tagCs	hexadecimal	-	*78	NMEA TAG checksum
3	tagEnd	string	-	\	NMEA TAG block end character
4	xxGLL	string	-	\$\$PGLL	GLL Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
5	lat	ddmm. mmmm	-	4717.11364	Latitude (degrees and minutes), see <a href="#">format description</a>
6	NS	character	-	N	North/South indicator
7	lon	dddmm. mmmm	-	00833.91565	Longitude (degrees and minutes), see <a href="#">format description</a>
8	EW	character	-	E	East/West indicator
9	time	hhmmss.ss	-	092321.00	UTC time. See section UTC representation in the integration manual for details.
10	status	character	-	A	Data validity status, see <a href="#">position fix flags description</a>
11	posMode	character	-	A	Positioning mode, see <a href="#">position fix flags description</a> (only available in NMEA 2.3 and later)
12	cs	hexadecimal	-	*60	Checksum
13	CRLF	character	-	-	Carriage return and line feed

## 2.8.3 GNS

### 2.8.3.1 GNSS fix data

<b>Message</b>	<b>NMEA-NAV2-GNS</b> <b>GNSS fix data</b>				
<b>Type</b>	Output				
<b>Comment</b>	<p>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.).</p> <p>To identify the navigation data source for NMEA Secondary filter output, the alphanumeric string source-identification (s:) parameter is used in a TAG Block, in respect to NMEA 0183 Standard.</p> <p> The output of this message is dependent on the currently selected datum (default: WGS84)</p>				
<b>Information</b>	Class/ID: 0xf7 0x0d		Number of fields: 20		
<b>Structure</b>	\s:1*78\\$\xxGNS, time, lat, NS, lon, EW, posMode, numSV, HDOP, alt, sep, diffAge, diffStation, nav ↵ Status*cs\r\n				

**Examples**

```

\s:1*78\$\GNGNS,103600.01,5114.51176,N,00012.29380,W,ANNN,07,1.18,111.5,45.6,,,V*00\r ↵
\n
\s:1*78\$\GNGNS,122310.2,3722.425671,N,12258.856215,W,DAAA,14,0.9,1005.543,6.5,,,V*0E ↵
\r\n
\s:1*78\$\GPGNS,122310.2,,,,,07,,,,,5.2,23,V*02\r\n

```

**Payload:**

Field	Name	Format	Unit	Example	Description
0	tagStart	string	-	\s:	NMEA TAG block start and parameter
1	source	numeric	-	1	NMEA TAG block source value (1 for secondary output messages)
2	tagCs	hexadecimal	-	*78	NMEA TAG checksum
3	tagEnd	string	-	\	NMEA TAG block end character
4	xxGNS	string	-	\$GPGNS	GNS Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
5	time	hhmmss.ss	-	091547.00	UTC time. See section UTC representation in the integration manual for details.
6	lat	ddmm. mmmm	-	5114.50897	Latitude (degrees and minutes), see <a href="#">format description</a>
7	NS	character	-	N	North/South indicator
8	lon	dddmm. mmmm	-	00012.28663	Longitude (degrees and minutes), see <a href="#">format description</a>
9	EW	character	-	E	East/West indicator
10	posMode	character	-	AAAA	Positioning mode, see <a href="#">position fix flags description</a> . The first four characters indicate the status for GPS, GLONASS, Galileo and BeiDou. Note that the NMEA GNS message only reports a single status. It indicates the status for all enabled constellations that have not been filtered out. To obtain a more detailed status report, refer to the status provided in the UBX messages.
11	numSV	numeric	-	10	Number of satellites used (range: 0-99)
12	HDOP	numeric	-	0.83	Horizontal Dilution of Precision
13	alt	numeric	m	111.1	Altitude above mean sea level
14	sep	numeric	m	45.6	Geoid separation: difference between ellipsoid and mean sea level
15	diffAge	numeric	s	-	Age of differential corrections (null when DGPS is not used)
16	diffStation	numeric	-	-	ID of station providing differential corrections (null when DGPS is not used)
17	navStatus	character	-	V	Navigational status indicator: V (Equipment is not providing navigational status information, fixed field, only available in NMEA 4.10 and later)
18	cs	hexadecimal	-	*71	Checksum
19	CRLF	character	-	-	Carriage return and line feed

## 2.8.4 GSA

### 2.8.4.1 GNSS DOP and active satellites

<b>Message</b>	<b>NMEA-NAV2-GSA</b> <b>GNSS DOP and active satellites</b>				
<b>Type</b>	Output				
<b>Comment</b>	<p>The GNSS receiver operating mode, satellites used for navigation, and DOP values.</p> <ul style="list-style-type: none"> <li>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.</li> <li>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)</li> </ul> <p><b>In a multi-GNSS system this message will be output multiple times, once for each GNSS.</b></p> <p>To identify the navigation data source for NMEA Secondary filter output, the alphanumeric string source-identification (s:) parameter is used in a TAG Block, in respect to NMEA 0183 Standard.</p>				
<b>Information</b>	Class/ID: 0xf7 0x02		Number of fields: 25		
<b>Structure</b>	\s:1*78\\$\xxGSA,opMode,navMode{,svid},PDOP,HDOP,VDOP,systemId*cs\r\n				
<b>Example</b>	\s:1*78\\$\\$GPGSA,A,3,23,29,07,08,09,18,26,28,,,,,1.94,1.18,1.54,1*0D\r\n				
<b>Payload:</b>					
<b>Field</b>	<b>Name</b>	<b>Format</b>	<b>Unit</b>	<b>Example</b>	<b>Description</b>
0	tagStart	string	-	\s:	NMEA TAG block start and parameter
1	source	numeric	-	1	NMEA TAG block source value (1 for secondary output messages)
2	tagCs	hexadecimal	-	*78	NMEA TAG checksum
3	tagEnd	string	-	\	NMEA TAG block end character
4	xxGSA	string	-	\$GPGSA	GSA Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
5	opMode	character	-	A	Operation mode: <ul style="list-style-type: none"> <li>M = Manually set to operate in 2D or 3D mode</li> <li>A = Automatically switching between 2D or 3D mode</li> </ul>
6	navMode	digit	-	3	Navigation mode, see <a href="#">position fix flags description</a>
<i>Start of repeated group (12 times)</i>					
7 + n	svid	numeric	-	29	Satellite number
<i>End of repeated group (12 times)</i>					
19	PDOP	numeric	-	1.94	Position dilution of precision
20	HDOP	numeric	-	1.18	Horizontal dilution of precision
21	VDOP	numeric	-	1.54	Vertical dilution of precision
22	systemId	hexadecimal	-	1	NMEA-defined GNSS system ID, see <a href="#">Signal Identifiers table</a> (only available in NMEA 4.10 and later)
23	cs	hexadecimal	-	*0D	Checksum
24	CRLF	character	-	-	Carriage return and line feed


## 2.8.5 RMC

### 2.8.5.1 Recommended minimum data

<b>Message</b>	<b>NMEA-NAV2-RMC</b> <b>Recommended minimum data</b>				
<b>Type</b>	Output				
<b>Comment</b>	The recommended minimum sentence defined by NMEA for GNSS system data.				



To identify the navigation data source for NMEA Secondary filter output, the alphanumeric string source-identification (s:) parameter is used in a TAG Block, in respect to NMEA 0183 Standard.

 The output of this message is dependent on the currently selected datum (default: WGS84)

Information	Class/ID: 0xf7 0x04	Number of fields: 20			
Structure	\s:1*78\\$\xxRMC,time,status,lat,NS,lon,EW,spd,cog,date,mv,mvEW,posMode,navStatus*cs\r\n				
Example	\s:1*78\\$\GPRMC,083559.00,A,4717.11437,N,00833.91522,E,0.004,77.52,091202,,A,V*57\r\n				
<b>Payload:</b>					
Field	Name	Format	Unit	Example	Description
0	tagStart	string	-	\s:	NMEA TAG block start and parameter
1	source	numeric	-	1	NMEA TAG block source value (1 for secondary output messages)
2	tagCs	hexadecimal	-	*78	NMEA TAG checksum
3	tagEnd	string	-	\	NMEA TAG block end character
4	xxRMC	string	-	\$GPRMC	RMC Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
5	time	hhmmss.ss	-	083559.00	UTC time. See section UTC representation in the integration manual for details.
6	status	character	-	A	Data validity status, see <a href="#">position fix flags description</a>
7	lat	ddmm. mmmmmm	-	4717.11437	Latitude (degrees and minutes), see <a href="#">format description</a>
8	NS	character	-	N	North/South indicator
9	lon	dddmm. mmmmmm	-	00833.91522	Longitude (degrees and minutes), see <a href="#">format description</a>
10	EW	character	-	E	East/West indicator
11	spd	numeric	knots	0.004	Speed over ground
12	cog	numeric	deg	77.52	Course over ground
13	date	ddmmyy	-	091202	Date in day, month, year format. See section UTC representation in the integration manual for details.
14	mv	numeric	deg	-	Magnetic variation value
15	mvEW	character	-	-	Magnetic variation E/W indicator
16	posMode	character	-	A	Mode Indicator, see <a href="#">position fix flags description</a> (only available in NMEA 2.3 and later)
17	navStatus	character	-	V	Navigational status indicator: V (Equipment is not providing navigational status information, fixed field, only available in NMEA 4.10 and later)
18	cs	hexadecimal	-	*57	Checksum
19	CRLF	character	-	-	Carriage return and line feed

## 2.8.6 VTG

### 2.8.6.1 Course over ground and ground speed

Message	NMEA-NAV2-VTG
	Course over ground and ground speed
Type	Output
Comment	Velocity is given as course over ground (COG) and speed over ground (SOG).

To identify the navigation data source for NMEA Secondary filter output, the alphanumeric string source-identification (s:) parameter is used in a TAG Block, in respect to NMEA 0183 Standard.

Information	Class/ID: 0xf7 0x05	Number of fields: 16			
Structure	\s:1*78\\$\xxVTG, cogt, cogtUnit, cogm, cogmUnit, sogn, sognUnit, sogk, sogkUnit, posMode*cs\r\n				
Example	\s:1*78\\$\\$GPVTG, 77.52, T, , M, 0.004, N, 0.008, K, A*06\r\n				
Payload:					
Field	Name	Format	Unit	Example	Description
0	tagStart	string	-	\s:	NMEA TAG block start and parameter
1	source	numeric	-	1	NMEA TAG block source value (1 for secondary output messages)
2	tagCs	hexadecimal	-	*78	NMEA TAG checksum
3	tagEnd	string	-	\	NMEA TAG block end character
4	xxVTG	string	-	\$GPVTG	VTG Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
5	cogt	numeric	degrees	77.52	Course over ground (true)
6	cogtUnit	character	-	T	Course over ground units: T (degrees true, fixed field)
7	cogm	numeric	degrees	-	Course over ground (magnetic)
8	cogmUnit	character	-	M	Course over ground units: M (degrees magnetic, fixed field)
9	sogn	numeric	knots	0.004	Speed over ground
10	sognUnit	character	-	N	Speed over ground units: N (knots, fixed field)
11	sogk	numeric	km/h	0.008	Speed over ground
12	sogkUnit	character	-	K	Speed over ground units: K (kilometers per hour, fixed field)
13	posMode	character	-	A	Mode indicator, see <a href="#">position fix flags description</a> (only available in NMEA 2.3 and later)
14	cs	hexadecimal	-	*06	Checksum
15	CRLF	character	-	-	Carriage return and line feed

## 2.8.7 ZDA

### 2.8.7.1 Time and date

Message	NMEA-NAV2-ZDA Time and date				
Type	Output				
Comment	UTC, day, month, year and local time zone. To identify the navigation data source for NMEA Secondary filter output, the alphanumeric string source-identification (s:) parameter is used in a TAG Block, in respect to NMEA 0183 Standard.				
Information	Class/ID: 0xf7 0x08	Number of fields: 13			
Structure	\s:1*78\\$\\$GPZDA, time, day, month, year, ltzh, ltzn*cs\r\n				
Example	\s:1*78\\$\\$xxZDA, 082710.00, 16, 09, 2002, 00, 00*64\r\n				
Payload:					
Field	Name	Format	Unit	Example	Description
0	tagStart	string	-	\s:	NMEA TAG block start and parameter
1	source	numeric	-	1	NMEA TAG block source value (1 for secondary output messages)

2	tagCs	hexadecimal	-	*78	NMEA TAG checksum
3	tagEnd	string	-	\	NMEA TAG block end character
4	xxZDA	string	-	\$GPZDA	ZDA Message ID (xx = current Talker ID, see <a href="#">NMEA Talker IDs table</a> )
5	time	hhmmss.ss	-	082710.00	UTC Time. See section UTC representation in the integration manual for details.
6	day	dd	day	16	UTC day (range: 1-31)
7	month	mm	month	09	UTC month (range: 1-12)
8	year	yyyy	year	2002	UTC year
9	ltzh	xx	-	00	Local time zone hours (fixed field, always 00)
10	ltzn	zz	-	00	Local time zone minutes (fixed field, always 00)
11	cs	hexadecimal	-	*64	Checksum
12	CRLF	character	-	-	Carriage return and line feed

## 2.9 PUBX messages

Proprietary NMEA messages for u-blox positioning receivers. See also [NMEA-proprietary messages](#).

### 2.9.1 CONFIG (PUBX,41)

#### 2.9.1.1 Set protocols and baud rate

Message	NMEA-PUBX-CONFIG				
	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
---	------	-----------	---	---	-------------------------------

## 2.9.2 POSITION (PUBX,00)

### 2.9.2.1 Poll a PUBX,00 message

<b>Message</b>	<b>NMEA-PUBX-POSITION</b> <b>Poll a PUBX,00 message</b>				
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				
Example	\$PUBX,00*33\r\n				
Payload:					
Field	Name	Format	Unit	Example	Description
0	PUBX	string	-	\$PUBX	Message ID, UBX protocol header, proprietary sentence
1	msgId	numeric	-	00	Set to 00 to poll a PUBX,00 message
2	cs	hexadecimal	-	*33	Checksum
3	CRLF	character	-	-	Carriage return and line feed

### 2.9.2.2 Lat/Long position data

<b>Message</b>	<b>NMEA-PUBX-POSITION</b> <b>Lat/Long position data</b>				
Type	Output				
Comment	This message contains position solution data. The datum selection may be changed using the message UBX-CFG-DAT.  The output of this message is dependent on the currently selected datum (default: WGS84).				
Information	Class/ID: 0xf1 0x00	Number of fields: 23			
Structure	\$PUBX,00,time,lat,NS,long,EW,altRef,navStat,hAcc,vAcc,SOG,COG,vVel,diffAge,HDOP,VDOP ↵,TDOP,numSvs,reserved,DR,*cs\r\n				
Example	\$PUBX,00,081350.00,4717.113210,N,00833.915187,E,546.589,G3,2.1,2.0,0.007,77.52,0.007 ↵,,0.92,1.19,0.77,9,0,0*5F\r\n				
Payload:					
Field	Name	Format	Unit	Example	Description
0	PUBX	string	-	\$PUBX	Message ID, UBX protocol header, proprietary sentence
1	msgId	numeric	-	00	Proprietary message identifier: 00
2	time	hhmmss.ss	-	081350.00	UTC time. See section UTC representation in the integration manual for details.
3	lat	ddmm.mmmmm	-	4717.113210	Latitude (degrees and minutes), see <a href="#">format description</a>
4	NS	character	-	N	North/South Indicator
5	long	dddmm.mmmmm	-	00833.915187	Longitude (degrees and minutes), see <a href="#">format description</a>
6	EW	character	-	E	East/West indicator
7	altRef	numeric	m	546.589	Altitude above user datum ellipsoid

8	navStat	string	-	G3	Navigation Status: <ul style="list-style-type: none"> <li>NF = No Fix</li> <li>DR = Dead reckoning only solution</li> <li>G2 = Stand alone 2D solution</li> <li>G3 = Stand alone 3D solution</li> <li>D2 = Differential 2D solution</li> <li>D3 = Differential 3D solution</li> <li>RK = Combined GPS + dead reckoning solution</li> <li>TT = Time only solution</li> </ul>
9	hAcc	numeric	m	2.1	Horizontal accuracy estimate
10	vAcc	numeric	m	2.0	Vertical accuracy estimate
11	SOG	numeric	km/h	0.007	Speed over ground
12	COG	numeric	deg	77.52	Course over ground
13	vVel	numeric	m/s	0.007	Vertical velocity (positive downwards)
14	diffAge	numeric	s	-	Age of differential corrections (blank when DGPS is not used)
15	HDOP	numeric	-	0.92	HDOP, Horizontal Dilution of Precision
16	VDOP	numeric	-	1.19	VDOP, Vertical Dilution of Precision
17	TDOP	numeric	-	0.77	TDOP, Time Dilution of Precision
18	numSvs	numeric	-	9	Number of satellites used in the navigation solution
19	reserved	numeric	-	-	Reserved, always set to 0
20	DR	numeric	-	-	DR used
21	cs	hexadecimal	-	*5B	Checksum
22	CRLF	character	-	-	Carriage return and line feed

## 2.9.3 RATE (PUBX,40)

### 2.9.3.1 Set NMEA message output rate

<b>Message</b>	<b>NMEA-PUBX-RATE</b> <b>Set NMEA message output rate</b>				
<b>Type</b>	Set				
<b>Comment</b>	Set/Get message rate configuration (s) to/from the receiver. <ul style="list-style-type: none"> <li>Send rate is relative to the event a message is registered on. For example, if the rate of a navigation message is set to 2, the message is sent every second navigation solution.</li> </ul>				
<b>Information</b>	Class/ID: 0xf1 0x40		Number of fields: 11		
<b>Structure</b>	\$PUBX,40,msgId,rddc,rus1,rus2,rusb,rspi,reserved*cs\r\n				
<b>Example</b>	\$PUBX,40,GLL,1,0,0,0,0,0*5D\r\n				
<b>Payload:</b>					
<b>Field</b>	<b>Name</b>	<b>Format</b>	<b>Unit</b>	<b>Example</b>	<b>Description</b>
0	PUBX	string	-	\$PUBX	Message ID, UBX protocol header, proprietary sentence
1	ID	numeric	-	40	Proprietary message identifier
2	msgId	string	-	GLL	NMEA message identifier
3	rddc	numeric	cycles	1	output rate on DDC <ul style="list-style-type: none"> <li>0 disables that message from being output on this port</li> <li>1 means that this message is output every epoch</li> </ul>

4	rus1	numeric	cycles	1	output rate on USART 1 <ul style="list-style-type: none"> <li>0 disables that message from being output on this port</li> <li>1 means that this message is output every epoch</li> </ul>
5	rus2	numeric	cycles	1	output rate on USART 2 <ul style="list-style-type: none"> <li>0 disables that message from being output on this port</li> <li>1 means that this message is output every epoch</li> </ul>
6	rusb	numeric	cycles	1	output rate on USB <ul style="list-style-type: none"> <li>0 disables that message from being output on this port</li> <li>1 means that this message is output every epoch</li> </ul>
7	rspi	numeric	cycles	1	output rate on SPI <ul style="list-style-type: none"> <li>0 disables that message from being output on this port</li> <li>1 means that this message is output every epoch</li> </ul>
8	reserved	numeric	-	-	Reserved: always fill with 0
9	cs	hexadecimal	-	*5D	Checksum
10	CRLF	character	-	-	Carriage return and line feed

## 2.9.4 SVSTATUS (PUBX,03)

### 2.9.4.1 Poll a PUBX,03 message

<b>Message</b>	<b>NMEA-PUBX-SVSTATUS</b> <b>Poll a PUBX,03 message</b>				
Type	Poll request				
Comment	A PUBX,03 message is polled by sending the PUBX,03 message without any data fields.				
Information	Class/ID: 0xf1 0x03		Number of fields: 4		
Structure	\$PUBX,03*30\r\n				
Example	\$PUBX,03*30\r\n				
Payload:					
Field	Name	Format	Unit	Example	Description
0	PUBX	string	-	\$PUBX	Message ID, UBX protocol header, proprietary sentence
1	msgId	numeric	-	03	Set to 03 to poll a PUBX,03 message
2	cs	hexadecimal	-	*30	Checksum
3	CRLF	character	-	-	Carriage return and line feed

### 2.9.4.2 Satellite status

<b>Message</b>	<b>NMEA-PUBX-SVSTATUS</b> <b>Satellite status</b>				
Type	Output				
Comment	The PUBX,03 message contains satellite status information.				
Information	Class/ID: 0xf1 0x03		Number of fields: 5 + n-6		
Structure	\$PUBX,03,GT{,sv,s,az,el,cno,lck},*cs\r\n				
Example	\$PUBX,03,11,23,-,,45,010,29,-,,46,013,07,-,,42,015,08,U,067,31,42,025,10,U,195,33 ↵ ,46,026,18,U,326,08,39,026,17,-,,32,015,26,U,306,66,48,025,27,U,073,10,36,026,28,U, ↵ 089,61,46,024,15,-,,39,014*0D\r\n				
Payload:					
Field	Name	Format	Unit	Example	Description

0	PUBX	string	-	\$PUBX	Message ID, UBX protocol header, proprietary sentence
1	msgId	numeric	-	03	Proprietary message identifier: 03
2	n	numeric	-	11	Number of GNSS satellites tracked
<i>Start of repeated group (n times)</i>					
3 + n·6	sv	numeric	-	23	Satellite ID according to UBX svId mapping (see <a href="#">Satellite Numbering</a> )
4 + n·6	s	character	-	-	Satellite status: <ul style="list-style-type: none"> <li>- = Not used</li> <li>U = Used in solution</li> <li>e = Ephemeris available, but not used for navigation</li> </ul>
5 + n·6	az	numeric	deg	-	Satellite azimuth (range: 0-359)
6 + n·6	el	numeric	deg	-	Satellite elevation (<= 90)
7 + n·6	cno	numeric	dBHz	45	Signal strength (C/N0, range 0-99), blank when not tracking
8 + n·6	lck	numeric	s	010	Satellite carrier lock time (range: 0-64) <ul style="list-style-type: none"> <li>0 = code lock only</li> <li>64 = lock for 64 seconds or more</li> </ul>
<i>End of repeated group (n times)</i>					
3 + n·6	cs	hexadecimal	-	*0D	Checksum
4 + n·6	CRLF	character	-	-	Carriage return and line feed

## 2.9.5 TIME (PUBX,04)

### 2.9.5.1 Poll a PUBX,04 message

<b>Message</b>	<b>NMEA-PUBX-TIME</b> <b>Poll a PUBX,04 message</b>				
<b>Type</b>	Poll request				
<b>Comment</b>	A PUBX,04 message is polled by sending the PUBX,04 message without any data fields.				
<b>Information</b>	Class/ID: 0xf1 0x04		Number of fields: 4		
<b>Structure</b>	\$PUBX,04*37\r\n				
<b>Example</b>	\$PUBX,04*37\r\n				
<b>Payload:</b>					
<b>Field</b>	<b>Name</b>	<b>Format</b>	<b>Unit</b>	<b>Example</b>	<b>Description</b>
0	PUBX	string	-	\$PUBX	Message ID, UBX protocol header, proprietary sentence
1	msgId	numeric	-	04	Set to 04 to poll a PUBX,04 message
2	cs	hexadecimal	-	*37	Checksum
3	CRLF	character	-	-	Carriage return and line feed

### 2.9.5.2 Time of day and clock information

<b>Message</b>	<b>NMEA-PUBX-TIME</b> <b>Time of day and clock information</b>				
<b>Type</b>	Output				
<b>Comment</b>					
<b>Information</b>	Class/ID: 0xf1 0x04		Number of fields: 12		
<b>Structure</b>	\$PUBX,04,time,date,utcTow,utcWk,leapSec,clkBias,clkDrift,tpGran,*cs\r\n				

**Example**     \$PUBX,04,073731.00,091202,113851.00,1196,15D,1930035,-2660.664,43,\*3C\r\n

**Payload:**

Field	Name	Format	Unit	Example	Description
0	PUBX	string	-	\$PUBX	Message ID, UBX protocol header, proprietary sentence
1	msgId	numeric	-	04	Proprietary message identifier: 04
2	time	hhmmss.ss	-	073731.00	UTC time. See section UTC representation in the integration manual for details.
3	date	ddmmyy	-	091202	UTC date, day, month, year. See section UTC representation in the integration manual for details.
4	utcTow	numeric	s	113851.00	UTC time of week
5	utcWk	numeric	-	1196	UTC week number, continues beyond 1023
6	leapSec	numeric/ text	s	15D	Leap seconds (not supported for protocol versions less than 13.01)  The number is marked with a <i>D</i> if the value is the firmware default value. If the value is not marked it has been received from a satellite.
7	clkBias	numeric	ns	1930035	Receiver clock bias
8	clkDrift	numeric	ns/s	-2660.664	Receiver clock drift
9	tpGran	numeric	ns	43	Time pulse granularity, the quantization error of the TIMEPULSE pin
10	cs	hexadecimal	-	*3C	Checksum
11	CRLF	character	-	-	Carriage return and line feed



## 3 UBX protocol

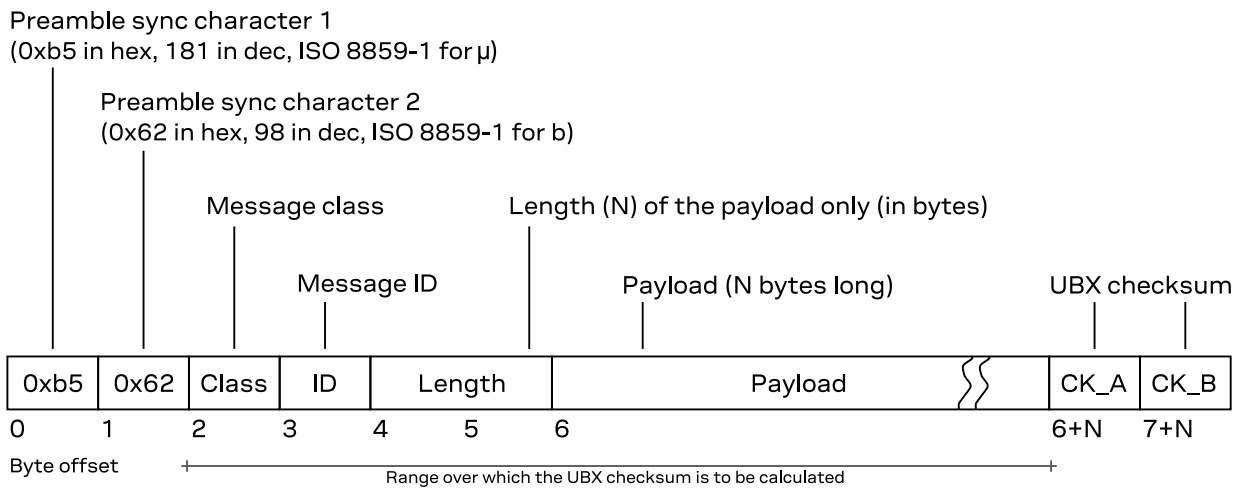
### 3.1 UBX protocol key features

u-blox receivers support a u-blox-proprietary protocol to communicate with a host computer. This protocol has the following key features:

- Compact – uses 8-bit binary data
- Checksum protected – uses a low-overhead checksum algorithm
- Modular – uses a two-stage message identifier (Class and Message ID)

### 3.2 UBX frame structure

The structure of a basic UBX frame is shown in the following diagram.



- Every *frame* starts with a 2-byte *preamble* consisting of two synchronization characters: 0xb5 and 0x62.
- A 1-byte *message class* field follows. A class is a group of messages that are related to each other.
- A 1-byte *message ID* field defines the message that is to follow.
- A 2-byte *length* field follows. The length is defined as being that of the payload only. It does not include the preamble, message class, message ID, length, or [UBX checksum](#) fields. The number format of the length field is an unsigned little-endian 16-bit integer (a "U2" in [UBX data types](#)).
- The *payload* field contains a variable number (= *length*) of bytes.
- The two 1-byte *CK\_A* and *CK\_B* fields hold a 16-bit checksum whose calculation is defined in [UBX checksum](#) section. This concludes the frame.

### 3.3 UBX payload definition rules

This section contains the rules and guidelines for UBX message payloads. See also [UBX message example](#).

#### 3.3.1 UBX structure packing

Values are placed in such an order that structure packing is not a problem. This means that two-byte values shall start on offsets that are a multiple of two; four-byte values shall start at a multiple of four; and so on.

#### 3.3.2 UBX reserved elements

Some messages contain reserved fields or bits to allow for future expansion. The contents of these elements should be ignored in output messages and must be set to zero in input messages. Where a message is output and subsequently returned to the receiver as an input message, reserved elements can either be explicitly set to zero or left with whatever value they were output with.

For fields in a bitfield the same rules apply. Note that bits not described are automatically reserved and are not explicitly stated (see [UBX message example](#)).

#### 3.3.3 UBX undefined values

The description of some fields provide specific meanings for specific values. For example, the field `gnssId` appears in many UBX messages and uses 0 to indicate GPS, 1 for SBAS and so on (see [GNSS identifiers](#) for details); however it is usually stored in a byte with far more possible values than the handful currently defined. All such undefined values are reserved for future expansion and therefore should not be used.

#### 3.3.4 UBX conditional values

Some UBX messages use validity flag fields to indicate whether the values of some value fields are valid. For example, the [UBX-NAV-PVT](#) message has the `validDate` and `validTime` fields that indicate whether the date (`year`, `month` and `day` fields), and, respectively, the time (`hour`, `min` and `sec` fields) are valid. This means that these value fields will only contain meaningful data if the corresponding flag field is set (has the value 1).

#### 3.3.5 UBX data types

The following data types (number formats) are defined.

Name	Type	Size (Bytes)	Range	Resolution
U1	unsigned 8-bit integer	1	$0 \dots 2^8 - 1$	1
I1	signed 8-bit integer, two's complement	1	$-2^7 \dots 2^7 - 1$	1
X1	8-bit bitfield	1	n/a	n/a
U2	unsigned little-endian 16-bit integer	2	$0 \dots 2^{16} - 1$	1
I2	signed little-endian 16-bit integer, two's complement	2	$-2^{15} \dots 2^{15} - 1$	1
X2	16-bit little-endian bitfield	2	n/a	n/a
U4	unsigned little-endian 32-bit integer	4	$0 \dots 2^{32} - 1$	1
I4	signed little-endian 32-bit integer, two's complement	4	$-2^{31} \dots 2^{31} - 1$	1
X4	32-bit little-endian bitfield	4	n/a	n/a

Name	Type	Size (Bytes)	Range	Resolution
R4	IEEE 754 single (32-bit) precision	4	$-2^{127} \dots 2^{127}$	$\sim \text{value} \cdot 2^{-24}$
R8	IEEE 754 double (64-bit) precision	8	$-2^{1023} \dots 2^{1023}$	$\sim \text{value} \cdot 2^{-53}$
CH	ASCII / ISO 8859-1 char (8-bit)	1	n/a	n/a
U <sub>.n</sub>	unsigned bitfield value of <i>n</i> bits width	var.	variable	variable
I <sub>.n</sub>	signed (two's complement) bitfield value of <i>n</i> bits width	var.	variable	variable
S <sub>.n</sub>	signed bitfield value of <i>n</i> bits width, in sign (most significant bit) and magnitude (remaining bits) notation	var.	variable	variable

### 3.3.6 UBX fields scale and unit

Fields in UBX messages can have a unit defined. Whenever possible, SI units and symbols are used (e.g. "m" for meters, "s" for seconds). For civil (UTC) time representation units of years (y), months (month), days (d), hours (h), minutes (min) and seconds (s) are used.

Fields in UBX messages can have a scale factor defined. Unity (factor 1) is assumed if no scale is specified. For integer type fields this is often combined with a unit. When a scale is combined with a unit, the scale represents the smallest storage unit. For example, if meters (m) are expressed (stored) in centimeters the scale would be 0.01 (or 1e-2). This is equivalent of specifying a unit of centimeters (cm) and no scale.

The description of some integer values (e.g. U2, I4 or I8) indicates a fixed-point format (e.g. [UU.FF], [IIII.FFF] or [IIIIII.FFFFFFFF]). The fixed-point value can be retrieved from the integer value by first casting it to appropriate type (e.g. as a floating-point number) and then scaling it with the indicated scaling factor.

### 3.3.7 UBX repeated fields

There are two types of repetitions in UBX messages. The first type specifies that a single field is repeated a constant number of times. This repetition is defined in the type of the field. For example, the [UBX message example](#) can specify a field `data` of type `U1[5]`. In this case the `data` field should be interpreted as an array of five U1 values.

The second type of repetition in messages is referred to as *repeated groups*, which groups one or more fields into a block of payload data. There are several types of repetition:

- The number of repetitions of *variable-by-field group* is indicated by another, earlier field in the same message. The number of repetitions can be zero or more, depending on the value of the referenced field.
- A *constant group* has a constant number of repetitions.
- An *optional group* is repeated zero or one times, depending on the available payload data. That is, the fields are present in the message only if the payload of the message is large enough to cover the whole group of fields.
- The number of repetitions of a *variable-by-size group* is given by the available payload size. The group will repeat until there is not enough payload data left to cover the whole group of fields another time.

Note that only some combinations of repeated groups of fields are possible in a single message. See also [UBX payload decoding](#).

### 3.3.8 UBX payload decoding

UBX message payloads are designed so that the data (fields) can be extracted by a single pass through the payload from start to end. Fixed-size messages are the trivial case where the offset of all fields is unambiguously defined. Variable-size messages have variable number of repetitions of one or multiple groups of fields. For groups where the number of repetitions is given by the value of another field, that field can always be found at a fixed offset in the message payload before the respective group of fields. Groups whose number of repetitions depend on the payload size can only be the last group of fields in a message and only one such group may exist in a message. See also [UBX repeated fields](#).

## 3.4 UBX checksum

The checksum is calculated over the message, starting and including the class field up until, but excluding, the checksum fields (see the figure [UBX frame structure](#)).

The checksum algorithm used is the 8-bit Fletcher algorithm, which is used in the TCP standard [RFC 1145](#)). This algorithm works as follows:

- `Buffer[N]` is an array of bytes that contains the data over which the checksum is to be calculated.
- The two `CK_A` and `CK_B` values are 8-bit unsigned integers, only! If implementing with larger-sized integer values, make sure to mask both `CK_A` and `CK_B` with the value `0xff` after both operations in the loop.
- After the loop, the two `UI` values contain the checksum, transmitted after the message payload, which concludes the frame.

```

1 CK_A = 0, CK_B = 0
2 For (I = 0; I < N; I++)
3 {
4     CK_A = CK_A + Buffer[I]
5     CK_B = CK_B + CK_A
6 }
```

## 3.5 UBX message flow

There are certain features associated with the messages being sent back and forth:

### 3.5.1 UBX acknowledgement

When messages from the class CFG are sent to the receiver, the receiver will send an "acknowledge" ([UBX-ACK-ACK](#)) or a "not acknowledge" ([UBX-ACK-NAK](#)) message back to the sender, depending on whether or not the message was processed correctly.

Some messages from other classes also use the same acknowledgement mechanism.

### 3.5.2 UBX polling mechanism

The UBX protocol is designed so that messages can be polled by sending the message required to the receiver but without a payload (or with just a single parameter that identifies the poll request). The receiver then responds with the same message with the payload populated.

### 3.6 GNSS, satellite, and signal numbering

See [GNSS, satellite, and signal identifiers](#) for details on how GNSS, satellites and signals are numbered in the UBX protocol.

### 3.7 UBX message example

This is an example of the definition of UBX messages as shown in the following sections.

<b>Message</b>	<b>UBX-DEMO-EXAMPLE</b>					
<b>①</b>	<b>Example demo message</b>					
<b>Type</b> ②	Periodic/pollled					
<b>Comment</b>	This is a comment that describes the use of the demo example message.					
<b>③</b>	There can be references to other sections in the documentation (such as: <a href="#">UBX protocol</a> ). 🔗 Note that there can be important remarks here.					
<b>Message</b> ④	<i>Header</i>	<i>Class ID</i>	<i>Length (bytes)</i>	<i>Payload</i>	<i>Checksum</i>	
<b>Structure</b>	0xb5 0x62 0x01 0x07		16 + numRepeat*4	see below	CK_A CK_B	
<b>Payload description:</b> ⑤						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	aField	-	-	a field that contains an unsigned integer with no particular scale or unit	
4	I4	anotherField	1e-2	m	a field that contains a length in meters (m) with a scale of 1e-2 (= 0.01), i.e. a length in centimeters	
8	X2	bitfield ⑥	-	-	this field contains flags or values smaller than one byte, whose definition follows below (bits not described are <a href="#">reserved</a> )	
bit 0	U:1	aFieldValid	-	-	the first bit in bitfield indicates whether the aField is valid or not (see <a href="#">UBX conditional values</a> )	
bit 1	U:1	someFlag	-	-	the second bit is a flag (1 = true, 0 = false)	
bits 5...2	U:4	aBitFieldValue	-	-	a 4-bits value (range: 0...15)	
10	U1[5] ⑦	reserved0	-	-	a <a href="#">reserved</a> field, whose value shall be ignored (in output messages) or set to 0 (in input messages)	
15	U1	numRepeat	-	-	number of repetitions in the group of fields below	
<b>Start of repeated group (numRepeat times) ⑧</b>						
16 + n*4	I2	someValue	-	-	a signed value in a repeated group of fields	
18 + n*4	U2	anotherValue	-	-	another value in a repeated group of fields	
<b>End of repeated group (numRepeat times)</b>						

① The first line shows the message name (see [Message naming](#)). The second line shows a short description of the message.

② The message type (see [Message types](#)).

③ This section contains comments that describe the message. Often links to other related sections in the documentation or other related messages are found here.

- ④ The message structure gives the parameters for the [UBX frame structure](#), notably the message class and message ID values and the payload length. For many messages the payload length is a fixed number (of bytes). Messages that contain repeated blocks of information (fields) have a variable payload (see [UBX repeated fields](#)).
- ⑤ The message payload definition is given as a list of fields and their parameters. Each field starts at a specified offset (in bytes) in the payload (see also [UBX structure packing](#)), is of a specific type (see [UBX data types](#)), has a unique name (within the message), and a description. Optionally, fields can have a scale and/or a unit (see [UBX fields scale and unit](#)).
- ⑥ Bitfields ("X" types) are broken down into smaller parts. Each part can be one or more bits wide. Values that are two or more bits wide can be unsigned or one of two signed value representation (see [UBX data types](#)). Note that the ten unused bits 15...6 are not explicitly stated as [UBX reserved elements](#).
- ⑦ Fields can be arrays of values of the same type (see [UBX repeated fields](#)).
- ⑧ Groups of fields can be repeated in the payload. The number of repetitions can be given by another field in the message (this example), a constant number, zero or one times (known as "optional group"), or derived from the remaining payload size (labeled as "repeated N times"). See also [UBX repeated fields](#) and [UBX payload decoding](#).

### 3.8 UBX messages overview

<i>Message</i>	<i>Class/ID</i>	<i>Description (Type)</i>
<b>UBX-ACK – Acknowledgement and negative acknowledgement messages</b>		
<a href="#">UBX-ACK-ACK</a>	0x05 0x01	• Message acknowledged (Output)
<a href="#">UBX-ACK-NAK</a>	0x05 0x00	• Message not acknowledged (Output)
<b>UBX-CFG – Configuration and command messages</b>		
<a href="#">UBX-CFG-CFG</a>	0x06 0x09	• Clear, save and load configurations (Command)
<a href="#">UBX-CFG-MSG</a>	0x06 0x01	• Poll a message configuration (Poll request) • Set message rate(s) (Get/set) • Set message rate (Get/set)
<a href="#">UBX-CFG-OTP</a>	0x06 0x41	• Write file 0xA4: receiver configuration items (Set)
<a href="#">UBX-CFG-PRT</a>	0x06 0x00	• Polls the configuration for one I/O port (Poll request) • Port configuration for UART ports (Get/set) • Port configuration for SPI port (Get/set) • Port configuration for I2C (DDC) port (Get/set)
<a href="#">UBX-CFG-RST</a>	0x06 0x04	• Reset receiver / Clear backup data structures (Command)
<a href="#">UBX-CFG-VALDEL</a>	0x06 0x8c	• Delete configuration item values (Set) • Delete configuration item values (with transaction) (Set)
<a href="#">UBX-CFG-VALGET</a>	0x06 0x8b	• Get configuration items (Poll request) • Configuration items (Polled)
<a href="#">UBX-CFG-VALSET</a>	0x06 0x8a	• Set configuration item values (Set)
<b>UBX-INF – Information messages</b>		
<a href="#">UBX-INF-DEBUG</a>	0x04 0x04	• ASCII output with debug contents (Output)
<a href="#">UBX-INF-ERROR</a>	0x04 0x00	• ASCII output with error contents (Output)
<a href="#">UBX-INF-NOTICE</a>	0x04 0x02	• ASCII output with informational contents (Output)
<a href="#">UBX-INF-TEST</a>	0x04 0x03	• ASCII output with test contents (Output)
<a href="#">UBX-INF-WARNING</a>	0x04 0x01	• ASCII output with warning contents (Output)
<b>UBX-MGA – GNSS assistance (A-GNSS) messages</b>		

<b>Message</b>	<b>Class/ID</b>	<b>Description (Type)</b>
UBX-MGA-ACK	0x13 0x60	• Multiple GNSS acknowledge message (Output)
UBX-MGA-DBD	0x13 0x80	• Poll the navigation database (Poll request) • Navigation database dump entry (Input/output)
UBX-MGA-GAL	0x13 0x02	• Galileo ephemeris assistance (Input) • Galileo almanac assistance (Input) • Galileo GPS time offset assistance (Input) • Galileo UTC assistance (Input)
UBX-MGA-GLO	0x13 0x06	• GLONASS ephemeris assistance (Input) • GLONASS almanac assistance (Input) • GLONASS auxiliary time offset assistance (Input)
UBX-MGA-GPS	0x13 0x00	• GPS ephemeris assistance (Input) • GPS almanac assistance (Input) • GPS health assistance (Input) • GPS UTC assistance (Input) • GPS ionosphere assistance (Input)
UBX-MGA-INI	0x13 0x40	• Initial position assistance XYZ (Input) • Initial position assistance LLH (Input) • Initial time assistance UTC (Input) • Initial time assistance GNSS (Input) • Initial clock drift assistance (Input) • Initial frequency assistance (Input)
UBX-MGA-QZSS	0x13 0x05	• QZSS ephemeris assistance (Input) • QZSS almanac assistance (Input) • QZSS health assistance (Input)
<b>UBX-MON – Monitoring messages</b>		
UBX-MON-COMMS	0x0a 0x36	• Communication port information (Periodic/poll)
UBX-MON-GNSS	0x0a 0x28	• Information message major GNSS selection (Polled)
UBX-MON-HW	0x0a 0x09	• Hardware status (Periodic/poll)
UBX-MON-HW3	0x0a 0x37	• I/O pin status (Periodic/poll)
UBX-MON-IO	0x0a 0x02	• I/O system status (Periodic/poll)
UBX-MON-MSGPP	0x0a 0x06	• Message parse and process status (Periodic/poll)
UBX-MON-PATCH	0x0a 0x27	• Installed patches (Polled)
UBX-MON-RF	0x0a 0x38	• RF information (Periodic/poll)
UBX-MON-RXBUF	0x0a 0x07	• Receiver buffer status (Periodic/poll)
UBX-MON-RXR	0x0a 0x21	• Receiver status information (Output)
UBX-MON-SPAN	0x0a 0x31	• Signal characteristics (Periodic/poll)
UBX-MON-SYS	0x0a 0x39	• Current system performance information (Periodic/poll)
UBX-MON-TXBUF	0x0a 0x08	• Transmitter buffer status (Periodic/poll)
UBX-MON-VER	0x0a 0x04	• Poll receiver and software version (Poll request) • Receiver and software version (Polled)
<b>UBX-NAV – Navigation solution messages</b>		
UBX-NAV-CLOCK	0x01 0x22	• Clock solution (Periodic/poll)
UBX-NAV-COV	0x01 0x36	• Covariance matrices (Periodic/poll)
UBX-NAV-DOP	0x01 0x04	• Dilution of precision (Periodic/poll)
UBX-NAV-EOE	0x01 0x61	• End of epoch (Periodic)
UBX-NAV-NMI	0x01 0x28	• Navigation message cross-check information (Periodic/poll)
UBX-NAV-ORB	0x01 0x34	• GNSS orbit database info (Periodic/poll)
UBX-NAV-POSECEF	0x01 0x01	• Position solution in ECEF (Periodic/poll)

<b>Message</b>	<b>Class/ID</b>	<b>Description (Type)</b>
UBX-NAV-POSLLH	0x01 0x02	• Geodetic position solution (Periodic/pollled)
UBX-NAV-PVT	0x01 0x07	• Navigation position velocity time solution (Periodic/pollled)
UBX-NAV-SAT	0x01 0x35	• Satellite information (Periodic/pollled)
UBX-NAV-SBAS	0x01 0x32	• SBAS status data (Periodic/pollled)
UBX-NAV-SIG	0x01 0x43	• Signal information (Periodic/pollled)
UBX-NAV-STATUS	0x01 0x03	• Receiver navigation status (Periodic/pollled)
UBX-NAV-TIMEBDS	0x01 0x24	• BeiDou time solution (Periodic/pollled)
UBX-NAV-TIMEGAL	0x01 0x25	• Galileo time solution (Periodic/pollled)
UBX-NAV-TIMEGLO	0x01 0x23	• GLONASS time solution (Periodic/pollled)
UBX-NAV-TIMEGPS	0x01 0x20	• GPS time solution (Periodic/pollled)
UBX-NAV-TIMELS	0x01 0x26	• Leap second event information (Periodic/pollled)
UBX-NAV-TIMENAVIC	0x01 0x63	• NavIC time solution (Periodic/pollled)
UBX-NAV-TIMEQZSS	0x01 0x27	• QZSS time solution (Periodic/pollled)
UBX-NAV-TIMEUTC	0x01 0x21	• UTC time solution (Periodic/pollled)
UBX-NAV-VELECEF	0x01 0x11	• Velocity solution in ECEF (Periodic/pollled)
UBX-NAV-VELNED	0x01 0x12	• Velocity solution in NED frame (Periodic/pollled)
<b>UBX-NAV2 – Navigation solution messages (Secondary output)</b>		
UBX-NAV2-CLOCK	0x29 0x22	• Clock solution (Periodic/pollled)
UBX-NAV2-COV	0x29 0x36	• Covariance matrices (Periodic/pollled)
UBX-NAV2-DOP	0x29 0x04	• Dilution of precision (Periodic/pollled)
UBX-NAV2-EOE	0x29 0x61	• End of epoch (Periodic)
UBX-NAV2-POSECEF	0x29 0x01	• Position solution in ECEF (Periodic/pollled)
UBX-NAV2-POSLLH	0x29 0x02	• Geodetic position solution (Periodic/pollled)
UBX-NAV2-PVT	0x29 0x07	• Navigation position velocity time solution (Periodic/pollled)
UBX-NAV2-SAT	0x29 0x35	• Satellite information (Periodic/pollled)
UBX-NAV2-SBAS	0x29 0x32	• SBAS status data (Periodic/pollled)
UBX-NAV2-SIG	0x29 0x43	• Signal information (Periodic/pollled)
UBX-NAV2-STATUS	0x29 0x03	• Receiver navigation status (Periodic/pollled)
UBX-NAV2-TIMEBDS	0x29 0x24	• BeiDou time solution (Periodic/pollled)
UBX-NAV2-TIMEGAL	0x29 0x25	• Galileo time solution (Periodic/pollled)
UBX-NAV2-TIMEGLO	0x29 0x23	• GLONASS time solution (Periodic/pollled)
UBX-NAV2-TIMEGPS	0x29 0x20	• GPS time solution (Periodic/pollled)
UBX-NAV2-TIMELS	0x29 0x26	• Leap second event information (Periodic/pollled)
UBX-NAV2-TIMENAVIC	0x29 0x63	• NavIC time solution (Periodic/pollled)
UBX-NAV2-TIMEUTC	0x29 0x21	• UTC time solution (Periodic/pollled)
UBX-NAV2-VELECEF	0x29 0x11	• Velocity solution in ECEF (Periodic/pollled)
UBX-NAV2-VELNED	0x29 0x12	• Velocity solution in NED frame (Periodic/pollled)
<b>UBX-RXM – Receiver manager messages</b>		
UBX-RXM-MEASX	0x02 0x14	• Satellite measurements for RRLP (Periodic/pollled)
UBX-RXM-PMREQ	0x02 0x41	• Power management request (Command)
UBX-RXM-RAWX	0x02 0x15	• Multi-GNSS raw measurements (Periodic/pollled)
UBX-RXM-RLM	0x02 0x59	• Galileo SAR short-RLM report (Output) • Galileo SAR long-RLM report (Output)
UBX-RXM-SFRBX	0x02 0x13	• Broadcast navigation data subframe (Output)



Message	Class/ID	Description (Type)
<b>UBX-SEC – Security messages</b>		
UBX-SEC-SIG	0x27 0x09	• Signal security information (Periodic/pollled)
UBX-SEC-SIGLOG	0x27 0x10	• Signal security log (Periodic/pollled)
UBX-SEC-UNIQID	0x27 0x03	• Unique chip ID (Output)
<b>UBX-TIM – Timing messages</b>		
UBX-TIM-SVIN	0x0d 0x04	• Survey-in data (Periodic/pollled)
UBX-TIM-TM2	0x0d 0x03	• Time mark data (Periodic/pollled)
UBX-TIM-TP	0x0d 0x01	• Time pulse time data (Periodic/pollled)
UBX-TIM-VRFY	0x0d 0x06	• Sourced time verification (Periodic/pollled)
<b>UBX-UPD – Firmware update messages</b>		
UBX-UPD-SOS	0x09 0x14	<ul style="list-style-type: none"> <li>• Poll backup restore status (Poll request)</li> <li>• Create backup in flash (Command)</li> <li>• Clear backup in flash (Command)</li> <li>• Backup creation acknowledge (Output)</li> <li>• System restored from backup (Output)</li> </ul>

## 3.9 UBX-ACK (0x05)

The messages in the UBX-ACK class are used to indicate acknowledgement or rejection (i.e. negative acknowledgement) of input messages, such as UBX-CFG messages.

### 3.9.1 UBX-ACK-ACK (0x05 0x01)

#### 3.9.1.1 Message acknowledged

Message	UBX-ACK-ACK Message acknowledged					
Type	Output					
Comment	Output upon processing of an input message. A UBX-ACK-ACK is sent as soon as possible but at least within one second.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x05	0x01	2	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	clsID	-	-	Class ID of the Acknowledged Message	
1	U1	msgID	-	-	Message ID of the Acknowledged Message	

### 3.9.2 UBX-ACK-NAK (0x05 0x00)

#### 3.9.2.1 Message not acknowledged

Message	UBX-ACK-NAK Message not acknowledged					
Type	Output					
Comment	Output upon processing of an input message. A UBX-ACK-NAK is sent as soon as possible but at least within one second.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x05	0x00	2	see below	CK_A CK_B
Payload description:						


Byte offset	Type	Name	Scale	Unit	Description
0	U1	clsID	-	-	Class ID of the Not-Acknowledged Message
1	U1	msgID	-	-	Message ID of the Not-Acknowledged Message

## 3.10 UBX-CFG (0x06)

The messages in the UBX-CFG class are used to configure the receiver and poll current configuration values as well as for sending commands to the receiver. Unless stated otherwise, any message in this class sent to the receiver is either acknowledged (by a [UBX-ACK-ACK](#) message) if processed successfully or rejected (with a [UBX-ACK-NAK](#) message) if processed unsuccessfully.

### 3.10.1 UBX-CFG-CFG (0x06 0x09)

#### 3.10.1.1 Clear, save and load configurations

Message	UBX-CFG-CFG					
Clear, save and load configurations						
Type	Command					
Comment	<p>See <a href="#">Receiver configuration</a> for a detailed description on how receiver configuration should be used. The behavior of this message has changed for protocol versions greater than 23.01. Use <a href="#">UBX-CFG-VALSET</a> and <a href="#">UBX-CFG-VALDEL</a> with the appropriate layers instead. These new messages support selective saving and clearing to retain the behavior removed from this message. The three masks which were used to clear, save and load a subsection of configuration have lost their meaning. It is no longer possible to save or clear a subsection of the configuration using this message. The behavior of the masks is now:</p> <ul style="list-style-type: none"> <li>if any bit is set in the clearMask: all configuration in the selected non-volatile memory is deleted</li> <li>if any bit is set in the saveMask: all current configuration is stored (copied) to the selected layers</li> <li>if any bit is set in the loadMask: The current configuration is discarded and rebuilt from all the lower layers</li> </ul> <p>Note that commands can be combined. The sequence of execution is clear, save, then load. The receiver replies with a single <a href="#">UBX-ACK-ACK</a> or <a href="#">UBX-ACK-NAK</a>. A <a href="#">UBX-ACK-ACK</a> indicates that all operations were successful. A <a href="#">UBX-ACK-NAK</a> indicates that at least one of the configured operations was unsuccessful. It is recommended to send individual commands for a more comprehensive monitoring of the success or not of the individual operations.</p> <p> Old functionality of this message is not available in protocol versions greater than 23.01. Use <a href="#">UBX-CFG-VALSET</a>, <a href="#">UBX-CFG-VALGET</a>, <a href="#">UBX-CFG-VALDEL</a> instead.</p>					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x06	0x09	12 + [0,1]	see below	CK_A CK_B

Payload description:

Byte offset	Type	Name	Scale	Unit	Description
0	X4	clearMask	-	-	Mask for configuration to clear
bits 31...0	U:32	clearAll	-	-	Clear all saved configuration from the selected non-volatile memory if any bit is set
4	X4	saveMask	-	-	Mask for configuration to save
bits 31...0	U:32	saveAll	-	-	Save all current configuration to the selected non-volatile memory if any bit is set
8	X4	loadMask	-	-	Mask for configuration to load
bits 31...0	U:32	loadAll	-	-	Discard current configuration and rebuilt it from lower non-volatile memory layers if any bit is set

Start of optional group

12	X1	deviceMask	-	-	Mask which selects the memory devices for saving and/or clearing operation Note that if a deviceMask is not provided, the receiver defaults the operation requested to battery-backed RAM (BBR) and Flash (if available)
bit 0	U:1	devBBR	-	-	Battery-backed RAM
bit 1	U:1	devFlash	-	-	Flash
bit 2	U:1	devEEPROM	-	-	EEPROM (only supported for protocol versions less than 14.00)
bit 4	U:1	devSpiFlash	-	-	SPI Flash (only supported for protocol versions less than 14.00)

End of optional group

### 3.10.2 UBX-CFG-MSG (0x06 0x01)

#### 3.10.2.1 Poll a message configuration

<b>Message</b>	<b>UBX-CFG-MSG</b>					
	<b>Poll a message configuration</b>					
Type	Poll request					
Comment	<p><b>This message is deprecated in protocol versions greater than 23.01. Use <a href="#">UBX-CFG-VALSET</a>, <a href="#">UBX-CFG-VALGET</a>, <a href="#">UBX-CFG-VALDEL</a> instead.</b></p> <p>See the <a href="#">Legacy UBX Message Fields Reference</a> for the corresponding configuration item.</p>					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x06	0x01	2	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	msgClass	-	-	Message class	
1	U1	msgID	-	-	Message identifier	

#### 3.10.2.2 Set message rate(s)

<b>Message</b>	<b>UBX-CFG-MSG</b>					
	<b>Set message rate(s)</b>					
Type	Get/set					
Comment	<p><b>This message is deprecated in protocol versions greater than 23.01. Use <a href="#">UBX-CFG-VALSET</a>, <a href="#">UBX-CFG-VALGET</a>, <a href="#">UBX-CFG-VALDEL</a> instead.</b></p> <p>See the <a href="#">Legacy UBX Message Fields Reference</a> for the corresponding configuration item.</p> <p>Get/set message rate configuration (s) to/from the receiver.</p> <ul style="list-style-type: none"> <li>Send rate is relative to the event a message is registered on. For example, if the rate of a navigation message is set to 2, the message is sent every second navigation solution. For configuring NMEA messages, the section <a href="#">NMEA Messages Overview</a> describes class and identifier numbers used.</li> </ul>					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x06	0x01	8	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	msgClass	-	-	Message class	
1	U1	msgID	-	-	Message identifier	
2	U1[6]	rate	-	-	Send rate on I/O port (6 ports)	

### 3.10.2.3 Set message rate

<b>Message</b>	<b>UBX-CFG-MSG</b>					
	<b>Set message rate</b>					
<b>Type</b>	Get/set					
<b>Comment</b>	<p>This message is deprecated in protocol versions greater than 23.01. Use <a href="#">UBX-CFG-VALSET</a>, <a href="#">UBX-CFG-VALGET</a>, <a href="#">UBX-CFG-VALDEL</a> instead.</p> <p>See the <a href="#">Legacy UBX Message Fields Reference</a> for the corresponding configuration item.</p> <p>Set message rate configuration for the current port.</p>					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x06	0x01	3	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	msgClass	-	-	Message class	
1	U1	msgID	-	-	Message identifier	
2	U1	rate	-	-	Send rate on current port	

### 3.10.3 UBX-CFG-OTP (0x06 0x41)

#### 3.10.3.1 Write file 0xA4: receiver configuration items

<b>Message</b>	<b>UBX-CFG-OTP</b>					
	<b>Write file 0xA4: receiver configuration items</b>					
<b>Type</b>	Set					
<b>Comment</b>	<p>Writes the <a href="#">configuration data</a> (key ID and value) for one or more configuration items to the OTP memory. Any supported configuration item can be set this way, provided there is enough free OTP memory available.</p> <p>It is possible to write multiple files of this type. However, each file on the OTP memory has its own header, which consumes memory. To reduce memory usage, combine the configurations of multiple items into a single file.</p> <p>The same configuration item can be set more than once. In such a case, only the latest value is effective.</p> <p>Configuration in the OTP memory is permanent and has limited space. Verify the configuration in advance and check the available space before writing the final configuration to the OTP memory.</p> <p>For details, see section OTP memory in the Integration manual.</p>					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x06	0x41	12 + [0..n]	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1[12]	cfgHeader	-	-	File header: use u-center tool to compose the message.	
<i>Start of repeated group (N times)</i>						
12 + n	U1	cfgData	-	-	<a href="#">Configuration data</a> (key and value pairs)	
<i>End of repeated group (N times)</i>						

### 3.10.4 UBX-CFG-PRT (0x06 0x00)

#### 3.10.4.1 Polls the configuration for one I/O port

<b>Message</b>	<b>UBX-CFG-PRT</b>					
	<b>Polls the configuration for one I/O port</b>					
<b>Type</b>	Poll request					

**Comment** This message is deprecated in protocol versions greater than 23.01. Use [UBX-CFG-VALSET](#), [UBX-CFG-VALGET](#), [UBX-CFG-VALDEL](#) instead.

See the [Legacy UBX Message Fields Reference](#) for the corresponding configuration item.

Sending this message with a port ID as payload results in having the receiver return the configuration for the specified port.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x06	0x00	1	see below	CK_A CK_B

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	U1	PortID	-	-	Port identifier number (see the other versions of CFG-PRT for valid values)

### 3.10.4.2 Port configuration for UART ports

**Message** **UBX-CFG-PRT**  
**Port configuration for UART ports**

**Type** Get/set

**Comment** This message is deprecated in protocol versions greater than 23.01. Use [UBX-CFG-VALSET](#), [UBX-CFG-VALGET](#), [UBX-CFG-VALDEL](#) instead.

See the [Legacy UBX Message Fields Reference](#) for the corresponding configuration item.

Several configurations can be concatenated to one input message. In this case the payload length can be a multiple of the normal length (see the other versions of CFG-PRT). Output messages from the module contain only one configuration unit.

Note that this message can affect baud rate and other transmission parameters. Because there may be messages queued for transmission there may be uncertainty about which protocol applies to such messages. In addition a message currently in transmission may be corrupted by a protocol change. Host data reception parameters may have to be changed to be able to receive future messages, including the acknowledge message resulting from the CFG-PRT message.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x06	0x00	20	see below	CK_A CK_B

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	U1	portID	-	-	Port identifier number (see the integration manual for valid UART port IDs)
1	U1	reserved0	-	-	<a href="#">Reserved</a>
2	X2	txReady	-	-	TX ready PIN configuration (not supported for protocol versions less than 13.01)
bit 0	U:1	en	-	-	Enable TX ready feature for this port
bit 1	U:1	pol	-	-	Polarity <ul style="list-style-type: none"> <li>0 High-active</li> <li>1 Low-active</li> </ul>
bits 6...2	U:5	pin	-	-	PIO to be used (must not be in use by another function)
bits 15...7	U:9	thres	-	-	Threshold <p>The given threshold is multiplied by 8 bytes.</p> <p>The TX ready PIN goes active after <math>\geq</math> thres*8 bytes are pending for the port and going inactive after the last pending bytes have been written to hardware (0-4 bytes before end of stream).</p> <ul style="list-style-type: none"> <li>0x000 no threshold</li> <li>0x001 8byte</li> </ul>

					<ul style="list-style-type: none"> <li>• 0x002 16byte</li> <li>• ...</li> <li>• 0x1FE 4080byte</li> <li>• 0x1FF 4088byte</li> </ul>	
4	X4	mode	-	-	A bit mask describing the UART mode	
	bits 7...6	U:2	charLen	-	-	Character length <ul style="list-style-type: none"> <li>• 00 5bit (not supported)</li> <li>• 01 6bit (not supported)</li> <li>• 10 7bit (supported only with parity)</li> <li>• 11 8bit</li> </ul>
	bits 11...9	U:3	parity	-	-	<ul style="list-style-type: none"> <li>• 000 Even parity</li> <li>• 001 Odd parity</li> <li>• 10X No parity</li> <li>• X1X Reserved</li> </ul>
	bits 13...12	U:2	nStopBits	-	-	Number of Stop bits <ul style="list-style-type: none"> <li>• 00 1 Stop bit</li> <li>• 01 1.5 Stop bit</li> <li>• 10 2 Stop bit</li> <li>• 11 0.5 Stop bit</li> </ul>
8	U4	baudRate	-	Bits/s	Baud rate in bits/second	
12	X2	inProtoMask	-	-	A mask describing which input protocols are active. Each bit of this mask is used for a protocol. Through that, multiple protocols can be defined on a single port.	
	bit 0	U:1	inUbx	-	-	UBX protocol
	bit 1	U:1	inNmea	-	-	NMEA protocol
	bit 2	U:1	inRtcm	-	-	RTCM2 protocol
	bit 5	U:1	inRtcm3	-	-	RTCM3 protocol (not supported for protocol versions less than 20.00)
14	X2	outProtoMask	-	-	A mask describing which output protocols are active. Each bit of this mask is used for a protocol. Through that, multiple protocols can be defined on a single port.	
	bit 0	U:1	outUbx	-	-	UBX protocol
	bit 1	U:1	outNmea	-	-	NMEA protocol
	bit 5	U:1	outRtcm3	-	-	RTCM3 protocol (not supported for protocol versions less than 20.00)
16	X2	flags	-	-	Flags bit mask	
	bit 1	U:1	extendedTx Timeout	-	-	Extended TX timeout: if set, the port will time out if allocated TX memory >=4 kB and no activity for 1.5 s. If not set the port will time out if no activity for 1.5 s regardless on the amount of allocated TX memory (not supported for protocol versions less than 13.01).
18	U1[2]	reserved1	-	-	<a href="#">Reserved</a>	

### 3.10.4.3 Port configuration for SPI port

<b>Message</b>	<b>UBX-CFG-PRT</b>					
	<b>Port configuration for SPI port</b>					
<b>Type</b>	Get/set					
<b>Comment</b>	<p><b>This message is deprecated in protocol versions greater than 23.01. Use <a href="#">UBX-CFG-VALSET</a>, <a href="#">UBX-CFG-VALGET</a>, <a href="#">UBX-CFG-VALDEL</a> instead.</b></p> <p>See the <a href="#">Legacy UBX Message Fields Reference</a> for the corresponding configuration item.</p> <p>Several configurations can be concatenated to one input message. In this case the payload length can be a multiple of the normal length. Output messages from the module contain only one configuration unit.</p>					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x06	0x00	20	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	portID	-	-	Port identifier number (= 4 for SPI port)	
1	U1	reserved0	-	-	<a href="#">Reserved</a>	
2	X2	txReady	-	-	TX ready PIN configuration (not supported for protocol versions less than 13.01)	
bit 0	U:1	en	-	-	Enable TX ready feature for this port	
bit 1	U:1	pol	-	-	Polarity <ul style="list-style-type: none"> <li>0 High-active</li> <li>1 Low-active</li> </ul>	
bits 6...2	U:5	pin	-	-	PIO to be used (must not be in use by another function)	
bits 15...7	U:9	thres	-	-	Threshold <p>The given threshold is multiplied by 8 bytes.</p> <p>The TX ready PIN goes active after <math>\geq \text{thres} * 8</math> bytes are pending for the port and going inactive after the last pending bytes have been written to hardware (0-4 bytes before end of stream).</p> <ul style="list-style-type: none"> <li>0x000 no threshold</li> <li>0x001 8byte</li> <li>0x002 16byte</li> <li>...</li> <li>0x1FE 4080byte</li> <li>0x1FF 4088byte</li> </ul>	
4	X4	mode	-	-	SPI Mode Flags	
bits 2...1	U:2	spiMode	-	-	<ul style="list-style-type: none"> <li>00 SPI Mode 0: CPOL = 0, CPHA = 0</li> <li>01 SPI Mode 1: CPOL = 0, CPHA = 1</li> <li>10 SPI Mode 2: CPOL = 1, CPHA = 0</li> <li>11 SPI Mode 3: CPOL = 1, CPHA = 1</li> </ul>	
bits 13...8	U:6	ffCnt	-	-	Number of bytes containing 0xFF to receive before switching off reception. Range: 0 (mechanism off) - 63	
8	U1[4]	reserved1	-	-	<a href="#">Reserved</a>	

12	X2	inProtoMask	-	-	A mask describing which input protocols are active. Each bit of this mask is used for a protocol. Through that, multiple protocols can be defined on a single port. (The bitfield inRtcm3 is not supported for protocol versions less than 20.00)
bit 0	U:1	inUbx	-	-	
bit 1	U:1	inNmea	-	-	
bit 2	U:1	inRtcm	-	-	
bit 5	U:1	inRtcm3	-	-	
14	X2	outProtoMask	-	-	A mask describing which output protocols are active. Each bit of this mask is used for a protocol. Through that, multiple protocols can be defined on a single port. (The bitfield outRtcm3 is not supported for protocol versions less than 20.00)
bit 0	U:1	outUbx	-	-	
bit 1	U:1	outNmea	-	-	
bit 5	U:1	outRtcm3	-	-	
16	X2	flags	-	-	Flags bit mask
bit 1	U:1	extendedTx Timeout	-	-	Extended TX timeout: if set, the port will time out if allocated TX memory >=4 kB and no activity for 1.5 s. (not supported for protocol versions less than 13.01)
18	U1[2]	reserved2	-	-	<a href="#">Reserved</a>

### 3.10.4.4 Port configuration for I2C (DDC) port

<b>Message</b>	<b>UBX-CFG-PRT</b> <b>Port configuration for I2C (DDC) port</b>					
<b>Type</b>	Get/set					
<b>Comment</b>	<p><b>This message is deprecated in protocol versions greater than 23.01. Use <a href="#">UBX-CFG-VALSET</a>, <a href="#">UBX-CFG-VALGET</a>, <a href="#">UBX-CFG-VALDEL</a> instead.</b></p> <p>See the <a href="#">Legacy UBX Message Fields Reference</a> for the corresponding configuration item.</p> <p>Several configurations can be concatenated to one input message. In this case the payload length can be a multiple of the normal length (see the other versions of CFG-PRT). Output messages from the module contain only one configuration unit.</p>					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x06	0x00	20	<i>see below</i>	CK_A CK_B
<b>Payload description:</b>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	portID	-	-	Port identifier number (= 0 for I2C (DDC) port)	
1	U1	reserved0	-	-	<a href="#">Reserved</a>	
2	X2	txReady	-	-	TX ready PIN configuration (not supported for protocol versions less than 13.01)	
bit 0	U:1	en	-	-	Enable TX ready feature for this port	
bit 1	U:1	pol	-	-	Polarity <ul style="list-style-type: none"> <li>0 High-active</li> <li>1 Low-active</li> </ul>	



bits 6...2	U:5	pin	-	-	PIO to be used (must not be in use by another function)
bits 15...7	U:9	thres	-	-	<p>Threshold</p> <p>The given threshold is multiplied by 8 bytes.</p> <p>The TX ready PIN goes active after <math>\geq</math> thres*8 bytes are pending for the port and going inactive after the last pending bytes have been written to hardware (0-4 bytes before end of stream).</p> <ul style="list-style-type: none"> <li>• 0x000 no threshold</li> <li>• 0x001 8byte</li> <li>• 0x002 16byte</li> <li>• ...</li> <li>• 0x1FE 4080byte</li> <li>• 0x1FF 4088byte</li> </ul>
4	X4	mode	-	-	I2C (DDC) Mode Flags
bits 7...1	U:7	slaveAddr	-	-	<p>Slave address</p> <p>Range: <math>0x07 &lt; \text{slaveAddr} &lt; 0x78</math>. Bit 0 must be 0</p>
8	U1[4]	reserved1	-	-	<a href="#">Reserved</a>
12	X2	inProtoMask	-	-	<p>A mask describing which input protocols are active.</p> <p>Each bit of this mask is used for a protocol. Through that, multiple protocols can be defined on a single port. (The bitfield inRtcm3 is not supported for protocol versions less than 20.00)</p>
bit 0	U:1	inUbx	-	-	
bit 1	U:1	inNmea	-	-	
bit 2	U:1	inRtcm	-	-	
bit 5	U:1	inRtcm3	-	-	
14	X2	outProtoMask	-	-	<p>A mask describing which output protocols are active.</p> <p>Each bit of this mask is used for a protocol. Through that, multiple protocols can be defined on a single port. (The bitfield outRtcm3 is not supported for protocol versions less than 20.00)</p>
bit 0	U:1	outUbx	-	-	
bit 1	U:1	outNmea	-	-	
bit 5	U:1	outRtcm3	-	-	
16	X2	flags	-	-	Flags bit mask
bit 1	U:1	extendedTx Timeout	-	-	<p>Extended TX timeout: if set, the port will time out if allocated TX memory <math>\geq</math> 4 kB and no activity for 1.5 s (not supported for protocol versions less than 13.01).</p>
18	U1[2]	reserved2	-	-	<a href="#">Reserved</a>

### 3.10.5 UBX-CFG-RST (0x06 0x04)

### 3.10.5.1 Reset receiver / Clear backup data structures

<b>Message</b>		<b>UBX-CFG-RST</b>				
		<b>Reset receiver / Clear backup data structures</b>				
<i>Type</i>	Command					
<i>Comment</i>	Do not expect this message to be acknowledged by the receiver. <ul style="list-style-type: none"> <li>Newer FW version will not acknowledge this message at all.</li> <li>Older FW version will acknowledge this message but the acknowledge may not be sent completely before the receiver is reset.</li> </ul>					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x06	0x04	4	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	X2	navBbrMask	-	-	BBR sections to clear. The following special sets apply: <ul style="list-style-type: none"> <li>0x0000 Hot start</li> <li>0x0001 Warm start</li> <li>0xFFFF Cold start</li> </ul>	
bit 0	U:1	eph	-	-	Ephemeris	
bit 1	U:1	alm	-	-	Almanac	
bit 2	U:1	health	-	-	Health	
bit 3	U:1	klob	-	-	Klobuchar parameters	
bit 4	U:1	pos	-	-	Position	
bit 5	U:1	clkd	-	-	Clock drift	
bit 6	U:1	osc	-	-	Oscillator parameter	
bit 7	U:1	utc	-	-	UTC correction + GPS leap seconds parameters	
bit 8	U:1	rtc	-	-	RTC	
bit 11	U:1	sfdr	-	-	SFDR Parameters (only available on the ADR/UDR/HPS product variant) and weak signal compensation estimates	
bit 12	U:1	vmon	-	-	SFDR Vehicle Monitoring Parameter (only available on the ADR/UDR/HPS product variant)	
bit 13	U:1	tct	-	-	TCT Parameters (only available on the ADR/UDR/HPS product variant)	
bit 15	U:1	aop	-	-	Autonomous orbit parameters	
2	U1	resetMode	-	-	Reset Type <ul style="list-style-type: none"> <li>0x00 = Hardware reset (watchdog) immediately</li> <li>0x01 = Controlled software reset</li> <li>0x02 = Controlled software reset (GNSS only)</li> <li>0x04 = Hardware reset (watchdog) after shutdown</li> <li>0x08 = Controlled GNSS stop</li> <li>0x09 = Controlled GNSS start</li> </ul>	
3	U1	reserved0	-	-	Reserved	

### 3.10.6 UBX-CFG-VALDEL (0x06 0x8c)

### 3.10.6.1 Delete configuration item values

<b>Message</b>	<b>UBX-CFG-VALDEL</b>					
	<b>Delete configuration item values</b>					
<b>Type</b>	Set					
<b>Comment</b>	<p>Overview:</p> <ul style="list-style-type: none"> <li>This message can be used to delete saved configuration to effectively revert the item values to defaults.</li> <li>This message can delete saved configuration from the flash configuration layer and the BBR configuration layer. The changes will not be effective until these layers are loaded into the RAM layer.</li> <li>This message is limited to containing a maximum of 64 keys up for deletion; i.e. N is a maximum of 64.</li> <li>This message can be used multiple times and every time the result will be applied immediately. To send this message multiple times with the result being applied at the end, see version 1 of <a href="#">UBX-CFG-VALDEL</a> that supports transactions.</li> <li>This message does not check if the resulting configuration is valid.</li> <li>See <a href="#">Receiver configuration</a> for details.</li> </ul> <p>This message returns a UBX-ACK-NAK and no configuration is applied:</p> <ul style="list-style-type: none"> <li>if any key is unknown to the receiver FW</li> <li>if the layer's bitfield does not specify a layer to delete a value from.</li> </ul> <p>Notes:</p> <ul style="list-style-type: none"> <li>If a key is sent multiple times within the same message, the value is effectively deleted only once.</li> <li>Attempting to delete items that have not been set before, or that have already been deleted, is considered a valid request.</li> <li>The provided keys can be complete key values (group and item specifiers) or wild-card specifications. A complete key value constitutes a deletion request for one key-value pair. A key value with a valid group specifier and 0xffff in the item part of the key value (bits 0-15) constitutes a deletion request for all items in the specified group. A key with a value of 0xffff in the group part of the key value (bits 16-27) is a deletion request for all items known to the receiver in all groups.</li> </ul>					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x06	0x8c	4 + [0..n]-4	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	version	-	-	Message version (0x00 for this version)	
1	X1	layers	-	-	The layers where the configuration should be deleted from	
bit 1	U <sub>:1</sub>	bbr	-	-	Delete configuration from the BBR layer	
bit 2	U <sub>:1</sub>	flash	-	-	Delete configuration from the Flash layer	
2	U1[2]	reserved0	-	-	<a href="#">Reserved</a>	
<i>Start of repeated group (N times)</i>						
4 + n-4	U4	keys	-	-	<a href="#">Configuration key IDs</a> of the configuration items to be deleted	
<i>End of repeated group (N times)</i>						

### 3.10.6.2 Delete configuration item values (with transaction)

<b>Message</b>	<b>UBX-CFG-VALDEL</b>					
	<b>Delete configuration item values (with transaction)</b>					
<b>Type</b>	Set					
<b>Comment</b>	<p>Overview:</p> <ul style="list-style-type: none"> <li>This message can be used to delete saved configuration to effectively revert them to defaults.</li> <li>This message can delete saved configuration from the flash configuration layer and the BBR configuration layer. The changes will not be effective until these layers are loaded into the RAM layer.</li> <li>This message is limited to containing a maximum of 64 keys up for deletion; i.e. N is a maximum of 64.</li> <li>This message can be used multiple times with the result being managed within a transaction.</li> <li>This message does not check if the resulting configuration is valid.</li> </ul>					

- See [Receiver configuration](#) for details.
- See version 0 of [UBX-CFG-VALDEL](#) for simplified version of this message.

This message returns a UBX-ACK-NAK, cancels any started transaction, and no configuration is applied:

- if any key within a transaction is unknown to the receiver FW
- if an invalid transaction state transition is requested
- if the layer's bitfield changes within a transaction
- if the layer's bitfield does not specify a layer to delete a value from.

Notes:

- Any request for another UBX-CFG- message type (including UBX-CFG-VALSET and UBX-CFG-VALGET) will cancel any started transaction, and no configuration is applied.
- This message can be sent with no keys to delete for the purposes of managing the transaction state transition.
- If a key is sent multiple times within the same message or within the same transaction, the value is effectively deleted only once.
- Attempting to delete items that have not been set before, or that have already been deleted, is considered a valid request.
- The provided keys can be complete key values (group and item specifiers) or wild-card specifications. A complete key value constitutes a deletion request for one key-value pair. A key value with a valid group specifier and 0xffff in the item part of the key value (bits 0-15) constitutes a deletion request for all items in the specified group. A key with a value of 0xffff in the group part of the key value (bits 16-27) is a deletion request for all items known to the receiver in all groups.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x06	0x8c	4 + [0..n]-4	see below	CK_A CK_B

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	U1	version	-	-	Message version (0x01 for this version)
1	X1	layers	-	-	The layers where the configuration should be deleted from
bit 1	U:1	bbr	-	-	Delete configuration from the BBR layer
bit 2	U:1	flash	-	-	Delete configuration from the Flash layer
2	X1	transaction	-	-	Transaction action to be applied:
bits 1...0	U:2	action	-	-	Transaction action to be applied: <ul style="list-style-type: none"> <li>• 0 = Transactionless UBX-CFG-VALDEL: In the next UBX-CFG-VALDEL, it can be either 0 or 1. If a transaction has not yet been started, the incoming configuration is applied. If a transaction has already been started, cancels any started transaction and the incoming configuration is applied.</li> <li>• 1 = (Re)Start deletion transaction: In the next UBX-CFG-VALDEL, it can be either 0, 1, 2 or 3. If a transaction has not yet been started, a transaction will be started. If a transaction has already been started, restarts the transaction, effectively removing all previous non-applied UBX-CFG-VALDEL messages.</li> <li>• 2 = Deletion transaction ongoing: In the next UBX-CFG-VALDEL, it can be either 0, 1, 2 or 3.</li> <li>• 3 = Apply and end a deletion transaction: In the next UBX-CFG-VALDEL, it can be either 0 or 1.</li> </ul>
3	U1	reserved0	-	-	<a href="#">Reserved</a>

Start of repeated group (N times)

4 + n·4	U4	keys	-	-	Configuration key IDs of the configuration items to be deleted
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End of repeated group (N times)

### 3.10.7 UBX-CFG-VALGET (0x06 0x8b)

#### 3.10.7.1 Get configuration items

<b>Message</b>	<b>UBX-CFG-VALGET</b>					
	<b>Get configuration items</b>					
<b>Type</b>	Poll request					
<b>Comment</b>	<p>Overview:</p> <ul style="list-style-type: none"> <li>This message is used to get configuration values by providing a list of configuration key IDs, which identify the configuration items to retrieve.</li> <li>This message can specify the configuration layer where the values of the specified configuration items are retrieved from.</li> <li>This message is limited to containing a maximum of 64 key IDs.</li> <li>See <a href="#">Receiver configuration</a> for details.</li> </ul> <p>This message returns a UBX-ACK-NAK:</p> <ul style="list-style-type: none"> <li>if any key is unknown to the receiver FW</li> <li>if the layer field specifies an invalid layer to get the value from</li> <li>if the keys array specifies more than 64 key IDs.</li> </ul> <p>Notes:</p> <ul style="list-style-type: none"> <li>If a value is requested multiple times within the same poll request, then the reply will contain it multiple times.</li> <li>The provided keys can be complete key values (group and item specifiers) or wild-card specifications. A complete key value will constitute a request for one key-value pair. A key value that has a valid group specifier and 0xffff in the item part of the key value (bits 0-15) constitutes a request for all items in the specified group. A key with a value of 0xffff in the group part of the key value (bits 16-27) is a request for all items known to the receiver in all groups.</li> <li>The response message is limited to containing a maximum of 64 key-value pairs. If there are wild-card specifications then there may be more than 64 possible responses. In order to handle this, the 'position' field can specify that the response message should skip this number of key-value pairs before it starts constructing the message. This allows a large set of values to be retrieved 64 at a time. If the response contains less than 64 key-value pairs then all values have been reported, otherwise there may be more to read.</li> <li>It is not possible to retrieve configuration values for the same configuration item from multiple configuration layers. Separate poll requests must be made for each desired layer.</li> </ul>					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x06	0x8b	4 + [0..n]·4	see below	CK_A CK_B
<b>Payload description:</b>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	version	-	-	Message version (0x00 for this version)	
1	U1	layer	-	-	The layer from which the configuration items should be retrieved: <ul style="list-style-type: none"> <li>0 - RAM layer</li> <li>1 - BBR layer</li> <li>2 - Flash layer</li> <li>7 - Default layer</li> </ul>	
2	U2	position	-	-	Skip this many key values before constructing output message	
<b>Start of repeated group (N times)</b>						
4 + n·4	U4	keys	-	-	Configuration key IDs of the configuration items to be retrieved	

End of repeated group (N times)

### 3.10.7.2 Configuration items

<b>Message</b>	<b>UBX-CFG-VALGET</b>					
	<b>Configuration items</b>					
<b>Type</b>	Polled					
<b>Comment</b>	This message is output by the receiver to return requested configuration data (key and value pairs). See <a href="#">Receiver configuration</a> for details.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x06	0x8b	4 + [0..n]	see below	CK_A CK_B
<b>Payload description:</b>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	version	-	-	Message version (0x01 for this version)	
1	U1	layer	-	-	The layer from which the configuration item was retrieved: <ul style="list-style-type: none"> <li>• 0 - RAM layer</li> <li>• 1 - BBR</li> <li>• 2 - Flash</li> <li>• 7 - Default</li> </ul>	
2	U2	position	-	-	Number of configuration items skipped in the result set before constructing this message (mirrors the equivalent field in the request message)	
<b>Start of repeated group (N times)</b>						
4 + n	U1	cfgData	-	-	<a href="#">Configuration data</a> (key and value pairs)	
<b>End of repeated group (N times)</b>						

### 3.10.8 UBX-CFG-VALSET (0x06 0x8a)

#### 3.10.8.1 Set configuration item values

<b>Message</b>	<b>UBX-CFG-VALSET</b>					
	<b>Set configuration item values</b>					
<b>Type</b>	Set					
<b>Comment</b>	<p>Overview:</p> <ul style="list-style-type: none"> <li>• This message is used to set a configuration by providing configuration data (a list of key and value pairs), which identify the configuration items to change, and their new values.</li> <li>• This message is limited to containing a maximum of 64 key-value pairs.</li> <li>• This message can be used multiple times and every time the result will be applied immediately. To send this message multiple times with the result being applied at the end, see version 1 of UBX-CFG-VALSET that supports transactions.</li> <li>• See <a href="#">Receiver configuration</a> for details.</li> </ul> <p>This message returns a UBX-ACK-NAK and no configuration is applied:</p> <ul style="list-style-type: none"> <li>• if any key is unknown to the receiver FW</li> <li>• if the layer's bitfield does not specify a layer to save a value to</li> <li>• if the requested configuration is not valid. The validity of a configuration is checked only if the message requests to apply the configuration to the RAM configuration layer.</li> </ul> <p>Notes:</p> <ul style="list-style-type: none"> <li>• If a key is sent multiple times within the same message, then the value eventually being applied is the last sent.</li> </ul>					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x06	0x8a	4 + [0..n]	see below	CK_A CK_B

Payload description:

Byte offset	Type	Name	Scale	Unit	Description
0	U1	version	-	-	Message version (0x00 for this version)
1	X1	layers	-	-	The layers where the configuration should be applied
bit 0	U <sub>:1</sub>	ram	-	-	Update configuration in the RAM layer
bit 1	U <sub>:1</sub>	bbr	-	-	Update configuration in the BBR layer
bit 2	U <sub>:1</sub>	flash	-	-	Update configuration in the Flash layer
2	U1[2]	reserved0	-	-	Reserved
Start of repeated group (N times)					
4 + n	U1	cfgData	-	-	Configuration data (key and value pairs)
End of repeated group (N times)					

## 3.11 UBX-INF (0x04)

Messages in the UBX-INF class are used to output strings from the firmware or application code. All messages have an associated type to indicate the nature or priority of the message.

### 3.11.1 UBX-INF-DEBUG (0x04 0x04)

#### 3.11.1.1 ASCII output with debug contents

Message	UBX-INF-DEBUG ASCII output with debug contents					
Type	Output					
Comment	This message has a variable length payload, representing an ASCII string.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x04	0x04	[0..n]	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
Start of repeated group (N times)						
0 + n	CH	str	-	-	ASCII Character	
End of repeated group (N times)						

### 3.11.2 UBX-INF-ERROR (0x04 0x00)

#### 3.11.2.1 ASCII output with error contents

Message	UBX-INF-ERROR ASCII output with error contents					
Type	Output					
Comment	This message has a variable length payload, representing an ASCII string.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x04	0x00	[0..n]	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
Start of repeated group (N times)						
0 + n	CH	str	-	-	ASCII Character	

End of repeated group (N times)

### 3.11.3 UBX-INF-NOTICE (0x04 0x02)

#### 3.11.3.1 ASCII output with informational contents

<b>Message</b>	<b>UBX-INF-NOTICE</b>					
	<b>ASCII output with informational contents</b>					
Type	Output					
Comment	This message has a variable length payload, representing an ASCII string.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x04	0x02	[0..n]	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
Start of repeated group (N times)						
0 + n	CH	str	-	-	ASCII Character	
End of repeated group (N times)						

### 3.11.4 UBX-INF-TEST (0x04 0x03)

#### 3.11.4.1 ASCII output with test contents

<b>Message</b>	<b>UBX-INF-TEST</b>					
	<b>ASCII output with test contents</b>					
Type	Output					
Comment	This message has a variable length payload, representing an ASCII string.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x04	0x03	[0..n]	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
Start of repeated group (N times)						
0 + n	CH	str	-	-	ASCII Character	
End of repeated group (N times)						

### 3.11.5 UBX-INF-WARNING (0x04 0x01)

#### 3.11.5.1 ASCII output with warning contents

<b>Message</b>	<b>UBX-INF-WARNING</b>					
	<b>ASCII output with warning contents</b>					
Type	Output					
Comment	This message has a variable length payload, representing an ASCII string.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x04	0x01	[0..n]	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
Start of repeated group (N times)						
0 + n	CH	str	-	-	ASCII Character	



End of repeated group (N times)

## 3.12 UBX-MGA (0x13)

The messages in the UBX-MGA class are used for sending GNSS assistance (A-GNSS, aiding) information to the receiver as well as backing up the navigation database from the receiver to a host.

### 3.12.1 UBX-MGA-ACK (0x13 0x60)

#### 3.12.1.1 Multiple GNSS acknowledge message

<b>Message</b>	<b>UBX-MGA-ACK-DATA0</b> <b>Multiple GNSS acknowledge message</b>					
<b>Type</b>	Output					
<b>Comment</b>	This message is sent by a u-blox receiver to acknowledge the receipt of an assistance message. Acknowledgments are enabled by setting the <a href="#">CFG-NAVSPG-ACKAIDING</a> item. See section Flow control in the integration manual for details.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x13	0x60	8	see below	CK_A CK_B
<b>Payload description:</b>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	type	-	-	Type of acknowledgment: <ul style="list-style-type: none"> <li>0 = The message was not used by the receiver (see infoCode field for an indication of why)</li> <li>1 = The message was accepted for use by the receiver (the infoCode field will be 0)</li> </ul>	
1	U1	version	-	-	Message version (0x00 for this version)	
2	U1	infoCode	-	-	Provides greater information on what the receiver chose to do with the message contents: <ul style="list-style-type: none"> <li>0 = The receiver accepted the data</li> <li>1 = The receiver does not know the time so it cannot use the data (To resolve this a <a href="#">UBX-MGA-INI-TIME_UTC</a> message should be supplied first)</li> <li>2 = The message version is not supported by the receiver</li> <li>3 = The message size does not match the message version</li> <li>4 = The message data could not be stored to the database</li> <li>5 = The receiver is not ready to use the message data</li> <li>6 = The message type is unknown</li> </ul>	
3	U1	msgId	-	-	UBX message ID of the acknowledged message	
4	U1[4]	msgPayload Start	-	-	The first 4 bytes of the acknowledged message's payload	

### 3.12.2 UBX-MGA-DBD (0x13 0x80)

#### 3.12.2.1 Poll the navigation database

<b>Message</b>	<b>UBX-MGA-DBD</b> <b>Poll the navigation database</b>
<b>Type</b>	Poll request

<b>Comment</b>	Poll the whole navigation data base. The receiver will send all available data from its internal database. The receiver will indicate the finish of the transmission with a <a href="#">UBX-MGA-ACK</a> . The msgPayloadStart field of the UBX-MGA-ACK message will contain a U4 representing the number of UBX-MGA-DBD-DATA* messages sent.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x13	0x80	0	see below	CK_A CK_B
<b>Payload</b>	This message has no payload.					

### 3.12.2.2 Navigation database dump entry

<b>Message</b>	<b>UBX-MGA-DBD</b> <b>Navigation database dump entry</b>					
<b>Type</b>	Input/output					
<b>Comment</b>	Navigation database entry. The data fields are firmware-specific. Transmission of this type of message will be acknowledged by <a href="#">UBX-MGA-ACK</a> messages, if acknowledgment has been enabled. See section AssistNow online in the integration manual for details. The maximum payload size for firmware 2.01 onwards is 164 bytes (which makes the maximum message size 172 bytes). <a href="#">↗</a> UBX-MGA-DBD messages are only intended to be sent back to the same receiver that generated them.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x13	0x80	12 + [0..n]	see below	CK_A CK_B
<b>Payload description:</b>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1[12]	reserved0	-	-	Reserved	
<i>Start of repeated group (N times)</i>						
12 + n	U1	data	-	-	firmware-specific data	
<i>End of repeated group (N times)</i>						

### 3.12.3 UBX-MGA-GAL (0x13 0x02)

#### 3.12.3.1 Galileo ephemeris assistance

<b>Message</b>	<b>UBX-MGA-GAL-EPH</b> <b>Galileo ephemeris assistance</b>					
<b>Type</b>	Input					
<b>Comment</b>	This message allows the delivery of Galileo ephemeris assistance to a receiver. See section AssistNow online in the integration manual for details.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x13	0x02	76	see below	CK_A CK_B
<b>Payload description:</b>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	type	-	-	Message type (0x01 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	U1	svId	-	-	Galileo Satellite identifier (see <a href="#">Satellite Numbering</a> )	
3	U1	reserved0	-	-	Reserved	
4	U2	iodNav	-	-	Ephemeris and clock correction Issue of Data	
6	I2	deltaN	2 <sup>-43</sup>	semi-circles/s	Mean motion difference from computed value	
8	I4	m0	2 <sup>-31</sup>	semi-circles	Mean anomaly at reference time	

12	U4	e	2 <sup>-33</sup>	-	Eccentricity
16	U4	sqrtA	2 <sup>-19</sup>	m <sup>0.5</sup>	Square root of the semi-major axis
20	I4	omega0	2 <sup>-31</sup>	semi-circles	Longitude of ascending node of orbital plane at weekly epoch
24	I4	i0	2 <sup>-31</sup>	semi-circles	Inclination angle at reference time
28	I4	omega	2 <sup>-31</sup>	semi-circles	Argument of perigee
32	I4	omegaDot	2 <sup>-43</sup>	semi-circles/s	Rate of change of right ascension
36	I2	iDot	2 <sup>-43</sup>	semi-circles/s	Rate of change of inclination angle
38	I2	cuc	2 <sup>-29</sup>	radians	Amplitude of the cosine harmonic correction term to the argument of latitude
40	I2	cus	2 <sup>-29</sup>	radians	Amplitude of the sine harmonic correction term to the argument of latitude
42	I2	crc	2 <sup>-5</sup>	radians	Amplitude of the cosine harmonic correction term to the orbit radius
44	I2	crs	2 <sup>-5</sup>	radians	Amplitude of the sine harmonic correction term to the orbit radius
46	I2	cic	2 <sup>-29</sup>	radians	Amplitude of the cosine harmonic correction term to the angle of inclination
48	I2	cis	2 <sup>-29</sup>	radians	Amplitude of the sine harmonic correction term to the angle of inclination
50	U2	toe	60	s	Ephemeris reference time
52	I4	af0	2 <sup>-34</sup>	s	SV clock bias correction coefficient
56	I4	af1	2 <sup>-46</sup>	s/s	SV clock drift correction coefficient
60	I1	af2	2 <sup>-59</sup>	s/s squared	SV clock drift rate correction coefficient
61	U1	sisaIndexE1E5b	-	-	Signal-In-Space Accuracy index for dual frequency E1-E5b
62	U2	toc	60	s	Clock correction data reference Time of Week
64	I2	bgdE1E5b	2 <sup>-32</sup>	s	E1-E5b Broadcast Group Delay
66	U1[2]	reserved1	-	-	<a href="#">Reserved</a>
68	U1	healthE1B	-	-	E1-B Signal Health Status
69	U1	dataValidityE1B	-	-	E1-B Data Validity Status
70	U1	healthE5b	-	-	E5b Signal Health Status
71	U1	dataValidityE5b	-	-	E5b Data Validity Status
72	U1[4]	reserved2	-	-	<a href="#">Reserved</a>

### 3.12.3.2 Galileo almanac assistance

**Message** UBX-MGA-GAL-ALM

**Galileo almanac assistance**

**Type** Input

**Comment** This message allows the delivery of Galileo almanac assistance to a receiver. See section AssistNow online in the integration manual for details.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x02	32	see below	CK_A CK_B

**Payload description:**

Byte offset	Type	Name	Scale	Unit	Description
0	U1	type	-	-	Message type (0x02 for this type)
1	U1	version	-	-	Message version (0x00 for this version)
2	U1	svId	-	-	Galileo Satellite identifier (see <a href="#">Satellite Numbering</a> )
3	U1	reserved0	-	-	<a href="#">Reserved</a>
4	U1	ioda	-	-	Almanac Issue of Data
5	U1	almWNa	-	week	Almanac reference week number
6	U2	toa	600	s	Almanac reference time
8	I2	deltaSqrtA	2 <sup>-9</sup>	m <sup>0.5</sup>	Difference with respect to the square root of the nominal semi-major axis (29 600 km)
10	U2	e	2 <sup>-16</sup>	-	Eccentricity
12	I2	deltaI	2 <sup>-14</sup>	semi-circles	Inclination at reference time relative to i0 = 56 degree
14	I2	omega0	2 <sup>-15</sup>	semi-circles	Longitude of ascending node of orbital plane at weekly epoch
16	I2	omegaDot	2 <sup>-33</sup>	semi-circles/s	Rate of change of right ascension
18	I2	omega	2 <sup>-15</sup>	semi-circles	Argument of perigee
20	I2	m0	2 <sup>-15</sup>	semi-circles	Satellite mean anomaly at reference time
22	I2	af0	2 <sup>-19</sup>	s	Satellite clock correction bias 'truncated'
24	I2	af1	2 <sup>-38</sup>	s/s	Satellite clock correction linear 'truncated'
26	U1	healthE1B	-	-	Satellite E1-B signal health status
27	U1	healthE5b	-	-	Satellite E5b signal health status
28	U1[4]	reserved1	-	-	<a href="#">Reserved</a>

### 3.12.3.3 Galileo GPS time offset assistance

<b>Message</b>	<b>UBX-MGA-GAL-TIMEOFFSET</b> <b>Galileo GPS time offset assistance</b>
----------------	----------------------------------------------------------------------------

Type	Input
------	-------

Comment	This message allows the delivery of Galileo time to GPS time offset. See section AssistNow online in the integration manual for details.
---------	---------------------------------------------------------------------------------------------------------------------------------------------

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x02	12	see below	CK_A CK_B

**Payload description:**

Byte offset	Type	Name	Scale	Unit	Description
0	U1	type	-	-	Message type (0x03 for this type)
1	U1	version	-	-	Message version (0x00 for this version)
2	U1[2]	reserved0	-	-	<a href="#">Reserved</a>
4	I2	a0G	2 <sup>-35</sup>	s	Constant term of the polynomial describing the offset
6	I2	a1G	2 <sup>-51</sup>	s/s	Rate of change of the offset
8	U1	t0G	3600	s	Reference time for GGTO data

9	U1	wn0G	-	weeks	Week Number of GGTO reference
10	U1[2]	reserved1	-	-	Reserved

### 3.12.3.4 Galileo UTC assistance

<b>Message</b>	<b>UBX-MGA-GAL-UTC</b>				
	<b>Galileo UTC assistance</b>				
<i>Type</i>	Input				
<i>Comment</i>	This message allows the delivery of Galileo UTC assistance to a receiver. See section AssistNow online in the integration manual for details.				
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>
	0xb5 0x62	0x13	0x02	20	see below
					CK_A CK_B
<i>Payload description:</i>					
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>
0	U1	type	-	-	Message type (0x05 for this type)
1	U1	version	-	-	Message version (0x00 for this version)
2	U1[2]	reserved0	-	-	Reserved
4	I4	a0	2 <sup>^</sup> -30	s	First parameter of UTC polynomial
8	I4	a1	2 <sup>^</sup> -50	s/s	Second parameter of UTC polynomial
12	I1	dtLS	-	s	Delta time due to current leap seconds
13	U1	tot	3600	s	UTC parameters reference time of week (Galileo time)
14	U1	wnt	-	weeks	UTC parameters reference week number (the 8-bit WNt field)
15	U1	wnLSF	-	weeks	Week number at the end of which the future leap second becomes effective (the 8-bit WNLSF field)
16	U1	dN	-	days	Day number at the end of which the future leap second becomes effective
17	I1	dTLSF	-	s	Delta time due to future leap seconds
18	U1[2]	reserved1	-	-	Reserved

### 3.12.4 UBX-MGA-GLO (0x13 0x06)

#### 3.12.4.1 GLONASS ephemeris assistance

<b>Message</b>	<b>UBX-MGA-GLO-EPH</b>				
	<b>GLONASS ephemeris assistance</b>				
<i>Type</i>	Input				
<i>Comment</i>	This message allows the delivery of GLONASS ephemeris assistance to a receiver. See section AssistNow online in the integration manual for details.				
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>
	0xb5 0x62	0x13	0x06	48	see below
					CK_A CK_B
<i>Payload description:</i>					
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>
0	U1	type	-	-	Message type (0x01 for this type)
1	U1	version	-	-	Message version (0x00 for this version)
2	U1	svId	-	-	GLONASS Satellite identifier (see <a href="#">Satellite Numbering</a> )
3	U1	reserved0	-	-	Reserved

4	U1	FT	-	-	User range accuracy
5	U1	B	-	-	Health flag from string 2
6	U1	M	-	-	Type of GLONASS satellite (1 indicates GLONASS-M)
7	I1	H	-	-	Carrier frequency number of navigation RF signal, Range=(-7 .. 6), -128 for unknown
8	I4	x	2 <sup>-11</sup>	km	X component of the SV position in PZ-90.02 coordinate System
12	I4	y	2 <sup>-11</sup>	km	Y component of the SV position in PZ-90.02 coordinate System
16	I4	z	2 <sup>-11</sup>	km	Z component of the SV position in PZ-90.02 coordinate System
20	I4	dx	2 <sup>-20</sup>	km/s	X component of the SV velocity in PZ-90.02 coordinate System
24	I4	dy	2 <sup>-20</sup>	km/s	Y component of the SV velocity in PZ-90.02 coordinate System
28	I4	dz	2 <sup>-20</sup>	km/s	Z component of the SV velocity in PZ-90.02 coordinate System
32	I1	ddx	2 <sup>-30</sup>	km/s <sup>2</sup>	X component of the SV acceleration in PZ-90.02 coordinate System
33	I1	ddy	2 <sup>-30</sup>	km/s <sup>2</sup>	Y component of the SV acceleration in PZ-90.02 coordinate System
34	I1	ddz	2 <sup>-30</sup>	km/s <sup>2</sup>	Z component of the SV acceleration in PZ-90.02 coordinate System
35	U1	tb	15	minutes	Index of a time interval within current day according to UTC(SU)
36	I2	gamma	2 <sup>-40</sup>	-	Relative carrier frequency deviation
38	U1	E	-	days	Ephemeris data age indicator
39	I1	deltaTau	2 <sup>-30</sup>	s	Time difference between L2 and L1 band
40	I4	tau	2 <sup>-30</sup>	s	SV clock bias
44	U1[4]	reserved1	-	-	<a href="#">Reserved</a>

### 3.12.4.2 GLONASS almanac assistance

<b>Message</b>	<b>UBX-MGA-GLO-ALM GLONASS almanac assistance</b>					
<b>Type</b>	Input					
<b>Comment</b>	This message allows the delivery of GLONASS almanac assistance to a receiver. See section AssistNow online in the integration manual for details.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x13	0x06	36	<i>see below</i>	CK_A CK_B
<b>Payload description:</b>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	type	-	-	Message type (0x02 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	U1	svId	-	-	GLONASS Satellite identifier	(see <a href="#">Satellite Numbering</a> )
3	U1	reserved0	-	-	<a href="#">Reserved</a>	

4	U2	N	-	days	Reference calendar day number of almanac within the four-year period (from string 5)
6	U1	M	-	-	Type of GLONASS satellite (1 indicates GLONASS-M)
7	U1	C	-	-	Unhealthy flag at instant of almanac upload (1 indicates operability of satellite)
8	I2	tau	2 <sup>-18</sup>	s	Coarse time correction to GLONASS time
10	U2	epsilon	2 <sup>-20</sup>	-	Eccentricity
12	I4	lambda	2 <sup>-20</sup>	semi-circles	Longitude of the first (within the N-day) ascending node of satellite orbit in PC-90.02 coordinate system
16	I4	deltaI	2 <sup>-20</sup>	semi-circles	Correction to the mean value of inclination
20	U4	tLambda	2 <sup>-5</sup>	s	Time of the first ascending node passage
24	I4	deltaT	2 <sup>-9</sup>	s/orbital-period	Correction to the mean value of Draconian period
28	I1	deltaDT	2 <sup>-14</sup>	s/orbital-period <sup>2</sup>	Rate of change of Draconian period
29	I1	H	-	-	Carrier frequency number of navigation RF signal, Range=(-7 .. 6)
30	I2	omega	-	-	Argument of perigee
32	U1[4]	reserved1	-	-	Reserved

### 3.12.4.3 GLONASS auxiliary time offset assistance

<b>Message</b>	<b>UBX-MGA-GLO-TIMEOFFSET</b>					
	<b>GLONASS auxiliary time offset assistance</b>					
Type	Input					
Comment	This message allows the delivery of auxiliary GLONASS assistance (including the GLONASS time offsets to other GNSS systems) to a receiver. See section AssistNow online in the integration manual for details.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x06	20	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	type	-	-	Message type (0x03 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	U2	N	-	days	Reference calendar day number within the four-year period of almanac (from string 5)	
4	I4	tauC	2 <sup>-27</sup>	s	Time scale correction to UTC(SU) time	
8	I4	tauGps	2 <sup>-31</sup>	s	Correction to GPS time relative to GLONASS time	
12	I2	B1	2 <sup>-10</sup>	s	Coefficient to determine delta UT1	
14	I2	B2	2 <sup>-16</sup>	s/msd	Rate of change of delta UT1	
16	U1[4]	reserved0	-	-	Reserved	

### 3.12.5 UBX-MGA-GPS (0x13 0x00)

### 3.12.5.1 GPS ephemeris assistance

<b>Message</b>		<b>UBX-MGA-GPS-EPH</b>				
		<b>GPS ephemeris assistance</b>				
<i>Type</i>	Input					
<i>Comment</i>	This message allows the delivery of GPS ephemeris assistance to a receiver. See section AssistNow online in the integration manual for details.					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x13	0x00	68	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	type	-	-	Message type (0x01 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	U1	svId	-	-	GPS Satellite identifier (see <a href="#">Satellite Numbering</a> )	
3	U1	reserved0	-	-	<a href="#">Reserved</a>	
4	U1	fitInterval	-	-	Fit interval flag	
5	U1	uraIndex	-	-	URA index	
6	U1	svHealth	-	-	SV health	
7	I1	tgd	2 <sup>-31</sup>	s	Group delay differential	
8	U2	iodc	-	-	IODC	
10	U2	toc	2 <sup>4</sup>	s	Clock data reference time	
12	U1	reserved1	-	-	<a href="#">Reserved</a>	
13	I1	af2	2 <sup>-55</sup>	s/s squared	Time polynomial coefficient 2	
14	I2	af1	2 <sup>-43</sup>	s/s	Time polynomial coefficient 1	
16	I4	af0	2 <sup>-31</sup>	s	Time polynomial coefficient 0	
20	I2	crs	2 <sup>-5</sup>	m	Crs	
22	I2	deltaN	2 <sup>-43</sup>	semi-circles/s	Mean motion difference from computed value	
24	I4	m0	2 <sup>-31</sup>	semi-circles	Mean anomaly at reference time	
28	I2	cuc	2 <sup>-29</sup>	radians	Amplitude of cosine harmonic correction term to argument of latitude	
30	I2	cus	2 <sup>-29</sup>	radians	Amplitude of sine harmonic correction term to argument of latitude	
32	U4	e	2 <sup>-33</sup>	-	Eccentricity	
36	U4	sqrtA	2 <sup>-19</sup>	m <sup>0.5</sup>	Square root of the semi-major axis	
40	U2	toe	2 <sup>4</sup>	s	Reference time of ephemeris	
42	I2	cic	2 <sup>-29</sup>	radians	Amplitude of cos harmonic correction term to angle of inclination	
44	I4	omega0	2 <sup>-31</sup>	semi-circles	Longitude of ascending node of orbit plane at weekly epoch	
48	I2	cis	2 <sup>-29</sup>	radians	Amplitude of sine harmonic correction term to angle of inclination	
50	I2	crc	2 <sup>-5</sup>	m	Amplitude of cosine harmonic correction term to orbit radius	



52	I4	i0	2 <sup>-31</sup>	semi-circles	Inclination angle at reference time
56	I4	omega	2 <sup>-31</sup>	semi-circles	Argument of perigee
60	I4	omegaDot	2 <sup>-43</sup>	semi-circles/s	Rate of right ascension
64	I2	idot	2 <sup>-43</sup>	semi-circles/s	Rate of inclination angle
66	U1[2]	reserved2	-	-	Reserved

### 3.12.5.2 GPS almanac assistance

<b>Message</b>	<b>UBX-MGA-GPS-ALM</b>					
	<b>GPS almanac assistance</b>					
Type	Input					
Comment	This message allows the delivery of GPS almanac assistance to a receiver. See section AssistNow online in the integration manual for details.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x00	36	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	type	-	-	Message type (0x02 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	U1	svId	-	-	GPS Satellite identifier (see <a href="#">Satellite Numbering</a> )	
3	U1	svHealth	-	-	SV health information	
4	U2	e	2 <sup>-21</sup>	-	Eccentricity	
6	U1	almWNa	-	week	Reference week number of almanac (the 8-bit WNa field)	
7	U1	toa	2 <sup>-12</sup>	s	Reference time of almanac	
8	I2	deltaI	2 <sup>-19</sup>	semi-circles	Delta inclination angle at reference time	
10	I2	omegaDot	2 <sup>-38</sup>	semi-circles/s	Rate of right ascension	
12	U4	sqrtA	2 <sup>-11</sup>	m <sup>0.5</sup>	Square root of the semi-major axis	
16	I4	omega0	2 <sup>-23</sup>	semi-circles	Longitude of ascending node of orbit plane	
20	I4	omega	2 <sup>-23</sup>	semi-circles	Argument of perigee	
24	I4	m0	2 <sup>-23</sup>	semi-circles	Mean anomaly at reference time	
28	I2	af0	2 <sup>-20</sup>	s	Time polynomial coefficient 0 (8 MSBs)	
30	I2	af1	2 <sup>-38</sup>	s/s	Time polynomial coefficient 1	
32	U1[4]	reserved0	-	-	Reserved	

### 3.12.5.3 GPS health assistance

<b>Message</b>	<b>UBX-MGA-GPS-HEALTH</b>					
	<b>GPS health assistance</b>					
Type	Input					
Comment	This message allows the delivery of GPS health assistance to a receiver.					

See section AssistNow online in the integration manual for details.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x00	40	see below	CK_A CK_B

Payload description:

Byte offset	Type	Name	Scale	Unit	Description
0	U1	type	-	-	Message type (0x04 for this type)
1	U1	version	-	-	Message version (0x00 for this version)
2	U1[2]	reserved0	-	-	Reserved
4	U1[32]	healthCode	-	-	Each byte represents a GPS SV (1-32). The 6 LSBs of each byte contains the 6 bit health code from subframes 4/5 page 25.
36	U1[4]	reserved1	-	-	Reserved

### 3.12.5.4 GPS UTC assistance

**Message**    **UBX-MGA-GPS-UTC**  
**GPS UTC assistance**

**Type**        Input

**Comment**    This message allows the delivery of GPS UTC assistance to a receiver.  
See section AssistNow online in the integration manual for details.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x00	20	see below	CK_A CK_B

Payload description:

Byte offset	Type	Name	Scale	Unit	Description
0	U1	type	-	-	Message type (0x05 for this type)
1	U1	version	-	-	Message version (0x00 for this version)
2	U1[2]	reserved0	-	-	Reserved
4	I4	utcA0	2 <sup>-30</sup>	s	First parameter of UTC polynomial
8	I4	utcA1	2 <sup>-50</sup>	s/s	Second parameter of UTC polynomial
12	I1	utcDtLS	-	s	Delta time due to current leap seconds
13	U1	utcTot	2 <sup>12</sup>	s	UTC parameters reference time of week (GPS time)
14	U1	utcWNt	-	weeks	UTC parameters reference week number (the 8-bit WNt field)
15	U1	utcWNlsf	-	weeks	Week number at the end of which the future leap second becomes effective (the 8-bit WNLSF field)
16	U1	utcDn	-	days	Day number at the end of which the future leap second becomes effective
17	I1	utcDtLSF	-	s	Delta time due to future leap seconds
18	U1[2]	reserved1	-	-	Reserved

### 3.12.5.5 GPS ionosphere assistance

**Message**    **UBX-MGA-GPS-IONO**  
**GPS ionosphere assistance**

**Type**        Input

**Comment**    This message allows the delivery of GPS ionospheric assistance to a receiver.  
See section AssistNow online in the integration manual for details.


Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x00	16	see below	CK_A CK_B

Payload description:

Byte offset	Type	Name	Scale	Unit	Description
0	U1	type	-	-	Message type (0x06 for this type)
1	U1	version	-	-	Message version (0x00 for this version)
2	U1[2]	reserved0	-	-	Reserved
4	I1	ionoAlpha0	2 <sup>-30</sup>	s	Ionospheric parameter alpha0 [s]
5	I1	ionoAlpha1	2 <sup>-27</sup>	s/semi-circle	Ionospheric parameter alpha1 [s/semi-circle]
6	I1	ionoAlpha2	2 <sup>-24</sup>	s/(semi-circle <sup>2</sup> )	Ionospheric parameter alpha2 [s/semi-circle <sup>2</sup> ]
7	I1	ionoAlpha3	2 <sup>-24</sup>	s/(semi-circle <sup>3</sup> )	Ionospheric parameter alpha3 [s/semi-circle <sup>3</sup> ]
8	I1	ionoBeta0	2 <sup>11</sup>	s	Ionospheric parameter beta0 [s]
9	I1	ionoBeta1	2 <sup>14</sup>	s/semi-circle	Ionospheric parameter beta1 [s/semi-circle]
10	I1	ionoBeta2	2 <sup>16</sup>	s/(semi-circle <sup>2</sup> )	Ionospheric parameter beta2 [s/semi-circle <sup>2</sup> ]
11	I1	ionoBeta3	2 <sup>16</sup>	s/(semi-circle <sup>3</sup> )	Ionospheric parameter beta3 [s/semi-circle <sup>3</sup> ]
12	U1[4]	reserved1	-	-	Reserved

### 3.12.6 UBX-MGA-INI (0x13 0x40)

#### 3.12.6.1 Initial position assistance XYZ

Message	UBX-MGA-INI-POS_XYZ
	Initial position assistance XYZ
Type	Input
Comment	This message allows the delivery of initial position assistance to a receiver in cartesian ECEF coordinates. This message is equivalent to the <a href="#">UBX-MGA-INI-POS_LLH</a> message, except for the coordinate system. See section AssistNow Online in the integration manual for details.  Supplying position assistance that is inaccurate by more than the specified position accuracy, may lead to substantially degraded receiver performance.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x40	20	see below	CK_A CK_B

Payload description:

Byte offset	Type	Name	Scale	Unit	Description
0	U1	type	-	-	Message type (0x00 for this type)
1	U1	version	-	-	Message version (0x00 for this version)
2	U1[2]	reserved0	-	-	Reserved
4	I4	ecefX	-	cm	WGS84 ECEF X coordinate
8	I4	ecefY	-	cm	WGS84 ECEF Y coordinate
12	I4	ecefZ	-	cm	WGS84 ECEF Z coordinate
16	U4	posAcc	-	cm	Position accuracy (stddev)

### 3.12.6.2 Initial position assistance LLH

<b>Message</b>	<b>UBX-MGA-INI-POS_LLH</b> <b>Initial position assistance LLH</b>					
<b>Type</b>	Input					
<b>Comment</b>	<p>This message allows the delivery of initial position assistance to a receiver in WGS84 lat/long/alt coordinates. This message is equivalent to the <a href="#">UBX-MGA-INI-POS_XYZ</a> message, except for the coordinate system. See section AssistNow online in the integration manual for details.</p> <p>☞ Supplying position assistance that is inaccurate by more than the specified position accuracy, may lead to substantially degraded receiver performance.</p>					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x13	0x40	20	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	type	-	-	Message type (0x01 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	U1[2]	reserved0	-	-	<a href="#">Reserved</a>	
4	I4	lat	1e-7	deg	WGS84 Latitude	
8	I4	lon	1e-7	deg	WGS84 Longitude	
12	I4	alt	-	cm	WGS84 Altitude	
16	U4	posAcc	-	cm	Position accuracy (stddev)	

### 3.12.6.3 Initial time assistance UTC

<b>Message</b>	<b>UBX-MGA-INI-TIME.UTC</b> <b>Initial time assistance UTC</b>					
<b>Type</b>	Input					
<b>Comment</b>	<p>This message allows the delivery of UTC time assistance to a receiver. This message is equivalent to the <a href="#">UBX-MGA-INI-TIME_GNSS</a> message, except for the time base. See section AssistNow online in the integration manual for details.</p> <p>☞ Supplying time assistance that is inaccurate by more than the specified time accuracy, may lead to substantially degraded receiver performance.</p>					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x13	0x40	24	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	type	-	-	Message type (0x10 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	X1	ref	-	-	Reference to be used to set time	
bits 3...0	U:4	source	-	-	<ul style="list-style-type: none"> <li>0 = none, i.e. on receipt of message (will be inaccurate!)</li> <li>1 = relative to pulse sent to EXTINT0</li> <li>2 = relative to pulse sent to EXTINT1</li> <li>3-15 = reserved</li> </ul>	
bit 4	U:1	fall	-	-	use falling edge of EXTINT pulse (default rising) - only if source is EXTINT	
bit 5	U:1	last	-	-	use last EXTINT pulse (default next pulse) - only if source is EXTINT	


3	I1	leapSecs	-	s	Number of leap seconds since 1980 (or 0x80 = -128 if unknown)
4	U2	year	-	-	Year
6	U1	month	-	-	Month, starting at 1
7	U1	day	-	-	Day, starting at 1
8	U1	hour	-	-	Hour, from 0 to 23
9	U1	minute	-	-	Minute, from 0 to 59
10	U1	second	-	s	Seconds, from 0 to 59
11	X1	bitfield0	-	-	bitfield:
	bit 0 U:1	trustedSource	-	-	Time is provided from a trusted source. Potentially usable for replay attack detection <ul style="list-style-type: none"> <li>0: Unknown</li> <li>1: Time source can be trusted for spoofing detection</li> </ul>
12	U4	ns	-	ns	Nanoseconds, from 0 to 999,999,999
16	U2	tAccS	-	s	Seconds part of time accuracy
18	U1[2]	reserved0	-	-	<a href="#">Reserved</a>
20	U4	tAccNs	-	ns	Nanoseconds part of time accuracy, from 0 to 999,999,999

### 3.12.6.4 Initial time assistance GNSS

<b>Message</b>	<b>UBX-MGA-INI-TIME_GNSS</b>					
	<b>Initial time assistance GNSS</b>					
Type	Input					
Comment	This message allows the delivery of time assistance to a receiver in a chosen GNSS timebase. This message is equivalent to the <a href="#">UBX-MGA-INI-TIME_UTC</a> message, except for the time base. See section AssistNow online in the integration manual for details. ⚠ Supplying time assistance that is inaccurate by more than the specified time accuracy, may lead to substantially degraded receiver performance.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x40	24	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	type	-	-	Message type (0x11 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	X1	ref	-	-	Reference to be used to set time	
bits 3...0	U:4	source	-	-	<ul style="list-style-type: none"> <li>0 = none, i.e. on receipt of message (will be inaccurate!)</li> <li>1 = relative to pulse sent to EXTINT0</li> <li>2 = relative to pulse sent to EXTINT1</li> <li>3-15 = reserved</li> </ul>	
bit 4	U:1	fall	-	-	use falling edge of EXTINT pulse (default rising) - only if source is EXTINT	
bit 5	U:1	last	-	-	use last EXTINT pulse (default next pulse) - only if source is EXTINT	

3	U1	gnssId	-	-	Source of time information. Currently supported: <ul style="list-style-type: none"> <li>• 0 = GPS time</li> <li>• 2 = Galileo time</li> <li>• 3 = BeiDou time</li> <li>• 6 = GLONASS time</li> <li>• 7 = NavIC time</li> </ul>
4	X1	bitfield0	-	-	bitfield:
	bit 0 U:1	trustedSource	-	-	Time is provided from a trusted source. Potentially usable for replay attack detection <ul style="list-style-type: none"> <li>• 0: Unknown</li> <li>• 1: Time source can be trusted for spoofing detection</li> </ul>
5	U1	reserved0	-	-	Reserved
6	U2	week	-	-	GNSS week number
8	U4	tow	-	s	GNSS time of week
12	U4	ns	-	ns	GNSS time of week, nanosecond part from 0 to 999,999,999
16	U2	tAccS	-	s	Seconds part of time accuracy
18	U1[2]	reserved1	-	-	Reserved
20	U4	tAccNs	-	ns	Nanoseconds part of time accuracy, from 0 to 999,999,999

### 3.12.6.5 Initial clock drift assistance

<b>Message</b>	<b>UBX-MGA-INI-CLKD</b>					
	<b>Initial clock drift assistance</b>					
Type	Input					
Comment	This message allows the delivery of clock drift assistance to a receiver. See section AssistNow online in the integration manual for details.  Supplying clock drift assistance that is inaccurate by more than the specified accuracy, may lead to substantially degraded receiver performance.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x40	12	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	type	-	-	Message type (0x20 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	U1[2]	reserved0	-	-	Reserved	
4	I4	clkD	-	ns/s	Clock drift	
8	U4	clkDAcc	-	ns/s	Clock drift accuracy	

### 3.12.6.6 Initial frequency assistance

<b>Message</b>	<b>UBX-MGA-INI-FREQ</b>					
	<b>Initial frequency assistance</b>					
Type	Input					
Comment	This message allows the delivery of external frequency assistance to a receiver. See section AssistNow online in the integration manual for details.					

☞ Supplying external frequency assistance that is inaccurate by more than the specified accuracy, may lead to substantially degraded receiver performance.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x40	12	see below	CK_A CK_B

Payload description:

Byte offset	Type	Name	Scale	Unit	Description
0	U1	type	-	-	Message type (0x21 for this type)
1	U1	version	-	-	Message version (0x00 for this version)
2	U1	reserved0	-	-	<a href="#">Reserved</a>
3	X1	flags	-	-	Frequency reference
bits 3...0	U:4	source	-	-	<ul style="list-style-type: none"> <li>0 = frequency available on EXTINT0</li> <li>1 = frequency available on EXTINT1</li> <li>2-15 = reserved</li> </ul>
bit 4	U:1	fall	-	-	use falling edge of EXTINT pulse (default rising)
4	I4	freq	1e-2	Hz	Frequency
8	U4	freqAcc	-	ppb	Frequency accuracy

### 3.12.7 UBX-MGA-QZSS (0x13 0x05)

#### 3.12.7.1 QZSS ephemeris assistance

Message	UBX-MGA-QZSS-EPH QZSS ephemeris assistance
---------	-----------------------------------------------

Type	Input
------	-------

**Comment** This message allows the delivery of QZSS ephemeris assistance to a receiver. See section AssistNow Online in the integration manual for details.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x05	68	see below	CK_A CK_B

Payload description:

Byte offset	Type	Name	Scale	Unit	Description
0	U1	type	-	-	Message type (0x01 for this type)
1	U1	version	-	-	Message version (0x00 for this version)
2	U1	svId	-	-	QZSS Satellite identifier (see <a href="#">Satellite Numbering</a> ), Range 1-5
3	U1	reserved0	-	-	<a href="#">Reserved</a>
4	U1	fitInterval	-	-	Fit interval flag
5	U1	uraIndex	-	-	URA index
6	U1	svHealth	-	-	SV health
7	I1	tgd	2 <sup>-31</sup>	s	Group delay differential
8	U2	iodc	-	-	IODC
10	U2	toc	2 <sup>4</sup>	s	Clock data reference time
12	U1	reserved1	-	-	<a href="#">Reserved</a>
13	I1	af2	2 <sup>-55</sup>	s/s squared	Time polynomial coefficient 2
14	I2	af1	2 <sup>-43</sup>	s/s	Time polynomial coefficient 1

16	I4	af0	2 <sup>-31</sup>	s	Time polynomial coefficient 0
20	I2	crs	2 <sup>-5</sup>	m	Crs
22	I2	deltaN	2 <sup>-43</sup>	semi-circles/s	Mean motion difference from computed value
24	I4	m0	2 <sup>-31</sup>	semi-circles	Mean anomaly at reference time
28	I2	cuc	2 <sup>-29</sup>	radians	Amp of cosine harmonic corr term to arg of lat
30	I2	cus	2 <sup>-29</sup>	radians	Amp of sine harmonic corr term to arg of lat
32	U4	e	2 <sup>-33</sup>	-	eccentricity
36	U4	sqrtA	2 <sup>-19</sup>	m <sup>0.5</sup>	Square root of the semi-major axis A
40	U2	toe	2 <sup>4</sup>	s	Reference time of ephemeris
42	I2	cic	2 <sup>-29</sup>	radians	Amp of cos harmonic corr term to angle of inclination
44	I4	omega0	2 <sup>-31</sup>	semi-circles	Long of asc node of orbit plane at weekly epoch
48	I2	cis	2 <sup>-29</sup>	radians	Amp of sine harmonic corr term to angle of inclination
50	I2	crc	2 <sup>-5</sup>	m	Amp of cosine harmonic corr term to orbit radius
52	I4	i0	2 <sup>-31</sup>	semi-circles	Inclination angle at reference time
56	I4	omega	2 <sup>-31</sup>	semi-circles	Argument of perigee
60	I4	omegaDot	2 <sup>-43</sup>	semi-circles/s	Rate of right ascension
64	I2	idot	2 <sup>-43</sup>	semi-circles/s	Rate of inclination angle
66	U1[2]	reserved2	-	-	Reserved

### 3.12.7.2 QZSS almanac assistance

<b>Message</b>	<b>UBX-MGA-QZSS-ALM</b>					
	<b>QZSS almanac assistance</b>					
Type	Input					
Comment	This message allows the delivery of QZSS almanac assistance to a receiver. See section AssistNow Online in the integration manual for details.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x05	36	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	type	-	-	Message type (0x02 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	U1	svId	-	-	QZSS Satellite identifier (see <a href="#">Satellite Numbering</a> ), Range 1-5	
3	U1	svHealth	-	-	Almanac SV health information	
4	U2	e	2 <sup>-21</sup>	-	Almanac eccentricity	
6	U1	almWNa	-	week	Reference week number of almanac (the 8-bit WNa field)	
7	U1	toa	2 <sup>12</sup>	s	Reference time of almanac	
8	I2	deltaI	2 <sup>-19</sup>	semi-circles	Delta inclination angle at reference time	



10	I2	omegaDot	2 <sup>-38</sup>	semi-circles/s	Almanac rate of right ascension
12	U4	sqrtA	2 <sup>-11</sup>	m <sup>0.5</sup>	Almanac square root of the semi-major axis A
16	I4	omega0	2 <sup>-23</sup>	semi-circles	Almanac long of asc node of orbit plane at weekly
20	I4	omega	2 <sup>-23</sup>	semi-circles	Almanac argument of perigee
24	I4	m0	2 <sup>-23</sup>	semi-circles	Almanac mean anomaly at reference time
28	I2	af0	2 <sup>-20</sup>	s	Almanac time polynomial coefficient 0 (8 MSBs)
30	I2	af1	2 <sup>-38</sup>	s/s	Almanac time polynomial coefficient 1
32	U1[4]	reserved0	-	-	Reserved

### 3.12.7.3 QZSS health assistance

<b>Message</b>	<b>UBX-MGA-QZSS-HEALTH</b>					
	<b>QZSS health assistance</b>					
Type	Input					
Comment	This message allows the delivery of QZSS health assistance to a receiver. See section AssistNow Online in the integration manual for details.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x13	0x05	12	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	type	-	-	Message type (0x04 for this type)	
1	U1	version	-	-	Message version (0x00 for this version)	
2	U1[2]	reserved0	-	-	Reserved	
4	U1[5]	healthCode	-	-	Each byte represents a QZSS SV (1-5). The 6 LSBs of each byte contains the 6 bit health code from subframes 4/5, data ID = 3, SV ID = 51	
9	U1[3]	reserved1	-	-	Reserved	

## 3.13 UBX-MON (0x0a)

The messages in the UBX-MON class are used to report the receiver status, such as hardware status or I/O subsystem statistics.

### 3.13.1 UBX-MON-COMMS (0x0a 0x36)

#### 3.13.1.1 Communication port information

<b>Message</b>	<b>UBX-MON-COMMS</b>					
	<b>Communication port information</b>					
Type	Periodic/pollled					
Comment	Consolidated communications information for all ports. The size of the message is determined by the number of ports that are in use on the receiver. A port is only included if communication, either send or receive, has been initiated on that port.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x0a	0x36	8 + nPorts*40	see below	CK_A CK_B
Payload description:						

Byte offset	Type	Name	Scale	Unit	Description
0	U1	version	-	-	Message version (0x00 for this version)
1	U1	nPorts	-	-	Number of ports included
2	X1	txErrors	-	-	TX error bitmask
bit 0	U <sub>:1</sub>	mem	-	-	Memory Allocation error
bit 1	U <sub>:1</sub>	alloc	-	-	Allocation error (TX buffer full)
bits 4...2	U <sub>:3</sub>	outputPort	-	-	Output port: Reports the port from which this message was output from. <ul style="list-style-type: none"> <li>• 0 = N/A</li> <li>• 1 = I2C</li> <li>• 2 = UART1</li> <li>• 3 = UART2</li> <li>• 4 = USB</li> <li>• 5 = SPI</li> </ul>
3	U1	reserved0	-	-	Reserved
4	U1[4]	protIds	-	-	The identifiers of the protocols reported in the msgs array. 0: UBX, 1: NMEA, 2: RTCM2, 5: RTCM3, 6: SPARTN, 0xFF: No protocol reported.
<i>Start of repeated group (nPorts times)</i>					
8 + n·40	U2	portId	-	-	Unique identifier for the port. See section Communications ports in the integration manual for details.
10 + n·40	U2	txPending	-	bytes	Number of bytes pending in transmitter buffer
12 + n·40	U4	txBytes	-	bytes	Number of bytes ever sent
16 + n·40	U1	txUsage	-	%	Maximum usage transmitter buffer during the last sysmon period
17 + n·40	U1	txPeakUsage	-	%	Maximum usage transmitter buffer
18 + n·40	U2	rxPending	-	bytes	Number of bytes in receiver buffer
20 + n·40	U4	rxBytes	-	bytes	Number of bytes ever received
24 + n·40	U1	rxUsage	-	%	Maximum usage receiver buffer during the last sysmon period
25 + n·40	U1	rxPeakUsage	-	%	Maximum usage receiver buffer
26 + n·40	U2	overrunErrs	-	-	Number of 100 ms timeslots with overrun errors
28 + n·40	U2[4]	msgs	-	msg	Number of successfully parsed messages for each protocol. The reported protocols are identified through the protIds field.
36 + n·40	U1[8]	reserved1	-	-	Reserved
44 + n·40	U4	skipped	-	bytes	Number of skipped bytes
<i>End of repeated group (nPorts times)</i>					

### 3.13.2 UBX-MON-GNSS (0x0a 0x28)

### 3.13.2.1 Information message major GNSS selection

<b>Message</b>		<b>UBX-MON-GNSS</b>				
		<b>Information message major GNSS selection</b>				
<i>Type</i>	Polled					
<i>Comment</i>	This message reports major GNSS selection. It does this by means of bit masks in U1 fields. Each bit in a bit mask corresponds to one major GNSS. Augmentation systems are not reported.					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x0a	0x28	8	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	version	-	-	Message version (0x00 for this version)	
1	X1	supported	-	-	A bit mask showing the major GNSS that can be supported by this receiver	
bit 0	U:1	GPSSup	-	-	GPS is supported	
bit 1	U:1	GlonassSup	-	-	GLONASS is supported	
bit 2	U:1	BeidouSup	-	-	BeiDou is supported	
bit 3	U:1	GalileoSup	-	-	Galileo is supported	
2	X1	defaultGnss	-	-	A bit mask showing the default major GNSS selection. If the default major GNSS selection is currently configured in the OTP memory for this receiver, it takes precedence over the default major GNSS selection configured in the executing firmware of this receiver.	
bit 0	U:1	GPSDef	-	-	GPS is default-enabled	
bit 1	U:1	GlonassDef	-	-	GLONASS is default-enabled	
bit 2	U:1	BeidouDef	-	-	BeiDou is default-enabled	
bit 3	U:1	GalileoDef	-	-	Galileo is default-enabled	
3	X1	enabled	-	-	A bit mask showing the current major GNSS selection enabled for this receiver	
bit 0	U:1	GPSEna	-	-	GPS is enabled	
bit 1	U:1	GlonassEna	-	-	GLONASS is enabled	
bit 2	U:1	BeidouEna	-	-	BeiDou is enabled	
bit 3	U:1	GalileoEna	-	-	Galileo is enabled	
4	U1	simultaneous	-	-	Maximum number of concurrent major GNSS that can be supported by this receiver	
5	U1[3]	reserved0	-	-	Reserved	

### 3.13.3 UBX-MON-HW (0x0a 0x09)

#### 3.13.3.1 Hardware status

<b>Message</b>		<b>UBX-MON-HW</b>				
		<b>Hardware status</b>				
<i>Type</i>	Periodic/pollled					

**Comment** Status of different aspects of the hardware, such as antenna, PIO/peripheral pins, noise level, automatic gain control (AGC)

**This message is deprecated in this protocol version. Use [UBX-MON-HW3](#) and [UBX-MON-RF](#) instead.**

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x0a	0x09	56	see below	CK_A CK_B

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	U1[56]	reserved0	-	-	Reserved

### 3.13.4 UBX-MON-HW3 (0x0a 0x37)

#### 3.13.4.1 I/O pin status

**Message** **UBX-MON-HW3**  
**I/O pin status**

**Type** Periodic/pollled

**Comment** This message contains information specific to each HW I/O pin, for example whether the pin is set as Input or Output.

For the antenna supervisor status and other RF status information, see the [UBX-MON-RF](#) message.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x0a	0x37	22 + nPins·6	see below	CK_A CK_B

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	U1	version	-	-	Message version (0x00 for this version)
1	U1	nPins	-	-	The number of I/O pins included
2	X1	flags	-	-	Flags
bit 0	U <sub>1</sub>	rtcCalib	-	-	RTC is calibrated
bit 1	U <sub>1</sub>	safeBoot	-	-	Safeboot mode (0 = inactive, 1 = active)
bit 2	U <sub>1</sub>	xtalAbsent	-	-	RTC xtal has been determined to be absent
3	CH[10]	hwVersion	-	-	Zero-terminated hardware version string (same as that returned in the <a href="#">UBX-MON-VER</a> message)
13	U1[9]	reserved0	-	-	Reserved

*Start of repeated group (nPins times)*

22 + n·6	U1	reserved1	-	-	Reserved
23 + n·6	U1	pinId	-	-	Identifier for the pin, including both external and internal pins
24 + n·6	X2	pinMask	-	-	Pin mask
bit 0	U <sub>1</sub>	periphPIO	-	-	Pin is set to peripheral or PIO? 0=Peripheral 1=PIO
bits 3...1	U <sub>3</sub>	pinBank	-	-	Bank the pin belongs to, where 0=A 1=B 2=C 3=D 4=E 5=F 6=G 7=H
bit 4	U <sub>1</sub>	direction	-	-	Pin direction? 0=Input 1=Output
bit 5	U <sub>1</sub>	value	-	-	Pin value? 0=Low 1=High
bit 6	U <sub>1</sub>	vpManager	-	-	Used by virtual pin manager? 0=No 1=Yes
bit 7	U <sub>1</sub>	pioIrq	-	-	Interrupt enabled? 0=No 1=Yes

bit 8	U:1	pioPullHigh	-	-	Using pull high resistor? 0=No 1=Yes
bit 9	U:1	pioPullLow	-	-	Using pull low resistor 0=No 1=Yes
26 + n·6	U1	VP	-	-	Virtual pin mapping
27 + n·6	U1	reserved2	-	-	<a href="#">Reserved</a>
<i>End of repeated group (nPins times)</i>					

### 3.13.5 UBX-MON-IO (0x0a 0x02)

#### 3.13.5.1 I/O system status

<b>Message</b>	<b>UBX-MON-IO</b>					
	<b>I/O system status</b>					
Type	Periodic/pollled					
Comment	The size of the message is determined by the number of ports 'N' the receiver supports, i.e. on u-blox 5 the number of ports is 6.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x0a	0x02	[0..n]·20	<i>see below</i>	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
<i>Start of repeated group (N times)</i>						
0 + n·20	U4	rxBytes	-	bytes	Number of bytes ever received	
4 + n·20	U4	txBytes	-	bytes	Number of bytes ever sent	
8 + n·20	U2	parityErrs	-	-	Number of 100 ms timeslots with parity errors	
10 + n·20	U2	framingErrs	-	-	Number of 100 ms timeslots with framing errors	
12 + n·20	U2	overrunErrs	-	-	Number of 100 ms timeslots with overrun errors	
14 + n·20	U2	breakCond	-	-	Number of 100 ms timeslots with break conditions	
16 + n·20	U1[4]	reserved0	-	-	<a href="#">Reserved</a>	
<i>End of repeated group (N times)</i>						

### 3.13.6 UBX-MON-MSGPP (0x0a 0x06)

#### 3.13.6.1 Message parse and process status

<b>Message</b>	<b>UBX-MON-MSGPP</b>					
	<b>Message parse and process status</b>					
Type	Periodic/pollled					
Comment						
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x0a	0x06	120	<i>see below</i>	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U2[8]	msg1	-	msgs	Number of successfully parsed messages for each protocol on port0	
16	U2[8]	msg2	-	msgs	Number of successfully parsed messages for each protocol on port1	
32	U2[8]	msg3	-	msgs	Number of successfully parsed messages for each protocol on port2	

48	U2[8]	msg4	-	msgs	Number of successfully parsed messages for each protocol on port3
64	U2[8]	msg5	-	msgs	Number of successfully parsed messages for each protocol on port4
80	U2[8]	msg6	-	msgs	Number of successfully parsed messages for each protocol on port5
96	U4[6]	skipped	-	bytes	Number skipped bytes for each port

### 3.13.7 UBX-MON-PATCH (0x0a 0x27)

#### 3.13.7.1 Installed patches

Message	UBX-MON-PATCH Installed patches					
Type	Polled					
Comment	This message reports information about patches installed and currently enabled on the receiver. It does not report on patches installed and then disabled. An enabled patch is considered active when the receiver executes from the code space where the patch resides on. For example, a ROM patch is reported active only when the system runs from ROM.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x0a	0x27	4 + nEntries·16	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U2	version	-	-	Message version (0x0001 for this version)	
2	U2	nEntries	-	-	Total number of reported patches	
Start of repeated group (nEntries times)						
4 + n·16	X4	patchInfo	-	-	Status information about the reported patch	
	bit 0	U <sub>1</sub>	activated	-	-	1: the patch is active, 0: otherwise
	bits 2...1	U <sub>2</sub>	location	-	-	Indicates where the patch is stored. 0: OTP, 1: ROM, 2: BBR, 3: file system
8 + n·16	U4	comparator Number	-	-	The number of the comparator	
12 + n·16	U4	patchAddress	-	-	The address that is targeted by the patch	
16 + n·16	U4	patchData	-	-	The data that is inserted at the patchAddress	
End of repeated group (nEntries times)						

### 3.13.8 UBX-MON-RF (0x0a 0x38)

#### 3.13.8.1 RF information

Message	UBX-MON-RF RF information					
Type	Periodic/pollled					
Comment	Information for each RF block. There are as many RF blocks reported as bands supported by this receiver.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x0a	0x38	4 + nBlocks·24	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	

0	U1	version	-	-	Message version (0x00 for this version)
1	U1	nBlocks	-	-	The number of RF blocks included
2	U1[2]	reserved0	-	-	Reserved
<i>Start of repeated group (nBlocks times)</i>					
4 + n·24	U1	blockId	-	-	RF block ID (0 = L1 band, 1 = L2 or L5 band depending on product configuration)
5 + n·24	X1	flags	-	-	Flags
	bits 1...0 U <sub>2</sub>	jammingState	-	-	Output from jamming/interference monitor (0 = unknown or feature disabled or flag unavailable, 1 = ok - no significant jamming, 2 = warning - interference visible but fix OK, 3 = critical - interference visible and no fix). This flag is deprecated in protocol versions that support UBX-SEC-SIG (version 0x02) and always reported as 0; instead jammingState in UBX-SEC-SIG should be monitored.
6 + n·24	U1	antStatus	-	-	Status of the antenna supervisor state machine (0x00=INIT, 0x01=DONTKNOW, 0x02=OK, 0x03=SHORT, 0x04=OPEN)
7 + n·24	U1	antPower	-	-	Current power status of antenna (0x00=OFF, 0x01=ON, 0x02=DONTKNOW)
8 + n·24	U4	postStatus	-	-	POST status word
12 + n·24	U1[4]	reserved1	-	-	Reserved
16 + n·24	U2	noisePerMS	-	-	Noise level as measured by the GPS core
18 + n·24	U2	agcCnt	-	-	AGC Monitor, as percentage of maximum gain, range 0 to 8191 (100%)
20 + n·24	U1	cwSuppression	-	-	CW interference suppression level, scaled (0=no CW jamming, 255 = strong CW jamming)
21 + n·24	I1	ofsI	-	-	Imbalance of I-part of complex signal, scaled (-128 = max. negative imbalance, 127 = max. positive imbalance)
22 + n·24	U1	magI	-	-	Magnitude of I-part of complex signal, scaled (0 = no signal, 255 = max.magnitude)
23 + n·24	I1	ofsQ	-	-	Imbalance of Q-part of complex signal, scaled (-128 = max. negative imbalance, 127 = max. positive imbalance)
24 + n·24	U1	magQ	-	-	Magnitude of Q-part of complex signal, scaled (0 = no signal, 255 = max.magnitude)
25 + n·24	U1[3]	reserved2	-	-	Reserved
<i>End of repeated group (nBlocks times)</i>					

### 3.13.9 UBX-MON-RXBUF (0x0a 0x07)

#### 3.13.9.1 Receiver buffer status

<b>Message</b>	<b>UBX-MON-RXBUF</b>					
	<b>Receiver buffer status</b>					
Type	Periodic/pollled					
Comment						
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x0a	0x07	24	see below	CK_A CK_B

---

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	U2[6]	pending	-	bytes	Number of bytes pending in receiver buffer for each target
12	U1[6]	usage	-	%	Maximum usage receiver buffer during the last sysmon period for each target
18	U1[6]	peakUsage	-	%	Maximum usage receiver buffer for each target

### 3.13.10 UBX-MON-RXR (0x0a 0x21)

#### 3.13.10.1 Receiver status information

<b>Message</b>		<b>UBX-MON-RXR</b>				
		<b>Receiver status information</b>				
Type	Output					
Comment	The receiver ready message is sent when the receiver changes from or to backup mode.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x0a	0x21	1	see below	CK_A CK_B
<i>Payload description:</i>						
Byte offset	Type	Name	Scale	Unit	Description	
0	X1	flags	-	-	Receiver status flags	
	bit 0 U:1	awake	-	-	not in backup mode	

### 3.13.11 UBX-MON-SPAN (0x0a 0x31)

#### 3.13.11.1 Signal characteristics

<b>Message</b>		<b>UBX-MON-SPAN</b>				
		<b>Signal characteristics</b>				
Type	Periodic/polled					
Comment	<p>This message is to be used as a basic spectrum analyzer, where it displays one spectrum for each of the receiver's existing RF paths. The spectrum is conveyed with the following parameters: The frequency span in Hz, the frequency bin resolution in Hz, the center frequency in Hz, and 256 bins with amplitude data. Additionally, in order to give further insight on the signal captured by the receiver, the current gain of the internal programmable gain amplifier (PGA) is provided.</p> <p><b>This message gives information for comparative analysis rather than absolute and precise spectrum overview. Users should not expect highly accurate spectrum amplitude.</b></p> <p>Note that the PGA gain is not included in the spectrum data but is available as a separate field. Neither the spectrum, nor the PGA gain considers the internal fixed LNA gain or an external third-party LNA.</p> <p>The center frequency at each bin, assuming a zero-based bin count, can be computed as</p> $f(i) = center + span * (i - 127) / 256$					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x0a	0x31	4 + numRfBlocks·272	see below	CK_A CK_B
<i>Payload description:</i>						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	version	-	-	Message version (0x00 for this version)	
1	U1	numRfBlocks	-	-	Number of RF blocks included	
2	U1[2]	reserved0	-	-	Reserved	
<i>Start of repeated group (numRfBlocks times)</i>						



4 + n·272	U1[256]	spectrum	2 <sup>-2</sup>	dB	Spectrum data (number of points = span/res) [Uuu.ff dB]
260 + n·272	U4	span	-	Hz	Spectrum span
264 + n·272	U4	res	-	Hz	Resolution of the spectrum
268 + n·272	U4	center	-	Hz	Center of spectrum span
272 + n·272	U1	pga	-	dB	Programmable gain amplifier
273 + n·272	U1[3]	reserved1	-	-	<a href="#">Reserved</a>

*End of repeated group (numRfBlocks times)*

### 3.13.12 UBX-MON-SYS (0x0a 0x39)

#### 3.13.12.1 Current system performance information

<b>Message</b>		<b>UBX-MON-SYS</b>				
		<b>Current system performance information</b>				
<i>Type</i>	Periodic/polled					
<i>Comment</i>	This message contains operationally relevant system information for monitoring purposes. cpuLoadMax value is only valid, if 1 second output frequency is set. Detailed information about ioUsage/ioUsageMax are available in <a href="#">UBX-MON-COMMS</a> message. tempValue has an accuracy of +/- 2 deg.					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x0a	0x39	24	<i>see below</i>	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	msgVer	-	-	Message Version (0x01)	
1	U1	bootType	-	-	Boot type system 0-Unknown 1-Cold Start 2-Watchdog 3-Hardware reset 4-Hardware backup 5-Software backup 6-Software reset 7-VIO fail 8-VDD_X fail 9-VDD_RF fail 10-V_CORE_HIGH fail 11-System reset	
2	U1	cpuLoad	-	-	Highest actual load of realtime tasks of all CPUs in %	
3	U1	cpuLoadMax	-	-	Maximal CPU load value in % seen since last restart	
4	U1	memUsage	-	-	Highest actual dynamic memory usage of all CPUs in %	
5	U1	memUsageMax	-	-	Maximal dynamic memory usage in % seen since last restart	
6	U1	ioUsage	-	-	Highest actual IO bandwidth usage of all rx/tx interfaces in %	
7	U1	ioUsageMax	-	-	Maximal bandwidth usage of all rx/tx interfaces in % seen since last restart	

8	U4	runTime	-	sec	Time since last restart
12	U2	noticeCount	-	-	Number of notices occurred since last restart
14	U2	warnCount	-	-	Number of warnings occurred since last restart
16	U2	errorCount	-	-	Number of errors occurred since last restart
18	I1	tempValue	-	-	Temperature value [C]
19	U1[5]	reserved0	-	-	Reserved

### 3.13.13 UBX-MON-TXBUF (0x0a 0x08)

#### 3.13.13.1 Transmitter buffer status

<b>Message</b>	<b>UBX-MON-TXBUF</b>					
	<b>Transmitter buffer status</b>					
Type	Periodic/poll					
Comment						
<b>Message structure</b>	<b>Header</b>	<b>Class</b>	<b>ID</b>	<b>Length (Bytes)</b>	<b>Payload</b>	<b>Checksum</b>
	0xb5 0x62	0x0a	0x08	28	see below	CK_A CK_B
<i>Payload description:</i>						
<b>Byte offset</b>	<b>Type</b>	<b>Name</b>	<b>Scale</b>	<b>Unit</b>	<b>Description</b>	
0	U2[6]	pending	-	bytes	Number of bytes pending in transmitter buffer for each target	
12	U1[6]	usage	-	%	Maximum usage transmitter buffer during the last sysmon period for each target	
18	U1[6]	peakUsage	-	%	Maximum usage transmitter buffer for each target	
24	U1	tUsage	-	%	Maximum usage of transmitter buffer during the last sysmon period for all targets	
25	U1	tPeakusage	-	%	Maximum usage of transmitter buffer for all targets	
26	X1	errors	-	-	Error bitmask	
	bits 5...0	U <sub>6</sub>	limit	-	-	Buffer limit of corresponding target reached
	bit 6	U <sub>1</sub>	mem	-	-	Memory Allocation error
	bit 7	U <sub>1</sub>	alloc	-	-	Allocation error (TX buffer full)
27	U1	reserved0	-	-	Reserved	

### 3.13.14 UBX-MON-VER (0x0a 0x04)

#### 3.13.14.1 Poll receiver and software version

<b>Message</b>	<b>UBX-MON-VER</b>					
	<b>Poll receiver and software version</b>					
Type	Poll request					
Comment						
<b>Message structure</b>	<b>Header</b>	<b>Class</b>	<b>ID</b>	<b>Length (Bytes)</b>	<b>Payload</b>	<b>Checksum</b>
	0xb5 0x62	0x0a	0x04	0	see below	CK_A CK_B
<b>Payload</b>	This message has no payload.					

### 3.13.14.2 Receiver and software version

<b>Message</b>		<b>UBX-MON-VER</b>				
		<b>Receiver and software version</b>				
Type	Polled					
Comment						
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x0a	0x04	40 + [0..n]-30	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	CH[30]	swVersion	-	-	Nul-terminated software version string.	
30	CH[10]	hwVersion	-	-	Nul-terminated hardware version string	
Start of repeated group (N times)						
40 + n*30	CH[30]	extension	-	-	Extended software information strings. A series of nul-terminated strings. Each extension field is 30 characters long and contains varying software information. Not all extension fields may appear. Examples of reported information: the software version string of the underlying ROM (when the receiver's firmware is running from flash), the firmware version, the supported <a href="#">protocol version</a> , the module identifier, the flash information structure (FIS) file information, the supported major GNSS, the supported augmentation systems. See <a href="#">Firmware and protocol versions</a> for details.	
End of repeated group (N times)						

## 3.14 UBX-NAV (0x01)

The messages in the UBX-NAV class are used to output navigation results and data, such as position, altitude and velocity in a number of formats, and status flags and accuracy estimate figures, or satellite and signal information. The messages are generated with the configured navigation rate.

### 3.14.1 UBX-NAV-CLOCK (0x01 0x22)

#### 3.14.1.1 Clock solution

<b>Message</b>		<b>UBX-NAV-CLOCK</b>				
		<b>Clock solution</b>				
Type	Periodic/pollled					
Comment						
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x22	20	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section Navigation epochs in the integration manual for details. See section iTOW timestamps in the integration manual for details.	

4	I4	clkB	-	ns	Clock bias
8	I4	clkD	-	ns/s	Clock drift
12	U4	tAcc	-	ns	Time accuracy estimate
16	U4	fAcc	-	ps/s	Frequency accuracy estimate

### 3.14.2 UBX-NAV-COV (0x01 0x36)

#### 3.14.2.1 Covariance matrices

<b>Message</b>	<b>UBX-NAV-COV</b>					
	<b>Covariance matrices</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	This message outputs the covariance matrices for the position and velocity solutions in the topocentric coordinate system defined as the local-level North (N), East (E), Down (D) frame. As the covariance matrices are symmetric, only the upper triangular part is output.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x01	0x36	64	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U1	version	-	-	Message version (0x00 for this version)	
5	U1	posCovValid	-	-	Position covariance matrix validity flag	
6	U1	velCovValid	-	-	Velocity covariance matrix validity flag	
7	U1[9]	reserved0	-	-	Reserved	
16	R4	posCovNN	-	m <sup>2</sup>	Position covariance matrix value p <sub>NN</sub>	
20	R4	posCovNE	-	m <sup>2</sup>	Position covariance matrix value p <sub>NE</sub>	
24	R4	posCovND	-	m <sup>2</sup>	Position covariance matrix value p <sub>ND</sub>	
28	R4	posCovEE	-	m <sup>2</sup>	Position covariance matrix value p <sub>EE</sub>	
32	R4	posCovED	-	m <sup>2</sup>	Position covariance matrix value p <sub>ED</sub>	
36	R4	posCovDD	-	m <sup>2</sup>	Position covariance matrix value p <sub>DD</sub>	
40	R4	velCovNN	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>NN</sub>	
44	R4	velCovNE	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>NE</sub>	
48	R4	velCovND	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>ND</sub>	
52	R4	velCovEE	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>EE</sub>	
56	R4	velCovED	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>ED</sub>	
60	R4	velCovDD	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>DD</sub>	

### 3.14.3 UBX-NAV-DOP (0x01 0x04)

#### 3.14.3.1 Dilution of precision

<b>Message</b>	<b>UBX-NAV-DOP</b>	
	<b>Dilution of precision</b>	
<b>Type</b>	Periodic/pollled	
<b>Comment</b>	<ul style="list-style-type: none"> <li>DOP values are dimensionless.</li> </ul>	

- All DOP values are scaled by a factor of 100. If the unit transmits a value of e.g. 156, the DOP value is 1.56.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x04	18	see below	CK_A CK_B

Payload description:

Byte offset	Type	Name	Scale	Unit	Description
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.
4	U2	gDOP	0.01	-	Geometric DOP
6	U2	pDOP	0.01	-	Position DOP
8	U2	tDOP	0.01	-	Time DOP
10	U2	vDOP	0.01	-	Vertical DOP
12	U2	hDOP	0.01	-	Horizontal DOP
14	U2	nDOP	0.01	-	Northing DOP
16	U2	eDOP	0.01	-	Easting DOP

### 3.14.4 UBX-NAV-EOE (0x01 0x61)

#### 3.14.4.1 End of epoch

Message	UBX-NAV-EOE End of epoch					
Type	Periodic					
Comment						
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x61	4	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	

### 3.14.5 UBX-NAV-NMI (0x01 0x28)

#### 3.14.5.1 Navigation message cross-check information

Message	UBX-NAV-NMI Navigation message cross-check information					
Type	Periodic/pollled					
Comment	Information about the validity of received satellite navigation payload.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x28	16	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	

4	U1	version	-	-	Message version (0x01 for this version)
5	U1[4]	reserved0	-	-	Reserved
9	X1	gpsNmiFlags	-	-	GPS navigation message cross-check information flags.
bit 0	U <sub>:1</sub>	wnoCheckedGPS	-	-	1 = week number check performed.
bit 1	U <sub>:1</sub>	wnoInvalidGPS	-	-	1 = week number invalid.
bit 2	U <sub>:1</sub>	UTCOREf CheckedGPS	-	-	1 = GPS UTCO reference time check performed.
bit 3	U <sub>:1</sub>	UTCOREf InvalidGPS	-	-	1 = GPS UTCO reference time invalid.
10	X1	gpsLsFlags	-	-	GPS leap second cross-check information flags.
bit 0	U <sub>:1</sub>	lsValGPS	-	-	1 = Leap second value out of range.
bit 1	U <sub>:1</sub>	dnRangeGPS	-	-	1 = Day number value out of range.
bit 2	U <sub>:1</sub>	totRangeGPS	-	-	1 = Data reference TOW out of range.
bit 3	U <sub>:1</sub>	lsEventGPS	-	-	1 = Unexpected leap second event.
bit 4	U <sub>:1</sub>	recNowGPS	-	-	1 = Data received this epoch.
11	X1	galNmiFlags	-	-	Galileo navigation message cross-check information flags.
bit 0	U <sub>:1</sub>	wnoCheckedGAL	-	-	1 = week number check performed.
bit 1	U <sub>:1</sub>	wnoInvalidGAL	-	-	1 = week number invalid.
12	X1	galLsFlags	-	-	Galileo leap second cross-check information flags.
bit 0	U <sub>:1</sub>	lsValGAL	-	-	1 = Leap second value out of range.
bit 1	U <sub>:1</sub>	dnRangeGAL	-	-	1 = Day number value out of range.
bit 2	U <sub>:1</sub>	totRangeGAL	-	-	1 = Data reference TOW out of range.
bit 3	U <sub>:1</sub>	lsEventGAL	-	-	1 = Unexpected leap second event.
bit 4	U <sub>:1</sub>	recNowGAL	-	-	1 = Data received this epoch.
13	X1	bdsNmiFlags	-	-	BeiDou navigation message cross-check information flags.
bit 0	U <sub>:1</sub>	wnoCheckedBDS	-	-	1 = week number check performed.
bit 1	U <sub>:1</sub>	wnoInvalidBDS	-	-	1 = week number invalid.
14	X1	bdsLsFlags	-	-	BeiDou leap second cross-check information flags.
bit 0	U <sub>:1</sub>	lsValBDS	-	-	1 = Leap second value out of range.
bit 1	U <sub>:1</sub>	dnRangeBDS	-	-	1 = Day number value out of range.

bit 2	U:1	totRangeBDS	-	-	1 = Data reference TOW out of range.
bit 3	U:1	lsEventBDS	-	-	1 = Unexpected leap second event.
bit 4	U:1	recNowBDS	-	-	1 = Data received this epoch.
15	X1	gloNmiFlags	-	-	GLONASS navigation message cross-check information flags.
bit 0	U:1	wnoCheckedGL 0	-	-	1 = week number check performed.
bit 1	U:1	wnoInvalidGL 0	-	-	1 = week number invalid.

### 3.14.6 UBX-NAV-ORB (0x01 0x34)

#### 3.14.6.1 GNSS orbit database info

<b>Message</b>	<b>UBX-NAV-ORB GNSS orbit database info</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	Status of the GNSS orbit database knowledge.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x01	0x34	8 + numSv*6	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U1	version	-	-	Message version (0x01 for this version)	
5	U1	numSv	-	-	Number of SVs in the database	
6	U1[2]	reserved0	-	-	Reserved	
<i>Start of repeated group (numSv times)</i>						
8 + n*6	U1	gnssId	-	-	GNSS ID	
9 + n*6	U1	svId	-	-	Satellite ID	
10 + n*6	X1	svFlag	-	-	Information Flags	
bits 1...0	U:2	health	-	-	SV health: <ul style="list-style-type: none"> <li>• 0 = unknown</li> <li>• 1 = healthy</li> <li>• 2 = not healthy</li> </ul>	
bits 3...2	U:2	visibility	-	-	SV health: <ul style="list-style-type: none"> <li>• 0 = unknown</li> <li>• 1 = below horizon</li> <li>• 2 = above horizon</li> <li>• 3 = above elevation mask</li> </ul>	

11 + n·6	X1	eph	-	-	Ephemeris data In products supporting L5 signals, the receiver may store multiple ephemeris data sets per satellite. ephUsability and ephSource fields show information on one of the data sets. It is not possible to choose which data set's status is shown.
bits 4...0	U:5	ephUsability	-	-	How long the receiver will be able to use the stored ephemeris data from now on: <ul style="list-style-type: none"> <li>• 31 = The usability period is unknown</li> <li>• 30 = The usability period is more than 450 minutes</li> <li>• 30 &gt; n &gt; 0 = The usability period is between (n-1)*15 and n*15 minutes</li> <li>• 0 = Ephemeris can no longer be used</li> </ul>
bits 7...5	U:3	ephSource	-	-	<ul style="list-style-type: none"> <li>• 0 = not available</li> <li>• 1 = GNSS transmission</li> <li>• 2 = external aiding</li> <li>• 3-7 = other</li> </ul>
12 + n·6	X1	alm	-	-	Almanac data
bits 4...0	U:5	almUsability	-	-	How long the receiver will be able to use the stored almanac data from now on: <ul style="list-style-type: none"> <li>• 31 = The usability period is unknown</li> <li>• 30 = The usability period is more than 30 days</li> <li>• 30 &gt; n &gt; 0 = The usability period is between n-1 and n days</li> <li>• 0 = Almanac can no longer be used</li> </ul>
bits 7...5	U:3	almSource	-	-	<ul style="list-style-type: none"> <li>• 0 = not available</li> <li>• 1 = GNSS transmission</li> <li>• 2 = external aiding</li> <li>• 3-7 = other</li> </ul>
13 + n·6	X1	otherOrb	-	-	Other orbit data available
bits 4...0	U:5	anoAop Usability	-	-	How long the receiver will be able to use the orbit data from now on: <ul style="list-style-type: none"> <li>• 31 = The usability period is unknown</li> <li>• 30 = The usability period is more than 30 days</li> <li>• 30 &gt; n &gt; 0 = The usability period is between n-1 and n days</li> <li>• 0 = Data can no longer be used</li> </ul>
bits 7...5	U:3	type	-	-	Type of orbit data: <ul style="list-style-type: none"> <li>• 0 = No orbit data available</li> <li>• 1 = AssistNow Offline data</li> <li>• 2 = AssistNow Autonomous data</li> <li>• 3-7 = Other orbit data</li> </ul>

End of repeated group (*numSv* times)

### 3.14.7 UBX-NAV-POSECEF (0x01 0x01)



### 3.14.7.1 Position solution in ECEF

<b>Message</b>	<b>UBX-NAV-POSECEF</b>					
	<b>Position solution in ECEF</b>					
Type	Periodic/pollled					
Comment	See important comments concerning validity of position given in section Navigation output filters in the integration manual.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x01	20	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	I4	ecefX	-	cm	ECEF X coordinate	
8	I4	ecefY	-	cm	ECEF Y coordinate	
12	I4	ecefZ	-	cm	ECEF Z coordinate	
16	U4	pAcc	-	cm	Position Accuracy Estimate	

### 3.14.8 UBX-NAV-POSLLH (0x01 0x02)

#### 3.14.8.1 Geodetic position solution

<b>Message</b>	<b>UBX-NAV-POSLLH</b>					
	<b>Geodetic position solution</b>					
Type	Periodic/pollled					
Comment	See important comments concerning validity of position given in section Navigation output filters in the integration manual.  This message outputs the Geodetic position in the currently selected ellipsoid. The default is the WGS84 Ellipsoid, but can be changed with the message <a href="#">CFG-NAVSPG-USE_USRDAT</a> .					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x02	28	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	I4	lon	1e-7	deg	Longitude	
8	I4	lat	1e-7	deg	Latitude	
12	I4	height	-	mm	Height above ellipsoid	
16	I4	hMSL	-	mm	Height above mean sea level	
20	U4	hAcc	-	mm	Horizontal accuracy estimate	
24	U4	vAcc	-	mm	Vertical accuracy estimate	

### 3.14.9 UBX-NAV-PVT (0x01 0x07)

### 3.14.9.1 Navigation position velocity time solution

<b>Message</b>		<b>UBX-NAV-PVT</b>				
		<b>Navigation position velocity time solution</b>				
<i>Type</i>	Periodic/pollled					
<i>Comment</i>	This message combines position, velocity and time solution, including accuracy figures. Note that during a leap second there may be more or less than 60 seconds in a minute. See description of leap seconds in the integration manual for details.					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x01	0x07	92	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U2	year	-	y	Year (UTC)	
6	U1	month	-	month	Month, range 1..12 (UTC)	
7	U1	day	-	d	Day of month, range 1..31 (UTC)	
8	U1	hour	-	h	Hour of day, range 0..23 (UTC)	
9	U1	min	-	min	Minute of hour, range 0..59 (UTC)	
10	U1	sec	-	s	Seconds of minute, range 0..60 (UTC)	
11	X1	valid	-	-	Validity flags	
	bit 0	U:1	validDate	-	-	1 = valid UTC Date (see section Time validity in the integration manual for details)
	bit 1	U:1	validTime	-	-	1 = valid UTC time of day (see section Time validity in the integration manual for details)
	bit 2	U:1	fullyResolved	-	-	1 = UTC time of day has been fully resolved (no seconds uncertainty). Cannot be used to check if time is completely solved.
	bit 3	U:1	validMag	-	-	1 = valid magnetic declination
12	U4	tAcc	-	ns	Time accuracy estimate (UTC)	
16	I4	nano	-	ns	Fraction of second, range -1e9 .. 1e9 (UTC)	
20	U1	fixType	-	-	GNSSfix Type: <ul style="list-style-type: none"> <li>• 0 = no fix</li> <li>• 1 = dead reckoning only</li> <li>• 2 = 2D-fix</li> <li>• 3 = 3D-fix</li> <li>• 4 = GNSS + dead reckoning combined</li> <li>• 5 = time only fix</li> </ul>	
21	X1	flags	-	-	Fix status flags	
	bit 0	U:1	gnssFixOK	-	-	1 = valid fix (i.e within DOP & accuracy masks)
	bit 1	U:1	diffSoln	-	-	1 = differential corrections were applied
	bits 4...2	U:3	psmState	-	-	Power save mode state (see Power management section in the integration manual for details). <ul style="list-style-type: none"> <li>• 0 = PSM is not active</li> <li>• 1 = Enabled (an intermediate state before Acquisition state)</li> </ul>

					<ul style="list-style-type: none"> <li>• 2 = Acquisition</li> <li>• 3 = Tracking</li> <li>• 4 = Power Optimized Tracking</li> <li>• 5 = Inactive</li> </ul>
bit 5	U:1	headVehValid	-	-	1 = heading of vehicle is valid, only set if the receiver is in sensor fusion mode
bits 7...6	U:2	carrSoln	-	-	Carrier phase range solution status: <ul style="list-style-type: none"> <li>• 0 = no carrier phase range solution</li> <li>• 1 = carrier phase range solution with floating ambiguities</li> <li>• 2 = carrier phase range solution with fixed ambiguities</li> </ul> (not supported for protocol versions less than 20.00)
22	X1	flags2	-	-	Additional flags
bit 5	U:1	confirmedAvai	-	-	1 = information about UTC Date and Time of Day validity confirmation is available (see section Time validity in the integration manual for details) This flag is only supported in <a href="#">Protocol Versions 19.00, 19.10, 20.10, 20.20, 20.30, 22.00, 23.00, 23.01, 27 and 28</a> .
bit 6	U:1	confirmedDate	-	-	1 = UTC Date validity could be confirmed (see section Time validity in the integration manual for details)
bit 7	U:1	confirmedTime	-	-	1 = UTC Time of Day could be confirmed (see section Time validity in the integration manual for details)
23	U1	numSV	-	-	Number of satellites used in Nav Solution
24	I4	lon	1e-7	deg	Longitude
28	I4	lat	1e-7	deg	Latitude
32	I4	height	-	mm	Height above ellipsoid
36	I4	hMSL	-	mm	Height above mean sea level
40	U4	hAcc	-	mm	Horizontal accuracy estimate
44	U4	vAcc	-	mm	Vertical accuracy estimate
48	I4	velN	-	mm/s	NED north velocity
52	I4	velE	-	mm/s	NED east velocity
56	I4	velD	-	mm/s	NED down velocity
60	I4	gSpeed	-	mm/s	Ground Speed (2-D)
64	I4	headMot	1e-5	deg	Heading of motion (2-D)
68	U4	sAcc	-	mm/s	Speed accuracy estimate
72	U4	headAcc	1e-5	deg	Heading accuracy estimate (both motion and vehicle)
76	U2	pDOP	0.01	-	Position DOP
78	X2	flags3	-	-	Additional flags
bit 0	U:1	invalidLlh	-	-	1 = Invalid lon, lat, height and hMSL (applicable to heading products only)
bits 4...1	U:4	lastCorrection Age	-	-	Age of the most recently received differential correction: <ul style="list-style-type: none"> <li>• 0 = Not available</li> <li>• 1 = Age between 0 and 1 second</li> </ul>

- 2 = Age between 1 (inclusive) and 2 seconds
- 3 = Age between 2 (inclusive) and 5 seconds
- 4 = Age between 5 (inclusive) and 10 seconds
- 5 = Age between 10 (inclusive) and 15 seconds
- 6 = Age between 15 (inclusive) and 20 seconds
- 7 = Age between 20 (inclusive) and 30 seconds
- 8 = Age between 30 (inclusive) and 45 seconds
- 9 = Age between 45 (inclusive) and 60 seconds
- 10 = Age between 60 (inclusive) and 90 seconds
- 11 = Age between 90 (inclusive) and 120 seconds
- >=12 = Age greater or equal than 120 seconds

bit 13	U:1	authTime	-	-	<p>Flag that indicates if the output time has been validated against an external trusted time source</p> <ul style="list-style-type: none"> <li>• 0 = Time is not authenticated</li> <li>• 1 = Time is authenticated</li> </ul>
bit 14	U:1	nmaFixStatus	-	-	<p>Flag assigned to a fix that has been computed mixing satellites with data authenticated through Navigation Message Authentication (NMA) methods and satellites using unauthenticated data. The fix is flagged as Verified when internal cross-checks validates the unauthenticated signals against the authenticated ones. Note that Not Verified status does not imply directly spoofing attacks, to identify spoofing alerts refer to <a href="#">UBX-SEC-SIG</a>.</p> <ul style="list-style-type: none"> <li>• 0 = Not Verified: The mixed solution does not agree with the NMA authenticated data or the comparison could not be performed, e.g., not enough authenticated SVs to extrapolate the result or cryptographic data not decoded yet</li> <li>• 1 = Verified: The mixed solution agrees with the NMA authenticated data</li> </ul> <p>Currently, the only existing NMA method is Galileo Open Service Navigation Message Authentication (OSNMA) protocol.</p>
80	U1[4]	reserved0	-	-	<a href="#">Reserved</a>
84	l4	headVeh	1e-5	deg	Heading of vehicle (2-D), this is only valid when headVehValid is set, otherwise the output is set to the heading of motion
88	l2	magDec	1e-2	deg	Magnetic declination. Only supported in ADR 4.10 and later.
90	U2	magAcc	1e-2	deg	Magnetic declination accuracy. Only supported in ADR 4.10 and later.

### 3.14.10 UBX-NAV-SAT (0x01 0x35)

#### 3.14.10.1 Satellite information

<b>Message</b>	<b>UBX-NAV-SAT</b> <b>Satellite information</b>
<b>Type</b>	Periodic/pollled

**Comment** This message displays information about SVs that are either known to be visible or currently tracked by the receiver. All signal related information corresponds to the subset of signals specified in [Signal Identifiers](#).

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x35	8 + numSvs·12	see below	CK_A CK_B

**Payload description:**

Byte offset	Type	Name	Scale	Unit	Description
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.
4	U1	version	-	-	Message version (0x01 for this version)
5	U1	numSvs	-	-	Number of satellites
6	U1[2]	reserved0	-	-	<a href="#">Reserved</a>

**Start of repeated group (numSvs times)**

8 + n·12	U1	gnssId	-	-	GNSS identifier (see <a href="#">Satellite Numbering</a> ) for assignment
9 + n·12	U1	svId	-	-	Satellite identifier (see <a href="#">Satellite Numbering</a> ) for assignment
10 + n·12	U1	cno	-	dBHz	Carrier to noise ratio (signal strength)
11 + n·12	I1	elev	-	deg	Elevation (range: +/-90), unknown if out of range
12 + n·12	I2	azim	-	deg	Azimuth (range 0-360), unknown if elevation is out of range
14 + n·12	I2	prRes	0.1	m	Pseudorange residual
16 + n·12	X4	flags	-	-	Bitmask
bits 2...0	U:3	qualityInd	-	-	Signal quality indicator: <ul style="list-style-type: none"> <li>0 = no signal</li> <li>1 = searching signal</li> <li>2 = signal acquired</li> <li>3 = signal detected but unusable</li> <li>4 = code locked and time synchronized</li> <li>5, 6, 7 = code and carrier locked and time synchronized</li> </ul>
bit 3	U:1	svUsed	-	-	1 = Signal in the subset specified in <a href="#">Signal Identifiers</a> is currently being used for navigation
bits 5...4	U:2	health	-	-	Signal health flag: <ul style="list-style-type: none"> <li>0 = unknown</li> <li>1 = healthy</li> <li>2 = unhealthy</li> </ul>
bit 6	U:1	diffCorr	-	-	1 = differential correction data is available for this SV
bit 7	U:1	smoothed	-	-	1 = carrier smoothed pseudorange used
bits 10...8	U:3	orbitSource	-	-	Orbit source: <ul style="list-style-type: none"> <li>0 = no orbit information is available for this SV</li> <li>1 = ephemeris is used</li> <li>2 = almanac is used</li> <li>3 = AssistNow Offline orbit is used</li> <li>4 = AssistNow Autonomous orbit is used</li> </ul>

Bit	Type	Field Name	Scale	Unit	Description
bit 11	U:1	ephAvail	-	-	1 = ephemeris is available for this SV
bit 12	U:1	almAvail	-	-	1 = almanac is available for this SV
bit 13	U:1	anoAvail	-	-	1 = AssistNow Offline data is available for this SV
bit 14	U:1	aopAvail	-	-	1 = AssistNow Autonomous data is available for this SV
bit 16	U:1	sbasCorrUsed	-	-	1 = SBAS corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 17	U:1	rtcmCorrUsed	-	-	1 = RTCM corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 18	U:1	slasCorrUsed	-	-	1 = QZSS SLAS corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 19	U:1	spartnCorrUsed	-	-	1 = SPARTN corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 20	U:1	prCorrUsed	-	-	1 = Pseudorange corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 21	U:1	crCorrUsed	-	-	1 = Carrier range corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 22	U:1	doCorrUsed	-	-	1 = Range rate (Doppler) corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 23	U:1	clasCorrUsed	-	-	1 = CLAS corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>

- 5, 6, 7 = other orbit information is used

End of repeated group (*numSvs* times)

### 3.14.11 UBX-NAV-SBAS (0x01 0x32)

#### 3.14.11.1 SBAS status data

Message	UBX-NAV-SBAS SBAS status data					
Type	Periodic/pollled					
Comment	This message outputs the status of the SBAS sub system					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x32	12 + cnt·12	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See the description of iTOW for details.	
4	U1	geo	-	-	PRN Number of the GEO where correction and integrity data is used from	
5	U1	mode	-	-	SBAS Mode <ul style="list-style-type: none"> <li>• 0 Disabled</li> <li>• 1 Enabled integrity</li> <li>• 3 Enabled test mode</li> </ul>	

6	I1	sys	-	-	SBAS System (WAAS/EGNOS/...) <ul style="list-style-type: none"> <li>-1 Unknown</li> <li>0 WAAS</li> <li>1 EGNOS</li> <li>2 MSAS</li> <li>3 GAGAN</li> <li>16 GPS</li> </ul>	
7	X1	service	-	-	SBAS Services available	
	bit 0	U <sub>:1</sub>	Ranging	-	-	GEO may be used as ranging source
	bit 1	U <sub>:1</sub>	Corrections	-	-	GEO is providing correction data
	bit 2	U <sub>:1</sub>	Integrity	-	-	GEO is providing integrity
	bit 3	U <sub>:1</sub>	Testmode	-	-	GEO is in test mode
	bit 4	U <sub>:1</sub>	Bad	-	-	Problem with signal or broadcast data indicated
8	U1	cnt	-	-	Number of SV data following	
9	X1	statusFlags	-	-	SBAS status flags	
	bits 1...0	U <sub>:2</sub>	integrityUsed	-	-	SBAS integrity used <ul style="list-style-type: none"> <li>0 = Unknown</li> <li>1 = Integrity information is not available or SBAS integrity is not enabled</li> <li>2 = Receiver uses only GPS satellites for which integrity information is available</li> </ul>
10	U1[2]	reserved0	-	-	Reserved	
<i>Start of repeated group (cnt times)</i>						
12 + n·12	U1	svid	-	-	SV ID	
13 + n·12	U1	reserved1	-	-	Reserved	
14 + n·12	U1	udre	-	-	Monitoring status	
15 + n·12	U1	svSys	-	-	System (WAAS/EGNOS/...) same as SYS	
16 + n·12	U1	svService	-	-	Services available same as SERVICE	
17 + n·12	U1	reserved2	-	-	Reserved	
18 + n·12	I2	prc	-	cm	Pseudo Range correction in [cm]	
20 + n·12	U1[2]	reserved3	-	-	Reserved	
22 + n·12	I2	ic	-	cm	Ionosphere correction in [cm]	
<i>End of repeated group (cnt times)</i>						

### 3.14.12 UBX-NAV-SIG (0x01 0x43)

#### 3.14.12.1 Signal information

<b>Message</b>	<b>UBX-NAV-SIG</b> <b>Signal information</b>
<b>Type</b>	Periodic/pollled
<b>Comment</b>	This message displays information about signals currently tracked or searched by the receiver.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x43	8 + numSigs·16	see below	CK_A CK_B
<i>Payload description:</i>						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U1	version	-	-	Message version (0x00 for this version)	
5	U1	numSigs	-	-	Number of signals	
6	U1[2]	reserved0	-	-	Reserved	
<i>Start of repeated group (numSigs times)</i>						
8 + n·16	U1	gnssId	-	-	GNSS identifier (see <a href="#">Satellite Numbering</a> ) for assignment	
9 + n·16	U1	svId	-	-	Satellite identifier (see <a href="#">Satellite Numbering</a> ) for assignment	
10 + n·16	U1	sigId	-	-	New style signal identifier (see <a href="#">Signal Identifiers</a> )	
11 + n·16	U1	freqId	-	-	Only used for GLONASS: This is the frequency slot + 7 (range from 0 to 13)	
12 + n·16	I2	prRes	0.1	m	Pseudorange residual	
14 + n·16	U1	cno	-	dBHz	Carrier-to-noise density ratio (signal strength)	
15 + n·16	U1	qualityInd	-	-	Signal quality indicator: <ul style="list-style-type: none"> <li>• 0 = no signal</li> <li>• 1 = searching signal</li> <li>• 2 = signal acquired</li> <li>• 3 = signal detected but unusable</li> <li>• 4 = code locked and time synchronized</li> <li>• 5, 6, 7 = code and carrier locked and time synchronized</li> </ul>	
16 + n·16	U1	corrSource	-	-	Correction source: <ul style="list-style-type: none"> <li>• 0 = no corrections</li> <li>• 1 = SBAS corrections</li> <li>• 2 = BeiDou corrections</li> <li>• 3 = RTCM2 corrections</li> <li>• 4 = RTCM3 OSR corrections</li> <li>• 5 = RTCM3 SSR corrections</li> <li>• 6 = QZSS SLAS corrections</li> <li>• 7 = SPARTN corrections</li> <li>• 8 = CLAS corrections</li> </ul>	
17 + n·16	U1	ionoModel	-	-	Ionospheric model used: <ul style="list-style-type: none"> <li>• 0 = no model</li> <li>• 1 = Klobuchar model transmitted by GPS</li> <li>• 2 = SBAS model</li> <li>• 3 = Klobuchar model transmitted by BeiDou</li> <li>• 8 = Iono delay derived from dual frequency observations</li> </ul>	
18 + n·16	X2	sigFlags	-	-	Signal related flags	
	bits 1...0 U <sub>2</sub>	health	-	-	Signal health flag: <ul style="list-style-type: none"> <li>• 0 = unknown</li> <li>• 1 = healthy</li> <li>• 2 = unhealthy</li> </ul>	



bit 2	U:1	prSmoothed	-	-	1 = Pseudorange has been smoothed
bit 3	U:1	prUsed	-	-	1 = Pseudorange has been used for this signal
bit 4	U:1	crUsed	-	-	1 = Carrier range has been used for this signal
bit 5	U:1	doUsed	-	-	1 = Range rate (Doppler) has been used for this signal
bit 6	U:1	prCorrUsed	-	-	1 = Pseudorange corrections have been used for this signal
bit 7	U:1	crCorrUsed	-	-	1 = Carrier range corrections have been used for this signal
bit 8	U:1	doCorrUsed	-	-	1 = Range rate (Doppler) corrections have been used for this signal
bit 9	U:1	authStatus	-	-	Authentication status of the navigation data used to compute the satellite's position in current navigation epoch. If the authentication fails, the navigation data is not used so the authentication status in this message can take only two values: <ul style="list-style-type: none"> <li>• 0 = Unknown</li> <li>• 1 = Authenticated</li> </ul> Note that currently the only data authentication function is provided by Galileo Open Service Navigation Message Authentication (OSNMA) protocol for E1 I/NAV message.
20 + n·16	U1[4]	reserved1	-	-	Reserved

*End of repeated group (numSigs times)*

### 3.14.13 UBX-NAV-STATUS (0x01 0x03)

#### 3.14.13.1 Receiver navigation status

<b>Message</b>	<b>UBX-NAV-STATUS</b>					
	<b>Receiver navigation status</b>					
<i>Type</i>	Periodic/pollled					
<i>Comment</i>	See important comments concerning the validity of the position given in section Navigation output filters in the Integration manual.					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x01	0x03	16	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. For details, see section iTOW timestamps in the integration manual.	
4	U1	gpsFix	-	-	GPSfix Type, this value does <b>not</b> qualify a fix as valid and within the limits. See note on flag gpsFixOk below. <ul style="list-style-type: none"> <li>• 0x00 = no fix</li> <li>• 0x01 = dead reckoning only</li> <li>• 0x02 = 2D-fix</li> <li>• 0x03 = 3D-fix</li> <li>• 0x04 = GPS + dead reckoning combined</li> <li>• 0x05 = Time only fix</li> <li>• 0x06..0xff = reserved</li> </ul>	
5	X1	flags	-	-	Navigation Status Flags	

	bit 0	U:1	gpsFixOk	-	-	1 = position and velocity valid and within DOP and ACC Masks.
	bit 1	U:1	diffSoln	-	-	1 = differential corrections were applied
	bit 2	U:1	wknSet	-	-	1 = Week Number valid (for details, see section Time validity in the Integration manual)
	bit 3	U:1	towSet	-	-	1 = Time of Week valid (for details, see section Time validity in the integration manual)
6	X1		fixStat	-	-	Fix Status Information
	bit 0	U:1	diffCorr	-	-	1 = differential corrections available
	bit 1	U:1	carrSolnValid	-	-	1 = valid carrSoln
	bits 7...6	U:2	mapMatching	-	-	map matching status: <ul style="list-style-type: none"> <li>• 00: none</li> <li>• 01: valid but not used, i.e. map matching data was received, but was too old</li> <li>• 10: valid and used, map matching data was applied</li> <li>• 11: valid and used, map matching data was applied. In case of sensor unavailability map matching data enables dead reckoning. This requires map matched latitude/longitude or heading data.</li> </ul>
7	X1		flags2	-	-	further information about navigation output
	bits 1...0	U:2	psmState	-	-	power save mode state (not supported for protocol versions less than 13.01) <ul style="list-style-type: none"> <li>• 0 = ACQUISITION [or when psm disabled]</li> <li>• 1 = TRACKING</li> <li>• 2 = POWER OPTIMIZED TRACKING</li> <li>• 3 = INACTIVE</li> </ul>
	bits 4...3	U:2	spooftDetState	-	-	Spoofing detection state (not supported for protocol versions less than 18.00) <ul style="list-style-type: none"> <li>• 0: Unknown or deactivated</li> <li>• 1: No spoofing indicated</li> <li>• 2: Spoofing indicated</li> <li>• 3: Multiple spoofing indications</li> </ul> Note that the spoofing state value only reflects the detector state for the current navigation epoch. As spoofing can be detected most easily at the transition from real signal to spoofing signal, this is also where the detector is triggered the most. I.e. a value of 1 - <i>No spoofing indicated</i> does not mean that the receiver is not spoofed, it simply states that the detector was not triggered in this epoch.
	bits 7...6	U:2	carrSoln	-	-	Carrier phase range solution status: <ul style="list-style-type: none"> <li>• 0 = no carrier phase range solution</li> <li>• 1 = carrier phase range solution with floating ambiguities</li> </ul>

- 2 = carrier phase range solution with fixed ambiguities

8	U4	ttff	-	ms	Time to first fix (millisecond time tag)
12	U4	msss	-	ms	Milliseconds since startup / reset

### 3.14.14 UBX-NAV-TIMEBDS (0x01 0x24)

#### 3.14.14.1 BeiDou time solution

<b>Message</b>	<b>UBX-NAV-TIMEBDS</b>					
	<b>BeiDou time solution</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	This message reports the precise BDS time of the most recent navigation solution including validity flags and an accuracy estimate.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	
	0xb5 0x62	0x01	0x24	20	see below	
					CK_A CK_B	
<b>Payload description:</b>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U4	SOW	-	s	BDS time of week (rounded to seconds)	
8	I4	fSOW	-	ns	Fractional part of SOW (range: +/-500000000). The precise BDS time of week in seconds is: $SOW + fSOW * 1e-9$	
12	I2	week	-	-	BDS week number of the navigation epoch	
14	I1	leaps	-	s	BDS leap seconds (BDS-UTC)	
15	X1	valid	-	-	Validity Flags	
	bit 0	U:1	sowValid	-	-	1 = Valid SOW and fSOW (see section Time validity in the integration manual for details)
	bit 1	U:1	weekValid	-	-	1 = Valid week (see section Time validity in the integration manual for details)
	bit 2	U:1	leapSValid	-	-	1 = Valid leap second
16	U4	tAcc	-	ns	Time Accuracy Estimate	

### 3.14.15 UBX-NAV-TIMEGAL (0x01 0x25)

#### 3.14.15.1 Galileo time solution

<b>Message</b>	<b>UBX-NAV-TIMEGAL</b>				
	<b>Galileo time solution</b>				
<b>Type</b>	Periodic/pollled				
<b>Comment</b>	This message reports the precise Galileo time of the most recent navigation solution including validity flags and an accuracy estimate.				
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>
	0xb5 0x62	0x01	0x25	20	see below
					CK_A CK_B
<b>Payload description:</b>					
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>

0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U4	galTow	-	s	Galileo time of week (rounded to seconds)	
8	I4	fGalTow	-	ns	Fractional part of the Galileo time of week (range: +/-500000000). The precise Galileo time of week in seconds is: $galTow + fGalTow * 1e-9$	
12	I2	galWno	-	-	Galileo week number	
14	I1	leapS	-	s	Galileo leap seconds (Galileo-UTC)	
15	X1	valid	-	-	Validity Flags	
	bit 0	U:1	galTowValid	-	-	1 = Valid galTow and fGalTow (see section Time validity in the integration manual for details)
	bit 1	U:1	galWnoValid	-	-	1 = Valid galWno (see section Time validity in the integration manual for details)
	bit 2	U:1	leapSValid	-	-	1 = Valid leapS
16	U4	tAcc	-	ns	Time Accuracy Estimate	

### 3.14.16 UBX-NAV-TIMEGLO (0x01 0x23)

#### 3.14.16.1 GLONASS time solution

<b>Message</b>	<b>UBX-NAV-TIMEGLO GLONASS time solution</b>					
Type	Periodic/pollled					
Comment	This message reports the precise GLO time of the most recent navigation solution including validity flags and an accuracy estimate.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x23	20	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U4	TOD	-	s	GLONASS time of day (rounded to integer seconds)	
8	I4	fTOD	-	ns	Fractional part of TOD (range: +/-500000000). The precise GLONASS time of day in seconds is: $TOD + fTOD * 1e-9$	
12	U2	Nt	-	days	Current date (range: 1-1461), starting at 1 from the 1st Jan of the year indicated by N4 and ending at 1461 at the 31st Dec of the third year after that indicated by N4	
14	U1	N4	-	-	Four-year interval number starting from 1996 (1=1996, 2=2000, 3=2004...)	
15	X1	valid	-	-	Validity flags	
	bit 0	U:1	todValid	-	-	1 = Valid TOD and fTOD (see section Time validity in the integration manual for details)
	bit 1	U:1	dateValid	-	-	1 = Valid N4 and Nt (see section Time validity in the integration manual for details)

16	U4	tAcc	-	ns	Time Accuracy Estimate
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### 3.14.17 UBX-NAV-TIMEGPS (0x01 0x20)

#### 3.14.17.1 GPS time solution

<b>Message</b>		<b>UBX-NAV-TIMEGPS</b>				
		<b>GPS time solution</b>				
Type	Periodic/pollled					
Comment	This message reports the precise GPS time of the most recent navigation solution including validity flags and an accuracy estimate.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x20	16	see below	CK_A CK_B
<i>Payload description:</i>						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	I4	fTOW	-	ns	Fractional part of iTOW (range: +/-500000). The precise GPS time of week in seconds is: $(iTOW * 1e-3) + (fTOW * 1e-9)$	
8	I2	week	-	-	GPS week number of the navigation epoch	
10	I1	leaps	-	s	GPS leap seconds (GPS-UTC)	
11	X1	valid	-	-	Validity Flags	
	bit 0	U:1	towValid	-	-	1 = Valid GPS time of week (iTOW & fTOW, (see section Time validity in the integration manual for details)
	bit 1	U:1	weekValid	-	-	1 = Valid GPS week number (see section Time validity in the integration manual for details)
	bit 2	U:1	leapsValid	-	-	1 = Valid GPS leap seconds
12	U4	tAcc	-	ns	Time Accuracy Estimate	

### 3.14.18 UBX-NAV-TIMELS (0x01 0x26)

#### 3.14.18.1 Leap second event information

<b>Message</b>		<b>UBX-NAV-TIMELS</b>				
		<b>Leap second event information</b>				
Type	Periodic/pollled					
Comment	Information about the upcoming leap second event if one is scheduled. Note: Many sources of leap second information provide the week number of a leap second event as an 8-bit unsigned number. For the upcoming leap second events, this can be resolved and displayed in this message. However, for the previous leap second events decoded from these sources, there is an inherent ambiguity of 256 weeks. Therefore, when the time since the previous event is more than 256 weeks, the dateOfLsGpsWn and timeToLsEvent parameters may provide incorrect information.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x26	24	see below	CK_A CK_B
<i>Payload description:</i>						
Byte offset	Type	Name	Scale	Unit	Description	

0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U1	version	-	-	Message version (0x00 for this version)	
5	U1[3]	reserved0	-	-	<a href="#">Reserved</a>	
8	U1	srcOfCurrLs	-	-	Information source for the current number of leap seconds. <ul style="list-style-type: none"> <li>0 = Default (hardcoded in the firmware, can be outdated)</li> <li>1 = Derived from time difference between GPS and GLONASS time</li> <li>2 = GPS</li> <li>3 = SBAS</li> <li>4 = BeiDou</li> <li>5 = Galileo</li> <li>6 = Aided data</li> <li>7 = Configured</li> <li>8 = NavIC</li> <li>255 = Unknown</li> </ul>	
9	I1	currLs	-	s	Current number of leap seconds since start of GPS time (Jan 6, 1980). It reflects how much GPS time is ahead of UTC time. Galileo number of leap seconds is the same as GPS. BeiDou number of leap seconds is 14 less than GPS. GLONASS follows UTC time, so no leap seconds.	
10	U1	srcOfLsChange	-	-	Information source for the future leap second event. <ul style="list-style-type: none"> <li>0 = No source</li> <li>2 = GPS</li> <li>3 = SBAS</li> <li>4 = BeiDou</li> <li>5 = Galileo</li> <li>6 = GLONASS</li> <li>7 = NavIC</li> </ul>	
11	I1	lsChange	-	s	Future leap second change if one is scheduled. +1 = positive leap second, -1 = negative leap second, 0 = no future leap second event scheduled or no information available. If the value is 0, then the amount of leap seconds did not change and the event should be ignored.	
12	I4	timeToLsEvent	-	s	Number of seconds until the next leap second event, or from the last leap second event if no future event scheduled. If > 0 event is in the future, = 0 event is now, < 0 event is in the past. Valid only if validTimeToLsEvent = 1.	
16	U2	dateOfLsGps Wn	-	-	GPS week number (WN) of the next leap second event or the last one if no future event scheduled. Valid only if validTimeToLsEvent = 1.	
18	U2	dateOfLsGps Dn	-	-	GPS day of week number (DN) for the next leap second event or the last one if no future event scheduled. Valid only if validTimeToLsEvent = 1. (GPS and Galileo DN: from 1 = Sun to 7 = Sat. BeiDou DN: from 0 = Sun to 6 = Sat.)	
20	U1[3]	reserved1	-	-	<a href="#">Reserved</a>	
23	X1	valid	-	-	Validity flags	
	bit 0	U:1	validCurrLs	-	-	1 = Valid current number of leap seconds value.

bit 1	U:1	validTimeToLs Event	-	-	1 = Valid time to next leap second event or from the last leap second event if no future event scheduled.
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### 3.14.19 UBX-NAV-TIMENAVIC (0x01 0x63)

#### 3.14.19.1 NavIC time solution

<b>Message</b>		<b>UBX-NAV-TIMENAVIC</b>				
		<b>NavIC time solution</b>				
<i>Type</i>	Periodic/pollled					
<i>Comment</i>	This message reports the precise NavIC time of the most recent navigation solution including validity flags and an accuracy estimate.					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x01	0x63	20	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U4	NavICTow	-	s	NavIC time of week (rounded to seconds)	
8	I4	fNavICTow	-	ns	Fractional part of the NavIC time of week (range: +/-500000000). The precise NavIC time of week in seconds is: $NavICTow + fNavICTow * 1e-9$	
12	I2	NavICWno	-	-	NavIC week number	
14	I1	leapS	-	s	NavIC leap seconds (NavIC-UTC)	
15	X1	valid	-	-	Validity Flags	
	bit 0	U:1	NavICTow Valid	-	-	1 = Valid NavICTow and fNavICTow (see section Time validity in the integration manual for details)
	bit 1	U:1	NavICWno Valid	-	-	1 = Valid NavICWno (see section Time validity in the integration manual for details)
	bit 2	U:1	leapSValid	-	-	1 = Valid leapS
16	U4	tAcc	-	ns	Time Accuracy Estimate	

### 3.14.20 UBX-NAV-TIMEQZSS (0x01 0x27)

#### 3.14.20.1 QZSS time solution

<b>Message</b>		<b>UBX-NAV-TIMEQZSS</b>				
		<b>QZSS time solution</b>				
<i>Type</i>	Periodic/pollled					
<i>Comment</i>	This message reports the precise QZSS time of the most recent navigation solution including validity flags and an accuracy estimate. See the Clocks and time section in the integration manual for details.					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x01	0x27	20	see below	CK_A CK_B
<i>Payload description:</i>						

Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch.	
4	U4	qzssTow	-	s	QZSS time of week (rounded to seconds)	
8	I4	fQzssTow	-	ns	Fractional part of QZSS time of week (range: +/-500000000). The precise QZSS time of week in seconds is: $qzssTow + (fQzssTow * 1e-9)$	
12	I2	qzssWno	-	-	QZSS week number of the navigation epoch	
14	I1	leapS	-	s	QZSS leap seconds (QZSS-UTC)	
15	X1	valid	-	-	Validity Flags	
	bit 0	U <sub>:1</sub>	qzssTowValid	-	-	1 = Valid QZSS time of week (qzssTow and fQzssTow)
	bit 1	U <sub>:1</sub>	qzssWnoValid	-	-	1 = Valid QZSS week number
	bit 2	U <sub>:1</sub>	leapSValid	-	-	1 = Valid QZSS leap seconds
16	U4	tAcc	-	ns	Time Accuracy Estimate	

### 3.14.21 UBX-NAV-TIMEUTC (0x01 0x21)

#### 3.14.21.1 UTC time solution

Message	UBX-NAV-TIMEUTC UTC time solution					
Type	Periodic/pollled					
Comment	Note that during a leap second there may be more or less than 60 seconds in a minute. See the description of leap seconds in the integration manual for details.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x01	0x21	20	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U4	tAcc	-	ns	Time accuracy estimate (UTC)	
8	I4	nano	-	ns	Fraction of second, range -1e9 .. 1e9 (UTC)	
12	U2	year	-	y	Year, range 1999..2099 (UTC)	
14	U1	month	-	month	Month, range 1..12 (UTC)	
15	U1	day	-	d	Day of month, range 1..31 (UTC)	
16	U1	hour	-	h	Hour of day, range 0..23 (UTC)	
17	U1	min	-	min	Minute of hour, range 0..59 (UTC)	
18	U1	sec	-	s	Seconds of minute, range 0..60 (UTC)	
19	X1	valid	-	-	Validity Flags	
	bit 0	U <sub>:1</sub>	validTOW	-	-	1 = Valid Time of Week (see section Time validity in the integration manual for details)
	bit 1	U <sub>:1</sub>	validWKN	-	-	1 = Valid Week Number (see section Time validity in the integration manual for details)
	bit 2	U <sub>:1</sub>	validUTC	-	-	1 = Valid UTC Time



bit 3	U:1	authStatus	-	-	Indicates if the parameters used to convert GNSS time into UTC time have been authenticated.
					<ul style="list-style-type: none"> <li>0 = Unknown</li> <li>1 = Authenticated</li> </ul> <p>Note that currently the only data authentication function is provided by Galileo Open Service Navigation Message Authentication (OSNMA) protocol for E1 I/NAV message. Systems other than EU UTC can be authenticated indirectly only using the above information.</p>
bits 7...4	U:4	utcStandard	-	-	UTC standard identifier. (Not supported for protocol versions less than 15.00)
					<ul style="list-style-type: none"> <li>0 = Information not available</li> <li>1 = Communications Research Laboratory (CRL), Tokyo, Japan</li> <li>2 = National Institute of Standards and Technology (NIST)</li> <li>3 = U.S. Naval Observatory (USNO)</li> <li>4 = International Bureau of Weights and Measures (BIPM)</li> <li>5 = European laboratories</li> <li>6 = Former Soviet Union (SU)</li> <li>7 = National Time Service Center (NTSC), China</li> <li>8 = National Physics Laboratory India (NPLI)</li> <li>15 = Unknown</li> </ul>

### 3.14.22 UBX-NAV-VELECEF (0x01 0x11)

#### 3.14.22.1 Velocity solution in ECEF

<b>Message</b>	<b>UBX-NAV-VELECEF</b>					
	<b>Velocity solution in ECEF</b>					
<i>Type</i>	Periodic/pollled					
<i>Comment</i>	See important comments concerning validity of position given in section Navigation output filters in the integration manual.					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x01	0x11	20	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	I4	ecefVX	-	cm/s	ECEF X velocity	
8	I4	ecefVY	-	cm/s	ECEF Y velocity	
12	I4	ecefVZ	-	cm/s	ECEF Z velocity	
16	U4	sAcc	-	cm/s	Speed accuracy estimate	

### 3.14.23 UBX-NAV-VELNED (0x01 0x12)

### 3.14.23.1 Velocity solution in NED frame

<b>Message</b>	<b>UBX-NAV-VELNED</b>					
	<b>Velocity solution in NED frame</b>					
<i>Type</i>	Periodic/pollled					
<i>Comment</i>	See important comments concerning validity of position given in section Navigation output filters in the integration manual.					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x01	0x12	36	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	I4	velN	-	cm/s	North velocity component	
8	I4	velE	-	cm/s	East velocity component	
12	I4	velD	-	cm/s	Down velocity component	
16	U4	speed	-	cm/s	Speed (3-D)	
20	U4	gSpeed	-	cm/s	Ground speed (2-D)	
24	I4	heading	1e-5	deg	Heading of motion 2-D	
28	U4	sAcc	-	cm/s	Speed accuracy Estimate	
32	U4	cAcc	1e-5	deg	Course / Heading accuracy estimate	

## 3.15 UBX-NAV2 (0x29)

The messages in the UBX-NAV2 class are used to output navigation results and data, such as position, altitude and velocity in a number of formats, and status flags and accuracy estimate figures, or satellite and signal information. The messages are generated with the configured navigation rate.

### 3.15.1 UBX-NAV2-CLOCK (0x29 0x22)

#### 3.15.1.1 Clock solution

<b>Message</b>	<b>UBX-NAV2-CLOCK</b>					
	<b>Clock solution</b>					
<i>Type</i>	Periodic/pollled					
<i>Comment</i>						
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x29	0x22	20	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section Navigation epochs in the integration manual for details. See section iTOW timestamps in the integration manual for details.	
4	I4	clkB	-	ns	Clock bias	
8	I4	clkD	-	ns/s	Clock drift	

12	U4	tAcc	-	ns	Time accuracy estimate
16	U4	fAcc	-	ps/s	Frequency accuracy estimate

### 3.15.2 UBX-NAV2-COV (0x29 0x36)

#### 3.15.2.1 Covariance matrices

Message	UBX-NAV2-COV					
	Covariance matrices					
Type	Periodic/pollled					
Comment	This message outputs the covariance matrices for the position and velocity solutions in the topocentric coordinate system defined as the local-level North (N), East (E), Down (D) frame. As the covariance matrices are symmetric, only the upper triangular part is output.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x36	64	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U1	version	-	-	Message version (0x00 for this version)	
5	U1	posCovValid	-	-	Position covariance matrix validity flag	
6	U1	velCovValid	-	-	Velocity covariance matrix validity flag	
7	U1[9]	reserved0	-	-	Reserved	
16	R4	posCovNN	-	m <sup>2</sup>	Position covariance matrix value p <sub>NN</sub>	
20	R4	posCovNE	-	m <sup>2</sup>	Position covariance matrix value p <sub>NE</sub>	
24	R4	posCovND	-	m <sup>2</sup>	Position covariance matrix value p <sub>ND</sub>	
28	R4	posCovEE	-	m <sup>2</sup>	Position covariance matrix value p <sub>EE</sub>	
32	R4	posCovED	-	m <sup>2</sup>	Position covariance matrix value p <sub>ED</sub>	
36	R4	posCovDD	-	m <sup>2</sup>	Position covariance matrix value p <sub>DD</sub>	
40	R4	velCovNN	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>NN</sub>	
44	R4	velCovNE	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>NE</sub>	
48	R4	velCovND	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>ND</sub>	
52	R4	velCovEE	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>EE</sub>	
56	R4	velCovED	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>ED</sub>	
60	R4	velCovDD	-	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v <sub>DD</sub>	

### 3.15.3 UBX-NAV2-DOP (0x29 0x04)

#### 3.15.3.1 Dilution of precision

Message	UBX-NAV2-DOP				
	Dilution of precision				
Type	Periodic/pollled				
Comment	<ul style="list-style-type: none"> <li>DOP values are dimensionless.</li> <li>All DOP values are scaled by a factor of 100. If the unit transmits a value of e.g. 156, the DOP value is 1.56.</li> </ul>				

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x04	18	see below	CK_A CK_B

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.
4	U2	gDOP	0.01	-	Geometric DOP
6	U2	pDOP	0.01	-	Position DOP
8	U2	tDOP	0.01	-	Time DOP
10	U2	vDOP	0.01	-	Vertical DOP
12	U2	hDOP	0.01	-	Horizontal DOP
14	U2	nDOP	0.01	-	Northing DOP
16	U2	eDOP	0.01	-	Easting DOP

### 3.15.4 UBX-NAV2-EOE (0x29 0x61)

#### 3.15.4.1 End of epoch

Message	UBX-NAV2-EOE End of epoch					
Type	Periodic					
Comment						

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x61	4	see below	CK_A CK_B

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.

### 3.15.5 UBX-NAV2-POSECEF (0x29 0x01)

#### 3.15.5.1 Position solution in ECEF

Message	UBX-NAV2-POSECEF Position solution in ECEF					
Type	Periodic/pollled					
Comment	See important comments concerning validity of position given in section Navigation output filters in the integration manual.					

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x01	20	see below	CK_A CK_B

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.
4	I4	ecefX	-	cm	ECEF X coordinate

8	I4	ecefY	-	cm	ECEF Y coordinate
12	I4	ecefZ	-	cm	ECEF Z coordinate
16	U4	pAcc	-	cm	Position Accuracy Estimate

### 3.15.6 UBX-NAV2-POSLLH (0x29 0x02)

#### 3.15.6.1 Geodetic position solution

<b>Message</b>	<b>UBX-NAV2-POSLLH</b>					
	<b>Geodetic position solution</b>					
Type	Periodic/pollled					
Comment	See important comments concerning validity of position given in section Navigation output filters in the integration manual. This message outputs the Geodetic position in the currently selected ellipsoid. The default is the WGS84 Ellipsoid, but can be changed with the message <a href="#">CFG-NAVSPG-USE_USRDAT</a> .					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x02	28	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	I4	lon	1e-7	deg	Longitude	
8	I4	lat	1e-7	deg	Latitude	
12	I4	height	-	mm	Height above ellipsoid	
16	I4	hMSL	-	mm	Height above mean sea level	
20	U4	hAcc	-	mm	Horizontal accuracy estimate	
24	U4	vAcc	-	mm	Vertical accuracy estimate	

### 3.15.7 UBX-NAV2-PVT (0x29 0x07)

#### 3.15.7.1 Navigation position velocity time solution

<b>Message</b>	<b>UBX-NAV2-PVT</b>					
	<b>Navigation position velocity time solution</b>					
Type	Periodic/pollled					
Comment	This message combines position, velocity and time solution, including accuracy figures. Note that during a leap second there may be more or less than 60 seconds in a minute. See description of leap seconds in the integration manual for details.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x07	92	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U2	year	-	y	Year (UTC)	
6	U1	month	-	month	Month, range 1..12 (UTC)	

7	U1	day	-	d	Day of month, range 1..31 (UTC)	
8	U1	hour	-	h	Hour of day, range 0..23 (UTC)	
9	U1	min	-	min	Minute of hour, range 0..59 (UTC)	
10	U1	sec	-	s	Seconds of minute, range 0..60 (UTC)	
11	X1	valid	-	-	Validity flags	
	bit 0	U <sub>:1</sub>	validDate	-	-	1 = valid UTC Date (see section Time validity in the integration manual for details)
	bit 1	U <sub>:1</sub>	validTime	-	-	1 = valid UTC time of day (see section Time validity in the integration manual for details)
	bit 2	U <sub>:1</sub>	fullyResolved	-	-	1 = UTC time of day has been fully resolved (no seconds uncertainty). Cannot be used to check if time is completely solved.
	bit 3	U <sub>:1</sub>	validMag	-	-	1 = valid magnetic declination
12	U4	tAcc	-	ns	Time accuracy estimate (UTC)	
16	I4	nano	-	ns	Fraction of second, range -1e9 .. 1e9 (UTC)	
20	U1	fixType	-	-	GNSSfix Type: <ul style="list-style-type: none"> <li>• 0 = no fix</li> <li>• 1 = dead reckoning only</li> <li>• 2 = 2D-fix</li> <li>• 3 = 3D-fix</li> <li>• 4 = GNSS + dead reckoning combined</li> <li>• 5 = time only fix</li> </ul>	
21	X1	flags	-	-	Fix status flags	
	bit 0	U <sub>:1</sub>	gnssFixOK	-	-	1 = valid fix (i.e within DOP & accuracy masks)
	bit 1	U <sub>:1</sub>	diffSoln	-	-	1 = differential corrections were applied
	bits 4...2	U <sub>:3</sub>	psmState	-	-	Power save mode state (see Power management section in the integration manual for details). <ul style="list-style-type: none"> <li>• 0 = PSM is not active</li> <li>• 1 = Enabled (an intermediate state before Acquisition state)</li> <li>• 2 = Acquisition</li> <li>• 3 = Tracking</li> <li>• 4 = Power Optimized Tracking</li> <li>• 5 = Inactive</li> </ul>
	bit 5	U <sub>:1</sub>	headVehValid	-	-	1 = heading of vehicle is valid, only set if the receiver is in sensor fusion mode
	bits 7...6	U <sub>:2</sub>	carrSoln	-	-	Carrier phase range solution status: <ul style="list-style-type: none"> <li>• 0 = no carrier phase range solution</li> <li>• 1 = carrier phase range solution with floating ambiguities</li> <li>• 2 = carrier phase range solution with fixed ambiguities</li> </ul> (not supported for protocol versions less than 20.00)
22	X1	flags2	-	-	Additional flags	
	bit 5	U <sub>:1</sub>	confirmedAvai	-	-	1 = information about UTC Date and Time of Day validity confirmation is available (see section Time validity in the integration manual for details)

This flag is only supported in [Protocol Versions 19.00, 19.10, 20.10, 20.20, 20.30, 22.00, 23.00, 23.01, 27 and 28](#).

bit 6	U:1	confirmedDate	-	-	1 = UTC Date validity could be confirmed (see section Time validity in the integration manual for details)
bit 7	U:1	confirmedTime	-	-	1 = UTC Time of Day could be confirmed (see section Time validity in the integration manual for details)
23	U1	numSV	-	-	Number of satellites used in Nav Solution
24	I4	lon	1e-7	deg	Longitude
28	I4	lat	1e-7	deg	Latitude
32	I4	height	-	mm	Height above ellipsoid
36	I4	hMSL	-	mm	Height above mean sea level
40	U4	hAcc	-	mm	Horizontal accuracy estimate
44	U4	vAcc	-	mm	Vertical accuracy estimate
48	I4	velN	-	mm/s	NED north velocity
52	I4	velE	-	mm/s	NED east velocity
56	I4	velD	-	mm/s	NED down velocity
60	I4	gSpeed	-	mm/s	Ground Speed (2-D)
64	I4	headMot	1e-5	deg	Heading of motion (2-D)
68	U4	sAcc	-	mm/s	Speed accuracy estimate
72	U4	headAcc	1e-5	deg	Heading accuracy estimate (both motion and vehicle)
76	U2	pDOP	0.01	-	Position DOP
78	X2	flags3	-	-	Additional flags
bit 0	U:1	invalidLlh	-	-	1 = Invalid lon, lat, height and hMSL (applicable to heading products only)
bits 4...1	U:4	lastCorrection Age	-	-	Age of the most recently received differential correction: <ul style="list-style-type: none"> <li>0 = Not available</li> <li>1 = Age between 0 and 1 second</li> <li>2 = Age between 1 (inclusive) and 2 seconds</li> <li>3 = Age between 2 (inclusive) and 5 seconds</li> <li>4 = Age between 5 (inclusive) and 10 seconds</li> <li>5 = Age between 10 (inclusive) and 15 seconds</li> <li>6 = Age between 15 (inclusive) and 20 seconds</li> <li>7 = Age between 20 (inclusive) and 30 seconds</li> <li>8 = Age between 30 (inclusive) and 45 seconds</li> <li>9 = Age between 45 (inclusive) and 60 seconds</li> <li>10 = Age between 60 (inclusive) and 90 seconds</li> <li>11 = Age between 90 (inclusive) and 120 seconds</li> <li>&gt;=12 = Age greater or equal than 120 seconds</li> </ul>
bit 13	U:1	authTime	-	-	Flag that indicates if the output time has been validated against an external trusted time source <ul style="list-style-type: none"> <li>0 = Time is not authenticated</li> <li>1 = Time is authenticated</li> </ul>
bit 14	U:1	nmaFixStatus	-	-	Flag assigned to a fix that has been computed mixing satellites with data authenticated through

Navigation Message Authentication (NMA) methods and satellites using unauthenticated data. The fix is flagged as Verified when internal cross-checks validates the unauthenticated signals against the authenticated ones. Note that Not Verified status does not imply directly spoofing attacks, to identify spoofing alerts refer to [UBX-SEC-SIG](#).

- 0 = Not Verified: The mixed solution does not agree with the NMA authenticated data or the comparison could not be performed, e.g., not enough authenticated SVs to extrapolate the result or cryptographic data not decoded yet
- 1 = Verified: The mixed solution agrees with the NMA authenticated data

Currently, the only existing NMA method is Galileo Open Service Navigation Message Authentication (OSNMA) protocol.

80	U1[4]	reserved0	-	-	Reserved
84	I4	headVeh	1e-5	deg	Heading of vehicle (2-D), this is only valid when headVehValid is set, otherwise the output is set to the heading of motion
88	I2	magDec	1e-2	deg	Magnetic declination. Only supported in ADR 4.10 and later.
90	U2	magAcc	1e-2	deg	Magnetic declination accuracy. Only supported in ADR 4.10 and later.

### 3.15.8 UBX-NAV2-SAT (0x29 0x35)

#### 3.15.8.1 Satellite information

Message	UBX-NAV2-SAT Satellite information					
Type	Periodic/polled					
Comment	This message displays information about SVs that are either known to be visible or currently tracked by the receiver. All signal related information corresponds to the subset of signals specified in <a href="#">Signal Identifiers</a> .					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x35	8 + numSvs*12	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U1	version	-	-	Message version (0x01 for this version)	
5	U1	numSvs	-	-	Number of satellites	
6	U1[2]	reserved0	-	-	Reserved	
Start of repeated group (numSvs times)						
8 + n*12	U1	gnssId	-	-	GNSS identifier (see <a href="#">Satellite Numbering</a> ) for assignment	
9 + n*12	U1	svId	-	-	Satellite identifier (see <a href="#">Satellite Numbering</a> ) for assignment	



10 + n·12	U1	cno	-	dBHz	Carrier to noise ratio (signal strength)
11 + n·12	I1	elev	-	deg	Elevation (range: +/-90), unknown if out of range
12 + n·12	I2	azim	-	deg	Azimuth (range 0-360), unknown if elevation is out of range
14 + n·12	I2	prRes	0.1	m	Pseudorange residual
16 + n·12	X4	flags	-	-	Bitmask
bits 2...0	U:3	qualityInd	-	-	Signal quality indicator: <ul style="list-style-type: none"> <li>• 0 = no signal</li> <li>• 1 = searching signal</li> <li>• 2 = signal acquired</li> <li>• 3 = signal detected but unusable</li> <li>• 4 = code locked and time synchronized</li> <li>• 5, 6, 7 = code and carrier locked and time synchronized</li> </ul>
bit 3	U:1	svUsed	-	-	1 = Signal in the subset specified in <a href="#">Signal Identifiers</a> is currently being used for navigation
bits 5...4	U:2	health	-	-	Signal health flag: <ul style="list-style-type: none"> <li>• 0 = unknown</li> <li>• 1 = healthy</li> <li>• 2 = unhealthy</li> </ul>
bit 6	U:1	diffCorr	-	-	1 = differential correction data is available for this SV
bit 7	U:1	smoothed	-	-	1 = carrier smoothed pseudorange used
bits 10...8	U:3	orbitSource	-	-	Orbit source: <ul style="list-style-type: none"> <li>• 0 = no orbit information is available for this SV</li> <li>• 1 = ephemeris is used</li> <li>• 2 = almanac is used</li> <li>• 3 = AssistNow Offline orbit is used</li> <li>• 4 = AssistNow Autonomous orbit is used</li> <li>• 5, 6, 7 = other orbit information is used</li> </ul>
bit 11	U:1	ephAvail	-	-	1 = ephemeris is available for this SV
bit 12	U:1	almAvail	-	-	1 = almanac is available for this SV
bit 13	U:1	anoAvail	-	-	1 = AssistNow Offline data is available for this SV
bit 14	U:1	aopAvail	-	-	1 = AssistNow Autonomous data is available for this SV
bit 16	U:1	sbasCorrUsed	-	-	1 = SBAS corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 17	U:1	rtcmCorrUsed	-	-	1 = RTCM corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 18	U:1	slasCorrUsed	-	-	1 = QZSS SLAS corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 19	U:1	spartnCorrUsed	-	-	1 = SPARTN corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 20	U:1	prCorrUsed	-	-	1 = Pseudorange corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>

bit 21	U:1	crCorrUsed	-	-	1 = Carrier range corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 22	U:1	doCorrUsed	-	-	1 = Range rate (Doppler) corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
bit 23	U:1	clasCorrUsed	-	-	1 = CLAS corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>

End of repeated group (*numSvs* times)

### 3.15.9 UBX-NAV2-SBAS (0x29 0x32)

#### 3.15.9.1 SBAS status data

<b>Message</b>		<b>UBX-NAV2-SBAS</b>				
		<b>SBAS status data</b>				
Type	Periodic/pollled					
Comment	This message outputs the status of the SBAS sub system					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x32	12 + cnt-12	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See the description of iTOW for details.	
4	U1	geo	-	-	PRN Number of the GEO where correction and integrity data is used from	
5	U1	mode	-	-	SBAS Mode <ul style="list-style-type: none"> <li>0 Disabled</li> <li>1 Enabled integrity</li> <li>3 Enabled test mode</li> </ul>	
6	I1	sys	-	-	SBAS System (WAAS/EGNOS/...) <ul style="list-style-type: none"> <li>-1 Unknown</li> <li>0 WAAS</li> <li>1 EGNOS</li> <li>2 MSAS</li> <li>3 GAGAN</li> <li>16 GPS</li> </ul>	
7	X1	service	-	-	SBAS Services available	
bit 0	U:1	Ranging	-	-	GEO may be used as ranging source	
bit 1	U:1	Corrections	-	-	GEO is providing correction data	
bit 2	U:1	Integrity	-	-	GEO is providing integrity	
bit 3	U:1	Testmode	-	-	GEO is in test mode	
bit 4	U:1	Bad	-	-	Problem with signal or broadcast data indicated	
8	U1	cnt	-	-	Number of SV data following	
9	X1	statusFlags	-	-	SBAS status flags	
bits 1...0	U:2	integrityUsed	-	-	SBAS integrity used <ul style="list-style-type: none"> <li>0 = Unknown</li> <li>1 = Integrity information is not available or SBAS integrity is not enabled</li> </ul>	

- 2 = Receiver uses only GPS satellites for which integrity information is available

10	U1[2]	reserved0	-	-	Reserved
<i>Start of repeated group (cnt times)</i>					
12 + n·12	U1	svid	-	-	SV ID
13 + n·12	U1	reserved1	-	-	Reserved
14 + n·12	U1	udre	-	-	Monitoring status
15 + n·12	U1	svSys	-	-	System (WAAS/EGNOS/...) same as SYS
16 + n·12	U1	svService	-	-	Services available same as SERVICE
17 + n·12	U1	reserved2	-	-	Reserved
18 + n·12	I2	prc	-	cm	Pseudo Range correction in [cm]
20 + n·12	U1[2]	reserved3	-	-	Reserved
22 + n·12	I2	ic	-	cm	Ionosphere correction in [cm]
<i>End of repeated group (cnt times)</i>					

### 3.15.10 UBX-NAV2-SIG (0x29 0x43)

#### 3.15.10.1 Signal information

<b>Message</b>	<b>UBX-NAV2-SIG</b> <b>Signal information</b>					
<i>Type</i>	Periodic/pollled					
<i>Comment</i>	This message displays information about signals currently tracked or searched by the receiver.					
<i>Message structure</i>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x29	0x43	8 + numSigs·16	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U1	version	-	-	Message version (0x00 for this version)	
5	U1	numSigs	-	-	Number of signals	
6	U1[2]	reserved0	-	-	Reserved	
<i>Start of repeated group (numSigs times)</i>						
8 + n·16	U1	gnssId	-	-	GNSS identifier (see <a href="#">Satellite Numbering</a> ) for assignment	
9 + n·16	U1	svId	-	-	Satellite identifier (see <a href="#">Satellite Numbering</a> ) for assignment	
10 + n·16	U1	sigId	-	-	New style signal identifier (see <a href="#">Signal Identifiers</a> )	
11 + n·16	U1	freqId	-	-	Only used for GLONASS: This is the frequency slot + 7 (range from 0 to 13)	
12 + n·16	I2	prRes	0.1	m	Pseudorange residual	
14 + n·16	U1	cno	-	dBHz	Carrier-to-noise density ratio (signal strength)	

15 + n·16	U1	qualityInd	-	-	Signal quality indicator: <ul style="list-style-type: none"> <li>0 = no signal</li> <li>1 = searching signal</li> <li>2 = signal acquired</li> <li>3 = signal detected but unusable</li> <li>4 = code locked and time synchronized</li> <li>5, 6, 7 = code and carrier locked and time synchronized</li> </ul>
16 + n·16	U1	corrSource	-	-	Correction source: <ul style="list-style-type: none"> <li>0 = no corrections</li> <li>1 = SBAS corrections</li> <li>2 = BeiDou corrections</li> <li>3 = RTCM2 corrections</li> <li>4 = RTCM3 OSR corrections</li> <li>5 = RTCM3 SSR corrections</li> <li>6 = QZSS SLAS corrections</li> <li>7 = SPARTN corrections</li> <li>8 = CLAS corrections</li> </ul>
17 + n·16	U1	ionoModel	-	-	Ionospheric model used: <ul style="list-style-type: none"> <li>0 = no model</li> <li>1 = Klobuchar model transmitted by GPS</li> <li>2 = SBAS model</li> <li>3 = Klobuchar model transmitted by BeiDou</li> <li>8 = Iono delay derived from dual frequency observations</li> </ul>
18 + n·16	X2	sigFlags	-	-	Signal related flags
	bits 1...0 U:2	health	-	-	Signal health flag: <ul style="list-style-type: none"> <li>0 = unknown</li> <li>1 = healthy</li> <li>2 = unhealthy</li> </ul>
	bit 2 U:1	prSmoothed	-	-	1 = Pseudorange has been smoothed
	bit 3 U:1	prUsed	-	-	1 = Pseudorange has been used for this signal
	bit 4 U:1	crUsed	-	-	1 = Carrier range has been used for this signal
	bit 5 U:1	doUsed	-	-	1 = Range rate (Doppler) has been used for this signal
	bit 6 U:1	prCorrUsed	-	-	1 = Pseudorange corrections have been used for this signal
	bit 7 U:1	crCorrUsed	-	-	1 = Carrier range corrections have been used for this signal
	bit 8 U:1	doCorrUsed	-	-	1 = Range rate (Doppler) corrections have been used for this signal
	bit 9 U:1	authStatus	-	-	Authentication status of the navigation data used to compute the satellite's position in current navigation epoch. If the authentication fails, the navigation data is not used so the authentication status in this message can take only two values: <ul style="list-style-type: none"> <li>0 = Unknown</li> <li>1 = Authenticated</li> </ul> <p>Note that currently the only data authentication function is provided by Galileo Open Service Navigation Message Authentication (OSNMA) protocol for E1 I/NAV message.</p>

20 + n·16    U1[4]    reserved1    -    -    Reserved

End of repeated group (*numSigs* times)

### 3.15.11 UBX-NAV2-STATUS (0x29 0x03)

#### 3.15.11.1 Receiver navigation status

<b>Message</b>		<b>UBX-NAV2-STATUS</b>				
		<b>Receiver navigation status</b>				
Type	Periodic/pollled					
Comment	See important comments concerning the validity of the position given in section Navigation output filters in the Integration manual.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x03	16	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. For details, see section iTOW timestamps in the integration manual.	
4	U1	gpsFix	-	-	GPSfix Type, this value does <b>not</b> qualify a fix as valid and within the limits. See note on flag gpsFixOk below. <ul style="list-style-type: none"> <li>• 0x00 = no fix</li> <li>• 0x01 = dead reckoning only</li> <li>• 0x02 = 2D-fix</li> <li>• 0x03 = 3D-fix</li> <li>• 0x04 = GPS + dead reckoning combined</li> <li>• 0x05 = Time only fix</li> <li>• 0x06..0xff = reserved</li> </ul>	
5	X1	flags	-	-	Navigation Status Flags	
bit 0	U:1	gpsFixOk	-	-	1 = position and velocity valid and within DOP and ACC Masks.	
bit 1	U:1	diffSoln	-	-	1 = differential corrections were applied	
bit 2	U:1	wknSet	-	-	1 = Week Number valid (for details, see section Time validity in the Integration manual)	
bit 3	U:1	towSet	-	-	1 = Time of Week valid (for details, see section Time validity in the integration manual)	
6	X1	fixStat	-	-	Fix Status Information	
bit 0	U:1	diffCorr	-	-	1 = differential corrections available	
bit 1	U:1	carrSolnValid	-	-	1 = valid carrSoln	
bits 7...6	U:2	mapMatching	-	-	map matching status: <ul style="list-style-type: none"> <li>• 00: none</li> </ul>	
7	X1	flags2	-	-	further information about navigation output	
bits 1...0	U:2	psmState	-	-	power save mode state (not supported for protocol versions less than 13.01) <ul style="list-style-type: none"> <li>• 0 = ACQUISITION [or when psm disabled]</li> <li>• 1 = TRACKING</li> <li>• 2 = POWER OPTIMIZED TRACKING</li> <li>• 3 = INACTIVE</li> </ul>	

bits 4...3	U:2	spooofDetState	-	-	Spoofing detection state (not supported for protocol versions less than 18.00) <ul style="list-style-type: none"> <li>0: Unknown or deactivated</li> <li>1: No spoofing indicated</li> <li>2: Spoofing indicated</li> <li>3: Multiple spoofing indications</li> </ul> Note that the spoofing state value only reflects the detector state for the current navigation epoch. As spoofing can be detected most easily at the transition from real signal to spoofing signal, this is also where the detector is triggered the most. I.e. a value of 1 - <i>No spoofing indicated</i> does not mean that the receiver is not spoofed, it simply states that the detector was not triggered in this epoch.
bits 7...6	U:2	carrSoln	-	-	Carrier phase range solution status: <ul style="list-style-type: none"> <li>0 = no carrier phase range solution</li> <li>1 = carrier phase range solution with floating ambiguities</li> <li>2 = carrier phase range solution with fixed ambiguities</li> </ul>
8	U4	ttff	-	ms	Time to first fix (millisecond time tag)
12	U4	msss	-	ms	Milliseconds since startup / reset

### 3.15.12 UBX-NAV2-TIMEBDS (0x29 0x24)

#### 3.15.12.1 BeiDou time solution

<b>Message</b>	<b>UBX-NAV2-TIMEBDS</b>					
	<b>BeiDou time solution</b>					
Type	Periodic/pollled					
Comment	This message reports the precise BDS time of the most recent navigation solution including validity flags and an accuracy estimate.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x24	20	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U4	SOW	-	s	BDS time of week (rounded to seconds)	
8	I4	fSOW	-	ns	Fractional part of SOW (range: +/-500000000). The precise BDS time of week in seconds is: $SOW + fSOW * 1e-9$	
12	I2	week	-	-	BDS week number of the navigation epoch	
14	I1	leaps	-	s	BDS leap seconds (BDS-UTC)	
15	X1	valid	-	-	Validity Flags	
bit 0	U:1	sowValid	-	-	1 = Valid SOW and fSOW (see section Time validity in the integration manual for details)	

bit 1	U:1	weekValid	-	-	1 = Valid week (see section Time validity in the integration manual for details)
bit 2	U:1	leapSValid	-	-	1 = Valid leap second
16	U4	tAcc	-	ns	Time Accuracy Estimate

### 3.15.13 UBX-NAV2-TIMEGAL (0x29 0x25)

#### 3.15.13.1 Galileo time solution

<b>Message</b>	<b>UBX-NAV2-TIMEGAL</b>				
	<b>Galileo time solution</b>				
<b>Type</b>	Periodic/pollled				
<b>Comment</b>	This message reports the precise Galileo time of the most recent navigation solution including validity flags and an accuracy estimate.				
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>
	0xb5 0x62	0x29	0x25	20	see below
<i>Checksum</i>					
					CK_A CK_B
<i>Payload description:</i>					
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.
4	U4	galTow	-	s	Galileo time of week (rounded to seconds)
8	I4	fGalTow	-	ns	Fractional part of the Galileo time of week (range: +/-500000000). The precise Galileo time of week in seconds is: $galTow + fGalTow * 1e-9$
12	I2	galWno	-	-	Galileo week number
14	I1	leapS	-	s	Galileo leap seconds (Galileo-UTC)
15	X1	valid	-	-	Validity Flags
bit 0	U:1	galTowValid	-	-	1 = Valid galTow and fGalTow (see section Time validity in the integration manual for details)
bit 1	U:1	galWnoValid	-	-	1 = Valid galWno (see section Time validity in the integration manual for details)
bit 2	U:1	leapSValid	-	-	1 = Valid leapS
16	U4	tAcc	-	ns	Time Accuracy Estimate

### 3.15.14 UBX-NAV2-TIMEGLO (0x29 0x23)

#### 3.15.14.1 GLONASS time solution

<b>Message</b>	<b>UBX-NAV2-TIMEGLO</b>				
	<b>GLONASS time solution</b>				
<b>Type</b>	Periodic/pollled				
<b>Comment</b>	This message reports the precise GLO time of the most recent navigation solution including validity flags and an accuracy estimate.				
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>
	0xb5 0x62	0x29	0x23	20	see below
<i>Checksum</i>					
					CK_A CK_B
<i>Payload description:</i>					

Byte offset	Type	Name	Scale	Unit	Description
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.
4	U4	TOD	-	s	GLONASS time of day (rounded to integer seconds)
8	I4	fTOD	-	ns	Fractional part of TOD (range: +/-500000000). The precise GLONASS time of day in seconds is: $TOD + fTOD * 1e-9$
12	U2	Nt	-	days	Current date (range: 1-1461), starting at 1 from the 1st Jan of the year indicated by N4 and ending at 1461 at the 31st Dec of the third year after that indicated by N4
14	U1	N4	-	-	Four-year interval number starting from 1996 (1=1996, 2=2000, 3=2004...)
15	X1	valid	-	-	Validity flags
	bit 0 U <sub>:1</sub>	todValid	-	-	1 = Valid TOD and fTOD (see section Time validity in the integration manual for details)
	bit 1 U <sub>:1</sub>	dateValid	-	-	1 = Valid N4 and Nt (see section Time validity in the integration manual for details)
16	U4	tAcc	-	ns	Time Accuracy Estimate

### 3.15.15 UBX-NAV2-TIMEGPS (0x29 0x20)

#### 3.15.15.1 GPS time solution

Message	UBX-NAV2-TIMEGPS GPS time solution					
Type	Periodic/pollled					
Comment	This message reports the precise GPS time of the most recent navigation solution including validity flags and an accuracy estimate.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x20	16	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	I4	fTOW	-	ns	Fractional part of iTOW (range: +/-500000). The precise GPS time of week in seconds is: $(iTOW * 1e-3) + (fTOW * 1e-9)$	
8	I2	week	-	-	GPS week number of the navigation epoch	
10	I1	leapS	-	s	GPS leap seconds (GPS-UTC)	
11	X1	valid	-	-	Validity Flags	
	bit 0 U <sub>:1</sub>	towValid	-	-	1 = Valid GPS time of week (iTOW & fTOW, (see section Time validity in the integration manual for details)	
	bit 1 U <sub>:1</sub>	weekValid	-	-	1 = Valid GPS week number (see section Time validity in the integration manual for details)	
	bit 2 U <sub>:1</sub>	leapSValid	-	-	1 = Valid GPS leap seconds	



12      U4      tAcc      -      ns      Time Accuracy Estimate

### 3.15.16 UBX-NAV2-TIMELS (0x29 0x26)

#### 3.15.16.1 Leap second event information

<b>Message</b>	<b>UBX-NAV2-TIMELS</b>					
	<b>Leap second event information</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	<p>Information about the upcoming leap second event if one is scheduled.</p> <p>Note: Many sources of leap second information provide the week number of a leap second event as an 8-bit unsigned number. For the upcoming leap second events, this can be resolved and displayed in this message. However, for the previous leap second events decoded from these sources, there is an inherent ambiguity of 256 weeks. Therefore, when the time since the previous event is more than 256 weeks, the dateOfLsGpsWn and timeToLsEvent parameters may provide incorrect information.</p>					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x29	0x26	24	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U1	version	-	-	Message version (0x00 for this version)	
5	U1[3]	reserved0	-	-	<a href="#">Reserved</a>	
8	U1	srcOfCurrLs	-	-	<p>Information source for the current number of leap seconds.</p> <ul style="list-style-type: none"> <li>0 = Default (hardcoded in the firmware, can be outdated)</li> <li>1 = Derived from time difference between GPS and GLONASS time</li> <li>2 = GPS</li> <li>3 = SBAS</li> <li>4 = BeiDou</li> <li>5 = Galileo</li> <li>6 = Aided data</li> <li>7 = Configured</li> <li>8 = NavIC</li> <li>255 = Unknown</li> </ul>	
9	I1	currLs	-	s	Current number of leap seconds since start of GPS time (Jan 6, 1980). It reflects how much GPS time is ahead of UTC time. Galileo number of leap seconds is the same as GPS. BeiDou number of leap seconds is 14 less than GPS. GLONASS follows UTC time, so no leap seconds.	
10	U1	srcOfLsChange	-	-	<p>Information source for the future leap second event.</p> <ul style="list-style-type: none"> <li>0 = No source</li> <li>2 = GPS</li> <li>3 = SBAS</li> <li>4 = BeiDou</li> <li>5 = Galileo</li> <li>6 = GLONASS</li> <li>7 = NavIC</li> </ul>	

11	I1	lsChange	-	s	Future leap second change if one is scheduled. +1 = positive leap second, -1 = negative leap second, 0 = no future leap second event scheduled or no information available. If the value is 0, then the amount of leap seconds did not change and the event should be ignored.	
12	I4	timeToLsEvent	-	s	Number of seconds until the next leap second event, or from the last leap second event if no future event scheduled. If > 0 event is in the future, = 0 event is now, < 0 event is in the past. Valid only if validTimeToLsEvent = 1.	
16	U2	dateOfLsGps Wn	-	-	GPS week number (WN) of the next leap second event or the last one if no future event scheduled. Valid only if validTimeToLsEvent = 1.	
18	U2	dateOfLsGps Dn	-	-	GPS day of week number (DN) for the next leap second event or the last one if no future event scheduled. Valid only if validTimeToLsEvent = 1. (GPS and Galileo DN: from 1 = Sun to 7 = Sat. BeiDou DN: from 0 = Sun to 6 = Sat.)	
20	U1[3]	reserved1	-	-	Reserved	
23	X1	valid	-	-	Validity flags	
	bit 0	U <sub>1</sub>	validCurrLs	-	-	1 = Valid current number of leap seconds value.
	bit 1	U <sub>1</sub>	validTimeToLs Event	-	-	1 = Valid time to next leap second event or from the last leap second event if no future event scheduled.

### 3.15.17 UBX-NAV2-TIMENAVIC (0x29 0x63)

#### 3.15.17.1 NavIC time solution

<b>Message</b>	<b>UBX-NAV2-TIMENAVIC</b>					
	<b>NavIC time solution</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	This message reports the precise NavIC time of the most recent navigation solution including validity flags and an accuracy estimate.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x29	0x63	20	see below	CK_A CK_B
<b>Payload description:</b>						
<b>Byte offset</b>	<b>Type</b>	<b>Name</b>	<b>Scale</b>	<b>Unit</b>	<b>Description</b>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U4	NavICTow	-	s	NavIC time of week (rounded to seconds)	
8	I4	fNavICTow	-	ns	Fractional part of the NavIC time of week (range: +/-500000000). The precise NavIC time of week in seconds is: $NavICTow + fNavICTow * 1e-9$	
12	I2	NavICWno	-	-	NavIC week number	
14	I1	leapS	-	s	NavIC leap seconds (NavIC-UTC)	
15	X1	valid	-	-	Validity Flags	

bit 0	U:1	NavICTow Valid	-	-	1 = Valid NavICTow and fNavICTow (see section Time validity in the integration manual for details)
bit 1	U:1	NavICWno Valid	-	-	1 = Valid NavICWno (see section Time validity in the integration manual for details)
bit 2	U:1	leapSValid	-	-	1 = Valid leapS
16	U4	tAcc	-	ns	Time Accuracy Estimate

### 3.15.18 UBX-NAV2-TIMEUTC (0x29 0x21)

#### 3.15.18.1 UTC time solution

<b>Message</b>	<b>UBX-NAV2-TIMEUTC</b>					
	<b>UTC time solution</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	Note that during a leap second there may be more or less than 60 seconds in a minute. See the description of leap seconds in the integration manual for details.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x29	0x21	20	see below	CK_A CK_B
<b>Payload description:</b>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	U4	tAcc	-	ns	Time accuracy estimate (UTC)	
8	I4	nano	-	ns	Fraction of second, range -1e9 .. 1e9 (UTC)	
12	U2	year	-	y	Year, range 1999..2099 (UTC)	
14	U1	month	-	month	Month, range 1..12 (UTC)	
15	U1	day	-	d	Day of month, range 1..31 (UTC)	
16	U1	hour	-	h	Hour of day, range 0..23 (UTC)	
17	U1	min	-	min	Minute of hour, range 0..59 (UTC)	
18	U1	sec	-	s	Seconds of minute, range 0..60 (UTC)	
19	X1	valid	-	-	Validity Flags	
bit 0	U:1	validTOW	-	-	1 = Valid Time of Week (see section Time validity in the integration manual for details)	
bit 1	U:1	validWKN	-	-	1 = Valid Week Number (see section Time validity in the integration manual for details)	
bit 2	U:1	validUTC	-	-	1 = Valid UTC Time	
bit 3	U:1	authStatus	-	-	Indicates if the parameters used to convert GNSS time into UTC time have been authenticated. <ul style="list-style-type: none"> <li>0 = Unknown</li> <li>1 = Authenticated</li> </ul> Note that currently the only data authentication function is provided by Galileo Open Service Navigation Message Authentication (OSNMA) protocol for E1 I/NAV message. Systems other than EU UTC can be authenticated indirectly only using the above information.	

bits 7...4	U:4	utcStandard	-	-	UTC standard identifier. (Not supported for protocol versions less than 15.00)
					<ul style="list-style-type: none"> <li>• 0 = Information not available</li> <li>• 1 = Communications Research Laboratory (CRL), Tokyo, Japan</li> <li>• 2 = National Institute of Standards and Technology (NIST)</li> <li>• 3 = U.S. Naval Observatory (USNO)</li> <li>• 4 = International Bureau of Weights and Measures (BIPM)</li> <li>• 5 = European laboratories</li> <li>• 6 = Former Soviet Union (SU)</li> <li>• 7 = National Time Service Center (NTSC), China</li> <li>• 8 = National Physics Laboratory India (NPLI)</li> <li>• 15 = Unknown</li> </ul>

### 3.15.19 UBX-NAV2-VELECEF (0x29 0x11)

#### 3.15.19.1 Velocity solution in ECEF

<b>Message</b>	<b>UBX-NAV2-VELECEF</b>					
	<b>Velocity solution in ECEF</b>					
Type	Periodic/pollled					
Comment	See important comments concerning validity of position given in section Navigation output filters in the integration manual.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x11	20	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.	
4	I4	ecefVX	-	cm/s	ECEF X velocity	
8	I4	ecefVY	-	cm/s	ECEF Y velocity	
12	I4	ecefVZ	-	cm/s	ECEF Z velocity	
16	U4	sAcc	-	cm/s	Speed accuracy estimate	

### 3.15.20 UBX-NAV2-VELNED (0x29 0x12)

#### 3.15.20.1 Velocity solution in NED frame

<b>Message</b>	<b>UBX-NAV2-VELNED</b>					
	<b>Velocity solution in NED frame</b>					
Type	Periodic/pollled					
Comment	See important comments concerning validity of position given in section Navigation output filters in the integration manual.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x29	0x12	36	see below	CK_A CK_B
Payload description:						

Byte offset	Type	Name	Scale	Unit	Description
0	U4	iTOW	-	ms	GPS time of week of the navigation epoch. See section iTOW timestamps in the integration manual for details.
4	I4	velN	-	cm/s	North velocity component
8	I4	velE	-	cm/s	East velocity component
12	I4	velD	-	cm/s	Down velocity component
16	U4	speed	-	cm/s	Speed (3-D)
20	U4	gSpeed	-	cm/s	Ground speed (2-D)
24	I4	heading	1e-5	deg	Heading of motion 2-D
28	U4	sAcc	-	cm/s	Speed accuracy Estimate
32	U4	cAcc	1e-5	deg	Course / Heading accuracy estimate

## 3.16 UBX-RXM (0x02)

The messages in the UBX-RXM class are used to output status and result data from the receiver manager as well as sending commands to the receiver manager.

### 3.16.1 UBX-RXM-MEASX (0x02 0x14)

#### 3.16.1.1 Satellite measurements for RRLP

Message	UBX-RXM-MEASX Satellite measurements for RRLP					
Type	Periodic/pollled					
Comment	<p>The message payload data is, where possible and appropriate, according to the Radio Resource LCS (Location Services) Protocol (RRLP) [1]. One exception is the satellite and GNSS IDs, which here are given according to the <a href="#">Satellite Numbering</a> scheme. The correct satellites have to be selected and their satellite ID translated accordingly [1, tab. A.10.14] for use in a RRLP Measure Position Response Component. Similarly, the measurement reference time of week has to be forwarded correctly (modulo 14400000 for the 24 LSB GPS measurements variant, modulo 3600000 for the 22 LSB Galileo and Additional Navigation Satellite Systems (GANSS) measurements variant) of the RRLP measure position response to the SMLC.</p> <p>Reference: [1] ETSI TS 144 031 V11.0.0 (2012-10), Digital cellular telecommunications system (Phase 2+), Location Services (LCS), Mobile Station (MS) - Serving Mobile Location Centre (SMLC), Radio Resource LCS Protocol (RRLP), (3GPP TS 44.031 version 11.0.0 Release 11).</p>					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x02	0x14	44 + numSV·24	see below	CK_A CK_B
Payload description:						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	version	-	-	Message version, currently 0x01	
1	U1[3]	reserved0	-	-	<a href="#">Reserved</a>	
4	U4	gpsTOW	-	ms	GPS measurement reference time	
8	U4	gloTOW	-	ms	GLONASS measurement reference time	
12	U4	bdsTOW	-	ms	BeiDou measurement reference time	
16	U1[4]	reserved1	-	-	<a href="#">Reserved</a>	
20	U4	qzssTOW	-	ms	QZSS measurement reference time	
24	U2	gpsTOWacc	2 <sup>-4</sup>	ms	GPS measurement reference time accuracy (0xffff => 4s)	

26	U2	gloTOWacc	2 <sup>-4</sup>	ms	GLONASS measurement reference time accuracy (0xffff = > 4s)
28	U2	bdsTOWacc	2 <sup>-4</sup>	ms	BeiDou measurement reference time accuracy (0xffff = > 4s)
30	U1[2]	reserved2	-	-	Reserved
32	U2	qzssTOWacc	2 <sup>-4</sup>	ms	QZSS measurement reference time accuracy (0xffff = > 4s)
34	U1	numSV	-	-	Number of satellites in repeated block
35	U1	flags	-	-	Flags
	bits 1...0 U <sub>2</sub>	towSet	-	-	TOW set (0 = no, 1 or 2 = yes)
36	U1[8]	reserved3	-	-	Reserved
<i>Start of repeated group (numSV times)</i>					
44 + n·24	U1	gnssId	-	-	GNSS ID (see <a href="#">Satellite Numbering</a> )
45 + n·24	U1	svId	-	-	Satellite ID (see <a href="#">Satellite Numbering</a> )
46 + n·24	U1	cNo	-	-	carrier noise ratio (0..63)
47 + n·24	U1	mpathIndic	-	-	multipath index (according to [1]) (0 = not measured, 1 = low, 2 = medium, 3 = high)
48 + n·24	I4	dopplerMS	0.04	m/s	Doppler measurement
52 + n·24	I4	dopplerHz	0.2	Hz	Doppler measurement
56 + n·24	U2	wholeChips	-	-	whole value of the code phase measurement (0..1022 for GPS)
58 + n·24	U2	fracChips	-	-	fractional value of the code phase measurement (0..1023)
60 + n·24	U4	codePhase	2 <sup>-21</sup>	ms	Code phase
64 + n·24	U1	intCodePhase	-	ms	Integer (part of the) code phase
65 + n·24	U1	pseuRangeRMS Err	-	-	pseudorange RMS error index (according to [1]) (0..63)
66 + n·24	U1[2]	reserved4	-	-	Reserved
<i>End of repeated group (numSV times)</i>					

### 3.16.2 UBX-RXM-PMREQ (0x02 0x41)

#### 3.16.2.1 Power management request

<b>Message</b>	<b>UBX-RXM-PMREQ</b> <b>Power management request</b>					
Type	Command					
Comment	This message requests a power management related task of the receiver.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x02	0x41	16	see below	CK_A CK_B
<i>Payload description:</i>						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	version	-	-	Message version (0x00 for this version)	
1	U1[3]	reserved0	-	-	Reserved	

4	U4	duration	-	ms	Duration of the requested task. The maximum supported value is 12 days. Set to 0 to wait for a wakeup signal on a pin	
8	X4	flags	-	-	task flags	
	bit 1	U:1	backup	-	-	Set to 1 to put the receiver into backup mode
	bit 2	U:1	force	-	-	Set to 1 for minimum power consumption
12	X4	wakeupSources	-	-	Configure pins to wake up the receiver. The receiver wakes up if there is either a falling or a rising edge on one of the configured pins.	
	bit 3	U:1	uartrx	-	-	Wake up the receiver if there is an edge on the UART RX pin
	bit 5	U:1	extint0	-	-	Wake up the receiver if there is an edge on the EXTINT0 pin
	bit 6	U:1	extint1	-	-	Wake up the receiver if there is an edge on the EXTINT1 pin
	bit 7	U:1	spics	-	-	Wake up the receiver if there is an edge on the SPI CS pin

### 3.16.3 UBX-RXM-RAWX (0x02 0x15)

#### 3.16.3.1 Multi-GNSS raw measurements

<b>Message</b>	<b>UBX-RXM-RAWX</b>					
	<b>Multi-GNSS raw measurements</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	This message contains the information needed to be able to generate a RINEX 3 multi-GNSS observation file (see <a href="ftp://ftp.igs.org/pub/data/format/">ftp://ftp.igs.org/pub/data/format/</a> ). This message contains pseudorange, Doppler, carrier phase, phase lock and signal quality information for GNSS satellites once signals have been synchronized. This message supports all active GNSS.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x02	0x15	16 + numMeas*32	see below	CK_A CK_B
<b>Payload description:</b>						
<b>Byte offset</b>	<b>Type</b>	<b>Name</b>	<b>Scale</b>	<b>Unit</b>	<b>Description</b>	
0	R8	rcvTow	-	s	Measurement time of week in receiver local time approximately aligned to the GPS time system. The receiver local time of week, week number and leap second information can be used to translate the time to other time systems. More information about the difference in time systems can be found in the RINEX 3 format documentation. For a receiver operating in GLONASS only mode, UTC time can be determined by subtracting the leapS field from GPS time regardless of whether the GPS leap seconds are valid.	
8	U2	week	-	weeks	GPS week number in receiver local time.	
10	I1	leapS	-	s	GPS leap seconds (GPS-UTC). This field represents the receiver's best knowledge of the leap seconds offset. A flag is given in the recStat bitfield to indicate if the leap seconds are known.	
11	U1	numMeas	-	-	Number of measurements to follow	
12	X1	recStat	-	-	Receiver tracking status bitfield	
	bit 0	U:1	leapSec	-	-	Leap seconds have been determined

	bit 1	U:1	clkReset	-	-	Clock reset applied. Typically the receiver clock is changed in increments of integer milliseconds.
13		U1	version	-	-	Message version (0x01 for this version)
14		U1[2]	reserved0	-	-	<a href="#">Reserved</a>
<i>Start of repeated group (numMeas times)</i>						
16 + n·32		R8	prMes	-	m	Pseudorange measurement [m]. GLONASS inter frequency channel delays are compensated with an internal calibration table.
24 + n·32		R8	cpMes	-	cycles	Carrier phase measurement [cycles]. The carrier phase initial ambiguity is initialized using an approximate value to make the magnitude of the phase close to the pseudorange measurement. Clock resets are applied to both phase and code measurements in accordance with the RINEX specification.
32 + n·32		R4	doMes	-	Hz	Doppler measurement (positive sign for approaching satellites) [Hz]
36 + n·32		U1	gnssId	-	-	GNSS identifier (see <a href="#">Satellite Numbering</a> for a list of identifiers)
37 + n·32		U1	svId	-	-	Satellite identifier (see <a href="#">Satellite Numbering</a> )
38 + n·32		U1	sigId	-	-	New style signal identifier (see <a href="#">Signal Identifiers</a> ).(not supported for protocol versions less than 27.00)
39 + n·32		U1	freqId	-	-	Only used for GLONASS: This is the frequency slot + 7 (range from 0 to 13)
40 + n·32		U2	locktime	-	ms	Carrier phase locktime counter (maximum 64500ms)
42 + n·32		U1	cno	-	dBHz	Carrier-to-noise density ratio (signal strength) [dB-Hz]
43 + n·32		X1	prStdev	0.01*2 <sup>n</sup>	m	Estimated pseudorange measurement standard deviation
	bits 3...0	U:4	prStd	-	-	Estimated pseudorange standard deviation
44 + n·32		X1	cpStdev	0.004	cycles	Estimated carrier phase measurement standard deviation (note a raw value of 0x0F indicates the value is invalid)
	bits 3...0	U:4	cpStd	-	-	Estimated carrier phase standard deviation
45 + n·32		X1	doStdev	0.002*2 <sup>n</sup>	Hz	Estimated Doppler measurement standard deviation.
	bits 3...0	U:4	doStd	-	-	Estimated Doppler standard deviation
46 + n·32		X1	trkStat	-	-	Tracking status bitfield
	bit 0	U:1	prValid	-	-	Pseudorange valid
	bit 1	U:1	cpValid	-	-	Carrier phase valid
	bit 2	U:1	halfCyc	-	-	Half cycle valid
	bit 3	U:1	subHalfCyc	-	-	Half cycle subtracted from phase
47 + n·32		U1	reserved1	-	-	<a href="#">Reserved</a>
<i>End of repeated group (numMeas times)</i>						

### 3.16.4 UBX-RXM-RLM (0x02 0x59)



### 3.16.4.1 Galileo SAR short-RLM report

<b>Message</b>	<b>UBX-RXM-RLM</b>				
	<b>Galileo SAR short-RLM report</b>				
<b>Type</b>	Output				
<b>Comment</b>	This message contains the contents of any Galileo Search and Rescue (SAR) Short Return Link Message detected by the receiver.				
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>
	0xb5 0x62	0x02	0x59	16	see below
					<i>Checksum</i>
					CK_A CK_B
<i>Payload description:</i>					
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>
0	U1	version	-	-	Message version (0x00 for this version)
1	U1	type	-	-	Message type (0x01 for Short-RLM)
2	U1	svId	-	-	Identifier of transmitting satellite (see <a href="#">Satellite Numbering</a> )
3	U1	reserved0	-	-	<a href="#">Reserved</a>
4	U1[8]	beacon	-	-	Beacon identifier (60 bits), with bytes ordered by earliest transmitted (most significant) first. Top four bits of first byte are zero.
12	U1	message	-	-	Message code (4 bits)
13	U1[2]	params	-	-	Parameters (16 bits), with bytes ordered by earliest transmitted (most significant) first.
15	U1	reserved1	-	-	<a href="#">Reserved</a>

### 3.16.4.2 Galileo SAR long-RLM report

<b>Message</b>	<b>UBX-RXM-RLM</b>				
	<b>Galileo SAR long-RLM report</b>				
<b>Type</b>	Output				
<b>Comment</b>	This message contains the contents of any Galileo Search and Rescue (SAR) Long Return Link Message detected by the receiver.				
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>
	0xb5 0x62	0x02	0x59	28	see below
					<i>Checksum</i>
					CK_A CK_B
<i>Payload description:</i>					
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>
0	U1	version	-	-	Message version (0x00 for this version)
1	U1	type	-	-	Message type (0x02 for Long-RLM)
2	U1	svId	-	-	Identifier of transmitting satellite (see <a href="#">Satellite Numbering</a> )
3	U1	reserved0	-	-	<a href="#">Reserved</a>
4	U1[8]	beacon	-	-	Beacon identifier (60 bits), with bytes ordered by earliest transmitted (most significant) first. Top four bits of first byte are zero.
12	U1	message	-	-	Message code (4 bits)
13	U1[12]	params	-	-	Parameters (96 bits), with bytes ordered by earliest transmitted (most significant) first.
25	U1[3]	reserved1	-	-	<a href="#">Reserved</a>

### 3.16.5 UBX-RXM-SFRBX (0x02 0x13)

### 3.16.5.1 Broadcast navigation data subframe

<b>Message</b>	<b>UBX-RXM-SFRBX</b>					
	<b>Broadcast navigation data subframe</b>					
<b>Type</b>	Output					
<b>Comment</b>	This message reports a complete subframe of broadcast navigation data decoded from a single signal. The number of data words reported in each message depends on the nature of the signal.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x02	0x13	8 + numWords·4	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	gnssId	-	-	GNSS identifier (see <a href="#">Satellite Numbering</a> )	
1	U1	svId	-	-	Satellite identifier (see <a href="#">Satellite Numbering</a> )	
2	U1	sigId	-	-	Signal identifier (see <a href="#">Signal Identifiers</a> )	
3	U1	freqId	-	-	Only used for GLONASS: This is the frequency slot + 7 (range from 0 to 13)	
4	U1	numWords	-	-	The number of data words contained in this message (up to 16, for currently supported signals)	
5	U1	chn	-	-	The tracking channel number the message was received on	
6	U1	version	-	-	Message version, (0x02 for this version)	
7	U1	reserved0	-	-	<a href="#">Reserved</a>	
<i>Start of repeated group (numWords times)</i>						
8 + n·4	U4	dwrđ	-	-	The data words	
<i>End of repeated group (numWords times)</i>						

## 3.17 UBX-SEC (0x27)

The messages in the UBX-SEC class are used for security features of the receiver.

### 3.17.1 UBX-SEC-SIG (0x27 0x09)

#### 3.17.1.1 Signal security information

<b>Message</b>	<b>UBX-SEC-SIG</b>					
	<b>Signal security information</b>					
<b>Type</b>	Periodic/pollé					
<b>Comment</b>	Information related to the security, i.e. availability and integrity, of the signals.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x27	0x09	4 + jamNumCentFreqs·4	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	version	-	-	Message version (0x02 for this version)	
1	X1	sigSecFlags	-	-	Signal security flags, providing high-level jamming and spoofing detector information	
bit 0	U:1	jamDetEnabled	-	-	Flag indicates whether jamming detection is enabled	
bits 2...1	U:2	jamState	-	-	Jamming state <ul style="list-style-type: none"> <li>0: Unknown</li> </ul>	

- 1: No jamming indicated
- 2: Warning; jamming indicated

0: *Unknown*, denotes that the currently available information is not sufficient to judge whether the receiver is jammed or not. This may occur at receiver start up (or more generally when the receiver is in a mode, where jamming detection is hindered) or when the jamming indicator is disabled. 1: *No jamming indicated*: the jamming indicator is enabled and does not sense any significant jamming. 2: *Warning; jamming indicated*: the jamming indicator is indicating jamming which has a significant impact on the signal tracking. (The list *jamPerCentFreq* can be checked to find out which frequency bands are jammed.)

bit 3	U:1	spfDetEnabled	-	-	Flag indicates whether spoofing detection is enabled
bits 6...4	U:3	spfState	-	-	Spoofing state <ul style="list-style-type: none"> <li>• 0: Unknown</li> <li>• 1: No spoofing indicated</li> <li>• 2: Spoofing indicated</li> <li>• 3: Spoofing affirmed</li> </ul>
2	U1	reserved0	-	-	<a href="#">Reserved</a>
3	U1	jamNumCentFreqs	-	-	The number of center frequencies we provide jamming information for (subsequent messages)
<i>Start of repeated group (jamNumCentFreqs times)</i>					
4 + n·4	X4	jamStateCentFreq	-	-	Jamming state of signals sharing a given center frequency Note that jamming information is only provided for center frequencies related to at least one in-use signal, for which a sufficient amount of information is currently available to judge if it is affected by jamming.
bits 23...0	U:24	centFreq	-	-	Center frequency in [kHz], floored to the nearest kHz multiple
bit 24	U:1	jammed	-	-	Flag indicates whether signals on the given center frequency are considered jammed

*End of repeated group (jamNumCentFreqs times)*

### 3.17.2 UBX-SEC-SIGLOG (0x27 0x10)

#### 3.17.2.1 Signal security log

<b>Message</b>	<b>UBX-SEC-SIGLOG</b> <b>Signal security log</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	This message provides a log of past signal security related events, that is, events related to jamming and spoofing. Each event is a combination of a detection type and a event type, where the event type 'indication started' and 'indication stopped' and also the event type 'indication triggered' and 'indication timed-out' form a pair. A maximum of 16 events are logged; after the log is filled, recent events take precedence over past events in the log. Power cycles and restarts of the receiver reset the log, deleting its content. Note: It is advised not to restart the receiver while it's indicating spoofing.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x27	0x10	8 + numEvents·8	<i>see below</i>	CK_A CK_B

---

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	U1	version	-	-	Message version (0x01 for this version)
1	U1	numEvents	-	-	Number of events
2	U1[6]	reserved0	-	-	Reserved
<i>Start of repeated group (numEvents times)</i>					
8 + n·8	U4	timeElapsed	-	s	Seconds elapsed since this event Special value 0xFFFFFFFF: more than 45 days
12 + n·8	U1	detectionType	-	-	Type of the spoofing or jamming detection: <ul style="list-style-type: none"> <li>• 0 = simulated signal</li> <li>• 1 = abnormal signal</li> <li>• 2 = INS/GNSS mismatch</li> <li>• 3 = abrupt changes in GNSS signal</li> <li>• 4 = jamming indicated</li> <li>• 5 = authentication failed</li> <li>• 6 = replayed signals</li> </ul>
13 + n·8	U1	eventType	-	-	Type of the event: <ul style="list-style-type: none"> <li>• 0 = indication started</li> <li>• 1 = indication stopped</li> <li>• 2 = indication triggered</li> <li>• 3 = indication timed-out</li> </ul> <p>Note: Single epoch events, caused by abrupt changes due to switching from the real to the spoofing signal or vice versa are handled as time-out events. This means that the time-out event is reported after a certain cool off period which is not related to any observations in the signal. The other detection types make use of 'start' and 'stop' event types.</p>
14 + n·8	U1[2]	reserved1	-	-	Reserved
<i>End of repeated group (numEvents times)</i>					

### 3.17.3 UBX-SEC-UNIQID (0x27 0x03)

#### 3.17.3.1 Unique chip ID

Message	UBX-SEC-UNIQID					
Type	Unique chip ID					
Type	Output					
Comment	This message is used to retrieve a unique chip identifier (48 bits, 6 bytes).					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x27	0x03	10	see below	CK_A CK_B
<i>Payload description:</i>						
Byte offset	Type	Name	Scale	Unit	Description	
0	U1	version	-	-	Message version (0x02 for this version)	
1	U1[3]	reserved0	-	-	Reserved	
4	U1[6]	uniqueId	-	-	Unique chip ID	

## 3.18 UBX-TIM (0x0d)

The messages in the UBX-TIM class are used to output timing information from the receiver, such as time pulse and time mark measurements.

### 3.18.1 UBX-TIM-SVIN (0x0d 0x04)

#### 3.18.1.1 Survey-in data

<b>Message</b>	<b>UBX-TIM-SVIN</b>					
	<b>Survey-in data</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	This message contains information about survey-in parameters. For details about the Time mode see section Time mode configuration.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x0d	0x04	28	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U4	dur	-	s	Passed survey-in observation time	
4	I4	meanX	-	cm	Current survey-in mean position ECEF X coordinate	
8	I4	meanY	-	cm	Current survey-in mean position ECEF Y coordinate	
12	I4	meanZ	-	cm	Current survey-in mean position ECEF Z coordinate	
16	U4	meanV	-	mm <sup>2</sup>	Current survey-in mean position 3D variance	
20	U4	obs	-	-	Number of position observations used during survey-in	
24	U1	valid	-	-	Survey-in position validity flag, 1 = valid, otherwise 0	
25	U1	active	-	-	Survey-in in progress flag, 1 = in-progress, otherwise 0	
26	U1[2]	reserved0	-	-	Reserved	

### 3.18.2 UBX-TIM-TM2 (0x0d 0x03)

#### 3.18.2.1 Time mark data

<b>Message</b>	<b>UBX-TIM-TM2</b>					
	<b>Time mark data</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	This message contains information for high precision time stamping / pulse counting. The delay figures and timebase given in <a href="#">CFG-TP configuration items</a> are also applied to the time results output in this message.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x0d	0x03	28	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	ch	-	-	Channel (i.e. EXTINT) upon which the pulse was measured	
1	X1	flags	-	-	Bitmask	
bit 0	U:1	mode	-	-	<ul style="list-style-type: none"> <li>• 0=single</li> <li>• 1=running</li> </ul>	

bit 1	U:1	run	-	-	<ul style="list-style-type: none"> <li>0=armed</li> <li>1=stopped</li> </ul>
bit 2	U:1	newFallingEdge	-	-	New falling edge detected
bits 4...3	U:2	timeBase	-	-	<ul style="list-style-type: none"> <li>0=Time base is Receiver time</li> <li>1=Time base is GNSS time (the system according to the configuration in <a href="#">CFG-TP configuration items</a> for tpIdx=0)</li> <li>2=Time base is UTC (the variant according to the configuration in <a href="#">CFG-NAVSPG-* configuration items</a>)</li> </ul>
bit 5	U:1	utc	-	-	<ul style="list-style-type: none"> <li>0=UTC not available</li> <li>1=UTC available</li> </ul>
bit 6	U:1	time	-	-	<ul style="list-style-type: none"> <li>0=Time is not valid</li> <li>1=Time is valid (Valid GNSS fix)</li> </ul>
bit 7	U:1	newRisingEdge	-	-	New rising edge detected
2	U2	count	-	-	Rising edge counter
4	U2	wnR	-	-	Week number of last rising edge
6	U2	wnF	-	-	Week number of last falling edge
8	U4	towMsR	-	ms	Tow of rising edge
12	U4	towSubMsR	-	ns	Millisecond fraction of tow of rising edge in nanoseconds
16	U4	towMsF	-	ms	Tow of falling edge
20	U4	towSubMsF	-	ns	Millisecond fraction of tow of falling edge in nanoseconds
24	U4	accEst	-	ns	Accuracy estimate

### 3.18.3 UBX-TIM-TP (0x0d 0x01)

#### 3.18.3.1 Time pulse time data

<b>Message</b>	<b>UBX-TIM-TP</b>					
	<b>Time pulse time data</b>					
<b>Type</b>	Periodic/pollled					
<b>Comment</b>	This message contains information on the timing of the next pulse at the TIMEPULSE0 output. The recommended configuration when using this message is to set both the measurement rate ( <a href="#">CFG-RATE</a> ) and the timepulse frequency ( <a href="#">CFG-TP</a> ) to 1 Hz.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x0d	0x01	16	see below	CK_A CK_B
<b>Payload description:</b>						
<b>Byte offset</b>	<b>Type</b>	<b>Name</b>	<b>Scale</b>	<b>Unit</b>	<b>Description</b>	
0	U4	towMS	-	ms	Time pulse time of week according to time base	
4	U4	towSubMS	2 <sup>-32</sup>	ms	Submillisecond part of towMS	
8	I4	qErr	-	ps	Quantization error of time pulse	
12	U2	week	-	weeks	Time pulse week number according to time base	
14	X1	flags	-	-	Flags	

bit 0	U:1	timeBase	-	-	<ul style="list-style-type: none"> <li>0 = Time base is GNSS</li> <li>1 = Time base is UTC</li> </ul>
bit 1	U:1	utc	-	-	<ul style="list-style-type: none"> <li>0 = UTC not available</li> <li>1 = UTC available</li> </ul>
bits 3...2	U:2	raim	-	-	(T)RAIM information <ul style="list-style-type: none"> <li>0 = Information not available</li> <li>1 = Not active</li> <li>2 = Active</li> </ul>
bit 4	U:1	qErrInvalid	-	-	<ul style="list-style-type: none"> <li>0 = Quantization error valid</li> <li>1 = Quantization error invalid</li> </ul>
bit 5	U:1	TpNotLocked	-	-	<ul style="list-style-type: none"> <li>0 = Next TP is locked to GNSS</li> <li>1 = Next TP is based on local time and not locked to GNSS - week/tow may be invalid</li> </ul>
15	X1	refInfo	-	-	Time reference information
bits 3...0	U:4	timeRefGnss	-	-	GNSS reference information. Only valid if time base is GNSS (timeBase=0). <ul style="list-style-type: none"> <li>0 = GPS</li> <li>1 = GLONASS</li> <li>2 = BeiDou</li> <li>3 = Galileo</li> <li>4 = NavIC</li> <li>15 = Unknown</li> </ul>
bits 7...4	U:4	utcStandard	-	-	UTC standard identifier. Only valid if time base is UTC (timeBase=1). <ul style="list-style-type: none"> <li>0 = Information not available</li> <li>1 = Communications Research Laboratory (CRL), Tokyo, Japan</li> <li>2 = National Institute of Standards and Technology (NIST)</li> <li>3 = U.S. Naval Observatory (USNO)</li> <li>4 = International Bureau of Weights and Measures (BIPM)</li> <li>5 = European laboratories</li> <li>6 = Former Soviet Union (SU)</li> <li>7 = National Time Service Center (NTSC), China</li> <li>8 = National Physics Laboratory India (NPLI)</li> <li>15 = Unknown</li> </ul>

### 3.18.4 UBX-TIM-VRFY (0x0d 0x06)

#### 3.18.4.1 Sourced time verification

<b>Message</b>	<b>UBX-TIM-VRFY</b> <b>Sourced time verification</b>
<b>Type</b>	Periodic/pollled
<b>Comment</b>	This message contains verification information about previous time received via assistance data or from RTC.

Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x0d	0x06	20	see below	CK_A CK_B

*Payload description:*

Byte offset	Type	Name	Scale	Unit	Description
0	I4	itow	-	ms	integer millisecond tow received by source
4	I4	frac	-	ns	sub-millisecond part of tow
8	I4	deltaMs	-	ms	integer milliseconds of delta time (current time minus sourced time)
12	I4	deltaNs	-	ns	Sub-millisecond part of delta time
16	U2	wno	-	week	Week number
18	X1	flags	-	-	Flags
	bits 2...0 U:3	src	-	-	Aiding time source <ul style="list-style-type: none"> <li>0 = no time aiding done</li> <li>2 = source was RTC</li> <li>3 = source was assistance data</li> </ul>
19	U1	reserved0	-	-	Reserved

## 3.19 UBX-UPD (0x09)

The messages in the UBX-UPD class are used to download a firmware to the receiver and to update the firmware on the flash.

### 3.19.1 UBX-UPD-SOS (0x09 0x14)

#### 3.19.1.1 Poll backup restore status

Message	UBX-UPD-SOS					
	<b>Poll backup restore status</b>					
Type	Poll request					
Comment	Sending this (empty) message to the receiver results in the receiver returning a <i>System restored from backup</i> message as defined below.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x09	0x14	0	see below	CK_A CK_B
Payload	This message has no payload.					

#### 3.19.1.2 Create backup in flash

Message	UBX-UPD-SOS					
	<b>Create backup in flash</b>					
Type	Command					
Comment	The host can send this message in order to save part of the battery-backed memory (BBR) in a file in the flash file system. The feature is designed in order to emulate the presence of the backup battery even if it is not present; the host can issue the save on shutdown command before switching off the device supply. It is recommended to issue a GNSS stop command using UBX-CFG-RST before in order to keep the BBR memory content consistent.					
Message structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xb5 0x62	0x09	0x14	4	see below	CK_A CK_B
<i>Payload description:</i>						
Byte offset	Type	Name	Scale	Unit	Description	



0	U1	cmd	-	-	Command (must be 0)
1	U1[3]	reserved0	-	-	Reserved

### 3.19.1.3 Clear backup in flash

<b>Message</b>	<b>UBX-UPD-SOS</b>					
	<b>Clear backup in flash</b>					
<b>Type</b>	Command					
<b>Comment</b>	The host can send this message in order to erase the backup file present in flash. It is recommended that the clear operation is issued after the host has received the notification that the memory has been restored after a reset. Alternatively the host can parse the startup string <i>Restored data saved on shutdown</i> or poll the UBX-UPD-SOS message for obtaining the status.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x09	0x14	4	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	cmd	-	-	Command (must be 1)	
1	U1[3]	reserved0	-	-	Reserved	

### 3.19.1.4 Backup creation acknowledge

<b>Message</b>	<b>UBX-UPD-SOS</b>					
	<b>Backup creation acknowledge</b>					
<b>Type</b>	Output					
<b>Comment</b>	The message is sent from the device as confirmation of creation of a backup file in flash. The host can safely shut down the device after having received this message.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x09	0x14	8	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	cmd	-	-	Command (must be 2)	
1	U1[3]	reserved0	-	-	Reserved	
4	U1	response	-	-	<ul style="list-style-type: none"> <li>0 = Not acknowledged</li> <li>1 = Acknowledged</li> </ul>	
5	U1[3]	reserved1	-	-	Reserved	

### 3.19.1.5 System restored from backup

<b>Message</b>	<b>UBX-UPD-SOS</b>					
	<b>System restored from backup</b>					
<b>Type</b>	Output					
<b>Comment</b>	The message is sent from the device to notify the host the BBR has been restored from a backup file in the flash file system. The host should clear the backup file after receiving this message. If the UBX-UPD-SOS message is polled, this message is resent.					
<b>Message structure</b>	<i>Header</i>	<i>Class</i>	<i>ID</i>	<i>Length (Bytes)</i>	<i>Payload</i>	<i>Checksum</i>
	0xb5 0x62	0x09	0x14	8	see below	CK_A CK_B
<i>Payload description:</i>						
<i>Byte offset</i>	<i>Type</i>	<i>Name</i>	<i>Scale</i>	<i>Unit</i>	<i>Description</i>	
0	U1	cmd	-	-	Command (must be 3)	
1	U1[3]	reserved0	-	-	Reserved	

4	U1	response	-	-	<ul style="list-style-type: none"><li>• 0 = Unknown</li><li>• 1 = Failed restoring from backup</li><li>• 2 = Restored from backup</li><li>• 3 = Not restored (no backup)</li></ul>
5	U1[3]	reserved1	-	-	<a href="#">Reserved</a>

## 4 Configuration interface

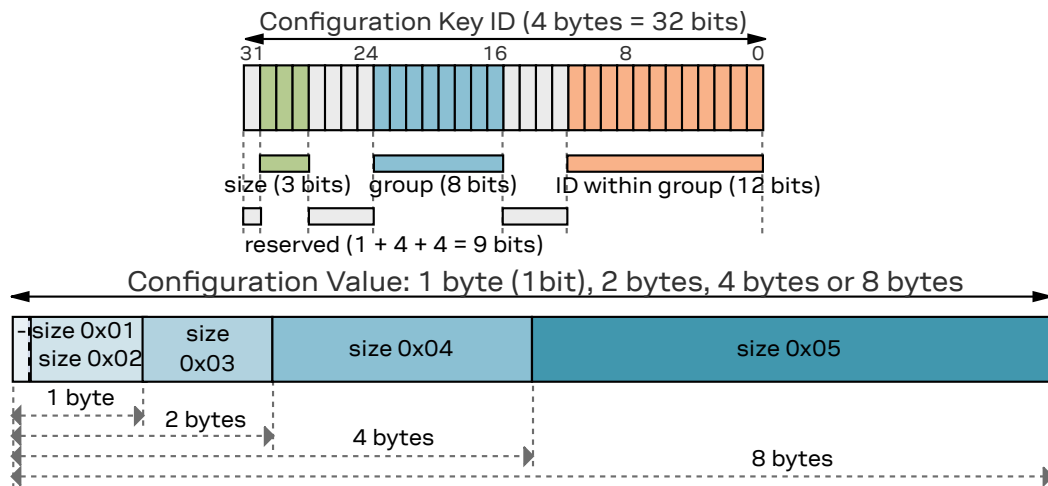
This chapter describes the receiver configuration interface.

### 4.1 Configuration database

The configuration database in the receiver's RAM stores the current receiver settings used during runtime. This database is constructed from multiple sources known as *configuration layers* when the receiver starts up. The active settings, known as the current configuration, are stored in the *RAM layer*. Each configuration layer is organized into *configuration items*, which are uniquely identified by a *configuration key ID* and hold a single *configuration value*.

### 4.2 Configuration items

The following figure shows the structure of a *configuration item*, which consists of a (*configuration*) *key ID* and its (*configuration*) *value*:



A configuration key ID is a 32-bit integer value, which is split into the following parts:

- Bit 31: Currently unused. Reserved for future use.
- Bits 30...28: Three bits that indicate the storage size of a configuration value (range 0x01-0x05, see below)
- Bits 27...24: Currently unused. Reserved for future use.
- Bits 23...16: Eight bits that define a unique group ID (range 0x01-0xfe)
- Bits 15...12: Currently unused. Reserved for future use.
- Bits 11...0: Twelve bits that define a unique item ID within a group (range 0x001-0xffe)

The entire 32-bit value is the unique key ID, which uniquely identifies a particular item. The numeric representation of the key ID uses the lower-case hexadecimal format, such as `0x20c400a1`. An easier, more readable text representation uses the form `CFG-GROUP-ITEM`. This is also referred to as the (*configuration*) *key name*.

Supported storage size identifiers (bits 30...28 of the key ID) are:

- 0x01: one bit (the actual storage used is one byte, but only the least significant bit is used)
- 0x02: one byte
- 0x03: two bytes
- 0x04: four bytes
- 0x05: eight bytes

Each configuration item is of a certain type, which defines the interpretation of the raw binary data (see also [UBX data types](#)):

- U1, U2, U4, U8: unsigned little-endian integers of 8-, 16-, 32- and 64-bit widths
- I1, I2, I4, I8: signed little-endian, two's complement integers of 8-, 16-, 32- and 64-bit widths
- R4, R8: IEEE 754 single (32-bit) and double (64-bit) precision floats
- E1, E2, E4: unsigned little-endian enumeration of 8-, 16-, and 32-bit widths
- X1, X2, X4, X8: unsigned little-endian integers of 8-, 16-, 32- and 64-bit widths for bitfields and other binary data, such as strings
- L: single-bit boolean (true = 1, false = 0), stored as U1

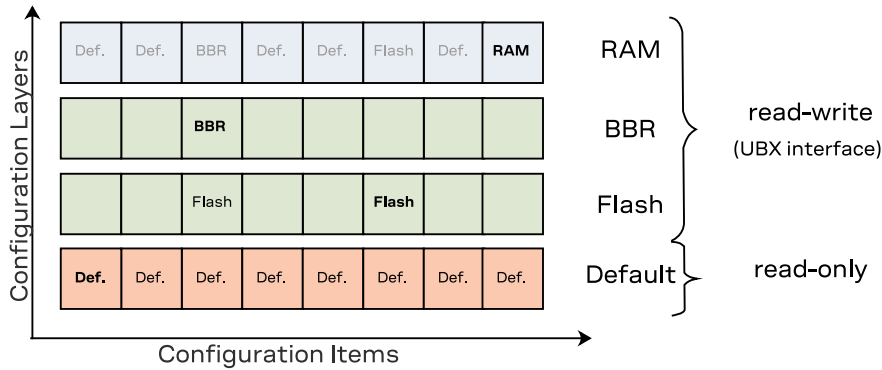
### 4.3 Configuration layers

The receiver has several *configuration layers*. They are separate sources of configuration items. Some of the layers are read-only and others are modifiable. Layers are organized in terms of priority. Values in a high-priority layer replace values stored in a low-priority layer. At startup, the receiver reads all configuration layers and stacks up the items to create the *current configuration*, which is used by the receiver at run-time.

The following configuration layers are available (in order of priority, highest priority first):

- **RAM:** This layer contains items stored in volatile RAM. This is the current configuration. The configuration items in this layer can be set at run-time and are effective immediately.
- **BBR:** This layer contains items stored in the battery-backed RAM. The contents in this layer are preserved as long as a battery backup supply is provided during off periods. The configuration items in this layer can be set at run-time and they become effective when the receiver is restarted.
- **Flash:** This layer contains configuration items stored permanently in the external flash memory and it is available only if external flash memory is used. The configuration items in this layer can be set at run-time and they become effective when the receiver is restarted.
- **Default:** This layer contains all items known to the running receiver software and the hard-coded default values. Data in this layer cannot be modified during run-time. The default layer includes limited one-time programmable (OTP) memory for setting customized default values during device production.

The stacking of the configuration items from the different layers (sources) in order to construct the current configuration in the RAM layer is depicted in the following figure. For each defined item, i.e. for each item in the default layer, the receiver software goes through the layers above and stacks all the found items on top. Some items may not be present in every layer. The result is the RAM layer filled with all configuration items given configuration values coming from the highest priority layer the corresponding item was present. In the example figure, bold text indicates the source of the value in the current configuration (the RAM layer). Empty boxes mean that the layer can hold the item but that it is not currently stored there. Boxes with text mean that an item is currently stored in the layer.



In the example figure above several items (e.g. the first item) are only set in the default layer and hence, the default value ends up in the current configuration in the RAM layer. The third item is present in the Default, flash and BBR layers. The value from the BBR layer has the highest priority and therefore it ends up in the RAM layer. On the other hand, the default value of the sixth item is changed by the value in the flash layer. The value of the last item is changed in the RAM layer only, i.e. upon startup the value in the RAM layer was the value from the default layer, but the value in the RAM layer was changed at runtime.

## 4.4 Configuration interface access

The following sections describe the existing interfaces to access the Configuration Database.

### 4.4.1 UBX protocol interface

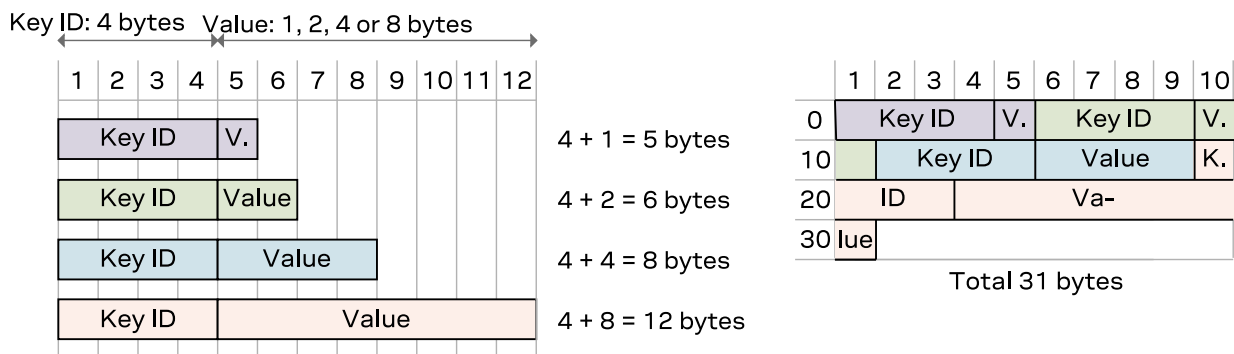
The following [UBX protocol](#) messages are available to access the configuration database:

- [UBX-CFG-VALGET](#) to read configuration items from the database
- [UBX-CFG-VALSET](#) to set configuration items in the database
- [UBX-CFG-VALDEL](#) to delete configuration items from the database

## 4.5 Configuration data

Configuration data is the binary representation of a list of key ID and value pairs. It is formed by concatenating keys (U4 values) and values (variable type) without any padding. This format is used in the [UBX-CFG-VALSET](#) and [UBX-CFG-VALGET](#) messages.

The figure below shows an example. The four items (key ID - value pairs) on the left use the four fundamental storage sizes: one byte (L, U1, I1, E1 and X1 types), 2 bytes (U2, I2, E2 and X2 types), four byte (U4, I4, E4, X4 and R4 types) and eight bytes (U8, I8, X8 and R8 types). When concatenated (right) the key IDs and values are not aligned and there is no padding.



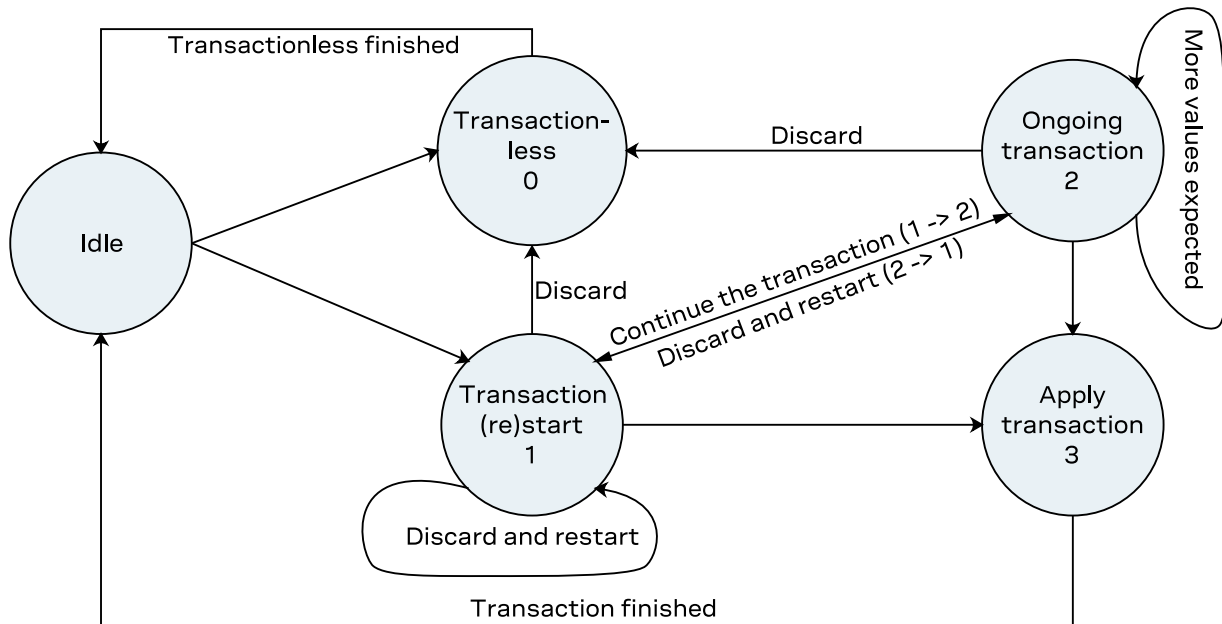
Note that this is an arbitrary example and any number of items of any value storage size can be concatenated the same way.

## 4.6 Configuration transactions

The configuration interface supports two mechanisms of configuration: the first is a transactionless mechanism where sent configuration changes are applied immediately to the configuration layer(s) requested. The second mechanism is a configuration transaction.

A transaction offers a way of queuing multiple configuration changes. It is particularly useful where different configuration keys depend on each other in such a way that sending one before the other can cause the configuration to be rejected. The queued configuration change requests are stored then checked collectively before being applied to the receiver.

A transaction can have the following states described in the figure below.



When starting a transaction, specify the layer(s) to apply the changes to. This list of configuration layer(s) must be observed throughout the transaction states. Modifying the configuration layer(s) mid-transaction causes the transaction to be aborted and consequently, no queued changes will be applied.

In the start transaction state, the receiver locks the configuration database so that changes from another entity or message cannot be applied. It is possible to send a configuration key-value pairs with the start transaction state. These are queued waiting to be applied.

In the ongoing state, a configuration key and value must be sent. The receiver aborts the transaction and does not apply any changes if this condition is violated. Key-value pairs sent in the ongoing state are queued waiting to be applied.

In the apply state, the receiver collectively checks the queued changes and applied them to the requested configuration layer(s). Note that any additional key-value pairs sent within the apply state are ignored.

Note that a transaction can only come from a single source, a [UBX-CFG-VALSET](#) message or a [UBX-CFG-VALDEL](#) message. This means that in any given transaction it is not possible to mix a delete

and a save request. Starting a transaction from a different source aborts the current transaction and the queued changes are not applied.

Refer to [UBX-CFG-VALSET](#) and [UBX-CFG-VALDEL](#) messages for a detailed description of how to set up a configuration transaction, its limitations and conditions that would cause the transaction to be rejected.

## 4.7 Configuration reset behavior

The RAM layer is always rebuilt from the layers below when the chip's processor comes out from reset. When using [UBX-CFG-RST](#) the processor goes through a reset cycle with these reset types (`resetMode` field):

- 0x00 hardware reset (watchdog) immediately
- 0x01 controlled software reset
- 0x04 hardware reset (watchdog) after shutdown

See section Forcing a receiver reset in the integration manual.

## 4.8 Configuration overview

Group	Description
<a href="#">CFG-BDS</a>	BeiDou system configuration
<a href="#">CFG-HW</a>	Hardware configuration
<a href="#">CFG-I2C</a>	Configuration of the I2C interface
<a href="#">CFG-I2CINPROT</a>	Input protocol configuration of the I2C interface
<a href="#">CFG-I2COUTPROT</a>	Output protocol configuration of the I2C interface
<a href="#">CFG-INFMSG</a>	Information message configuration
<a href="#">CFG-MOT</a>	Motion detector configuration
<a href="#">CFG-MSGOUT</a>	Message output configuration
<a href="#">CFG-NAV2</a>	Secondary output configuration
<a href="#">CFG-NAVMASK</a>	Satellite Mask Configuration
<a href="#">CFG-NAVSPG</a>	Standard precision navigation configuration
<a href="#">CFG-NMEA</a>	NMEA protocol configuration
<a href="#">CFG-RATE</a>	Navigation and measurement rate configuration
<a href="#">CFG-RINV</a>	Remote inventory
<a href="#">CFG-SBAS</a>	SBAS configuration
<a href="#">CFG-SEC</a>	Security configuration
<a href="#">CFG-SIGNAL</a>	Satellite systems (GNSS) signal configuration
<a href="#">CFG-SPI</a>	Configuration of the SPI interface
<a href="#">CFG-SPIINPROT</a>	Input protocol configuration of the SPI interface
<a href="#">CFG-SPIOUTPROT</a>	Output protocol configuration of the SPI interface
<a href="#">CFG-TMODE</a>	Time mode configuration
<a href="#">CFG-TP</a>	Time pulse configuration
<a href="#">CFG-TXREADY</a>	TX ready configuration
<a href="#">CFG-UART1</a>	Configuration of the UART1 interface
<a href="#">CFG-UART1INPROT</a>	Input protocol configuration of the UART1 interface

Group	Description
<a href="#">CFG-UART1OUTPROT</a>	Output protocol configuration of the UART1 interface

## 4.9 Configuration reference

### 4.9.1 CFG-BDS: BeiDou system configuration

Note that enabling and disabling of individual GNSS is done via the [CFG-SIGNAL](#) configuration group.

Configuration item	Key ID	Type	Scale	Unit	Description
<a href="#">CFG-BDS-USE_GEO_PRN</a>	0x10340014	L	-	-	Use BeiDou geostationary satellites (PRN 1-5 and 59-63)

Table 5: CFG-BDS configuration items

### 4.9.2 CFG-HW: Hardware configuration

Hardware configuration settings.

Note that not all settings are available for all products. See the applicable data sheet for supported features.

Configuration item	Key ID	Type	Scale	Unit	Description
<a href="#">CFG-HW-ANT_CFG_VOLTCTRL</a>	0x10a3002e	L	-	-	Active antenna voltage control flag Enable active antenna voltage control flag. Used by EXT and MADC engines.
<a href="#">CFG-HW-ANT_CFG_SHORTDET</a>	0x10a3002f	L	-	-	Short antenna detection flag Enable short antenna detection flag. Used by EXT and MADC engines.
<a href="#">CFG-HW-ANT_CFG_SHORTDET_POL</a>	0x10a30030	L	-	-	Short antenna detection polarity Set to true if polarity of the antenna short detection is active low. Used by EXT engine.
<a href="#">CFG-HW-ANT_CFG_OPENDET</a>	0x10a30031	L	-	-	Open antenna detection flag Enable open antenna detection flag. Used by EXT and MADC engines.
<a href="#">CFG-HW-ANT_CFG_OPENDET_POL</a>	0x10a30032	L	-	-	Open antenna detection polarity Set to true if polarity of the antenna open detection is active low. Used by EXT engine.
<a href="#">CFG-HW-ANT_CFG_PWRDOWN</a>	0x10a30033	L	-	-	Power down antenna flag Enable power down antenna logic in the event of antenna short circuit. CFG-HW-ANT_CFG_SHORTDET must be enabled to use this feature. Used by EXT and MADC engines.
<a href="#">CFG-HW-ANT_CFG_PWRDOWN_POL</a>	0x10a30034	L	-	-	Power down antenna logic polarity Set to true if polarity of the antenna power down logic is active high. Used by EXT and MADC engines.
<a href="#">CFG-HW-ANT_CFG_RECOVER</a>	0x10a30035	L	-	-	Automatic recovery from short state flag Enable automatic recovery from short state. Used by EXT and MADC engines.
<a href="#">CFG-HW-ANT_SUP_SWITCH_PIN</a>	0x20a30036	U1	-	-	Antenna switch PIO number Antenna switch PIO number. Used by EXT and MADC engines.
<a href="#">CFG-HW-ANT_SUP_SHORT_PIN</a>	0x20a30037	U1	-	-	Antenna short detection PIO number Antenna short detection PIO number. Used by EXT engine.
<a href="#">CFG-HW-ANT_SUP_OPEN_PIN</a>	0x20a30038	U1	-	-	Antenna open detection PIO number Antenna open detection PIO number. Used by EXT engine.
<a href="#">CFG-HW-ANT_ON_SHORT_US</a>	0x30a3003c	U2	-	-	ANT on->short timeout[us] Delay in microseconds between turning the antenna power supply on and enabling the antenna short circuit detection.
<a href="#">CFG-HW-ANT_SUP_ENGINE</a>	0x20a30054	E1	-	-	Antenna supervisor engine selection



Configuration item	Key ID	Type	Scale	Unit	Description
Select the engine used to evaluate antenna state. The EXT engine uses an external comparator for current measurement. The MADC engine uses a built-in measurement ADC and requires only a shunt resistor for current measurement. The MADC engine is supported only in selected u-blox generation 9 receivers. See <a href="#">Table 7</a> below for a list of possible constants for this item.					
<i>CFG-HW-ANT_SUP_SHORT_THR</i>	0x20a30055	U1	-	mV	Antenna supervisor MADC engine short detection threshold
Threshold above which antenna short is detected. Used by MADC engine.					
<i>CFG-HW-ANT_SUP_OPEN_THR</i>	0x20a30056	U1	-	mV	Antenna supervisor MADC engine open detection threshold
Threshold below which antenna open/disconnected is detected. Used by MADC engine.					
<i>CFG-HW-RF_LNA_MODE</i>	0x20a30057	E1	-	-	Mode for internal LNA
Sets the operating mode for the RF LNA. Lowgain or bypass options can be used if there is already a external LNA in front of the chip with sufficient gain. See <a href="#">Table 8</a> below for a list of possible constants for this item.					

**Table 6: CFG-HW configuration items**

Constant	Value	Description
<i>EXT</i>	0	Use the EXT engine (not available in all products)
<i>MADC</i>	1	Use the MADC engine (not available in all products)

**Table 7: Constants for CFG-HW-ANT\_SUP\_ENGINE**

Constant	Value	Description
<i>NORMAL</i>	0	All RFs. Normal operation, internal LNA enabled at full gain
<i>LOWGAIN</i>	1	All RFs. LNA enabled in low gain mode
<i>BYPASS</i>	2	All RFs. Bypass LNA

**Table 8: Constants for CFG-HW-RF\_LNA\_MODE**

### 4.9.3 CFG-I2C: Configuration of the I2C interface

Settings needed to configure the I2C communication interface.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-I2C-ADDRESS</i>	0x20510001	U1	-	-	I2C address of the receiver (7 bits)
<i>CFG-I2C-EXTENDEDTIMEOUT</i>	0x10510002	L	-	-	Flag to disable timeouting the interface after 1.5 s
<i>CFG-I2C-ENABLED</i>	0x10510003	L	-	-	Flag to indicate if the I2C interface should be enabled

**Table 9: CFG-I2C configuration items**

### 4.9.4 CFG-I2CINPROT: Input protocol configuration of the I2C interface

Input protocol enable flags of the I2C interface.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-I2CINPROT-UBX</i>	0x10710001	L	-	-	Flag to indicate if UBX should be an input protocol on I2C

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-I2CINPROT-NMEA</i>	0x10710002	L	-	-	Flag to indicate if NMEA should be an input protocol on I2C

**Table 10: CFG-I2CINPROT configuration items**

#### 4.9.5 CFG-I2COUTPROT: Output protocol configuration of the I2C interface

Output protocol enable flags of the I2C interface.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-I2COUTPROT-UBX</i>	0x10720001	L	-	-	Flag to indicate if UBX should be an output protocol on I2C
<i>CFG-I2COUTPROT-NMEA</i>	0x10720002	L	-	-	Flag to indicate if NMEA should be an output protocol on I2C

**Table 11: CFG-I2COUTPROT configuration items**

#### 4.9.6 CFG-INFMSG: Information message configuration

Information message configuration for the NMEA and UBX protocols.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-INFMSG-UBX_I2C</i>	0x20920001	X1	-	-	Information message enable flags for the UBX protocol on the I2C interface
See <a href="#">Table 13</a> below for a list of possible constants for this item.					
<i>CFG-INFMSG-UBX_UART1</i>	0x20920002	X1	-	-	Information message enable flags for the UBX protocol on the UART1 interface
See <a href="#">Table 13</a> below for a list of possible constants for this item.					
<i>CFG-INFMSG-UBX_SPI</i>	0x20920005	X1	-	-	Information message enable flags for the UBX protocol on the SPI interface
See <a href="#">Table 13</a> below for a list of possible constants for this item.					
<i>CFG-INFMSG-NMEA_I2C</i>	0x20920006	X1	-	-	Information message enable flags for the NMEA protocol on the I2C interface
See <a href="#">Table 13</a> below for a list of possible constants for this item.					
<i>CFG-INFMSG-NMEA_UART1</i>	0x20920007	X1	-	-	Information message enable flags for the NMEA protocol on the UART1 interface
See <a href="#">Table 13</a> below for a list of possible constants for this item.					
<i>CFG-INFMSG-NMEA_SPI</i>	0x2092000a	X1	-	-	Information message enable flags for the NMEA protocol on the SPI interface
See <a href="#">Table 13</a> below for a list of possible constants for this item.					

**Table 12: CFG-INFMSG configuration items**

Constant	Value	Description
<i>ERROR</i>	0x01	Enable ERROR information messages
<i>WARNING</i>	0x02	Enable WARNING information messages
<i>NOTICE</i>	0x04	Enable NOTICE information messages
<i>TEST</i>	0x08	Enable TEST information messages
<i>DEBUG</i>	0x10	Enable DEBUG information messages

**Table 13: Constants for CFG-INFMSG-UBX\_I2C, CFG-INFMSG-UBX\_UART1, CFG-INFMSG-UBX\_SPI, CFG-INFMSG-NMEA\_I2C, CFG-INFMSG-NMEA\_UART1, CFG-INFMSG-NMEA\_SPI**

#### 4.9.7 CFG-MOT: Motion detector configuration

The items in this group specify the parameters used for the internal receiver motion detector. The platform motion is assessed by combining the detected motion of different detectors looking at

specific data types (i.e. GNSS, gyroscopes, accelerometers, wheel ticks). The decision thresholds of the internal detectors can be specified using the configuration items in this group.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MOT-GNSSSPEED_THRS</i>	0x20250038	U1	0.01	m/s	Static hold speed threshold, below which the receiver is considered to be stationary
Set this parameter to 0 to enable the default firmware value or behavior.					
<i>CFG-MOT-GNSSDIST_THRS</i>	0x3025003b	U2	1.0	m	Static hold distance threshold, within which the receiver is considered to be stationary
Set this parameter to 0 to enable the default firmware value or behavior.					

**Table 14: CFG-MOT configuration items**

#### 4.9.8 CFG-MSGOUT: Message output configuration

For each message and port a separate output rate (per second, per epoch) can be configured.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGOUT-NMEA_ID_DTM_I2C</i>	0x209100a6	U1	-	-	Output rate of the NMEA-GX-DTM message on port I2C
<i>CFG-MSGOUT-NMEA_ID_DTM_SPI</i>	0x209100aa	U1	-	-	Output rate of the NMEA-GX-DTM message on port SPI
<i>CFG-MSGOUT-NMEA_ID_DTM_UART1</i>	0x209100a7	U1	-	-	Output rate of the NMEA-GX-DTM message on port UART1
<i>CFG-MSGOUT-NMEA_ID_GBS_I2C</i>	0x209100dd	U1	-	-	Output rate of the NMEA-GX-GBS message on port I2C
<i>CFG-MSGOUT-NMEA_ID_GBS_SPI</i>	0x209100e1	U1	-	-	Output rate of the NMEA-GX-GBS message on port SPI
<i>CFG-MSGOUT-NMEA_ID_GBS_UART1</i>	0x209100de	U1	-	-	Output rate of the NMEA-GX-GBS message on port UART1
<i>CFG-MSGOUT-NMEA_ID_GGA_I2C</i>	0x209100ba	U1	-	-	Output rate of the NMEA-GX-GGA message on port I2C
<i>CFG-MSGOUT-NMEA_ID_GGA_SPI</i>	0x209100be	U1	-	-	Output rate of the NMEA-GX-GGA message on port SPI
<i>CFG-MSGOUT-NMEA_ID_GGA_UART1</i>	0x209100bb	U1	-	-	Output rate of the NMEA-GX-GGA message on port UART1
<i>CFG-MSGOUT-NMEA_ID_GLL_I2C</i>	0x209100c9	U1	-	-	Output rate of the NMEA-GX-GLL message on port I2C
<i>CFG-MSGOUT-NMEA_ID_GLL_SPI</i>	0x209100cd	U1	-	-	Output rate of the NMEA-GX-GLL message on port SPI
<i>CFG-MSGOUT-NMEA_ID_GLL_UART1</i>	0x209100ca	U1	-	-	Output rate of the NMEA-GX-GLL message on port UART1
<i>CFG-MSGOUT-NMEA_ID_GNS_I2C</i>	0x209100b5	U1	-	-	Output rate of the NMEA-GX-GNS message on port I2C
<i>CFG-MSGOUT-NMEA_ID_GNS_SPI</i>	0x209100b9	U1	-	-	Output rate of the NMEA-GX-GNS message on port SPI
<i>CFG-MSGOUT-NMEA_ID_GNS_UART1</i>	0x209100b6	U1	-	-	Output rate of the NMEA-GX-GNS message on port UART1
<i>CFG-MSGOUT-NMEA_ID_GRS_I2C</i>	0x209100ce	U1	-	-	Output rate of the NMEA-GX-GRS message on port I2C
<i>CFG-MSGOUT-NMEA_ID_GRS_SPI</i>	0x209100d2	U1	-	-	Output rate of the NMEA-GX-GRS message on port SPI
<i>CFG-MSGOUT-NMEA_ID_GRS_UART1</i>	0x209100cf	U1	-	-	Output rate of the NMEA-GX-GRS message on port UART1
<i>CFG-MSGOUT-NMEA_ID_GSA_I2C</i>	0x209100bf	U1	-	-	Output rate of the NMEA-GX-GSA message on port I2C

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGOUT-NMEA_ID_GSA_SPI</i>	0x209100c3	U1	-	-	Output rate of the NMEA-GX-GSA message on port SPI
<i>CFG-MSGOUT-NMEA_ID_GSA_UART1</i>	0x209100c0	U1	-	-	Output rate of the NMEA-GX-GSA message on port UART1
<i>CFG-MSGOUT-NMEA_ID_GST_I2C</i>	0x209100d3	U1	-	-	Output rate of the NMEA-GX-GST message on port I2C
<i>CFG-MSGOUT-NMEA_ID_GST_SPI</i>	0x209100d7	U1	-	-	Output rate of the NMEA-GX-GST message on port SPI
<i>CFG-MSGOUT-NMEA_ID_GST_UART1</i>	0x209100d4	U1	-	-	Output rate of the NMEA-GX-GST message on port UART1
<i>CFG-MSGOUT-NMEA_ID_GSV_I2C</i>	0x209100c4	U1	-	-	Output rate of the NMEA-GX-GSV message on port I2C
<i>CFG-MSGOUT-NMEA_ID_GSV_SPI</i>	0x209100c8	U1	-	-	Output rate of the NMEA-GX-GSV message on port SPI
<i>CFG-MSGOUT-NMEA_ID_GSV_UART1</i>	0x209100c5	U1	-	-	Output rate of the NMEA-GX-GSV message on port UART1
<i>CFG-MSGOUT-NMEA_ID_RLM_I2C</i>	0x20910400	U1	-	-	Output rate of the NMEA-GX-RLM message on port I2C
<i>CFG-MSGOUT-NMEA_ID_RLM_SPI</i>	0x20910404	U1	-	-	Output rate of the NMEA-GX-RLM message on port SPI
<i>CFG-MSGOUT-NMEA_ID_RLM_UART1</i>	0x20910401	U1	-	-	Output rate of the NMEA-GX-RLM message on port UART1
<i>CFG-MSGOUT-NMEA_ID_RMC_I2C</i>	0x209100ab	U1	-	-	Output rate of the NMEA-GX-RMC message on port I2C
<i>CFG-MSGOUT-NMEA_ID_RMC_SPI</i>	0x209100af	U1	-	-	Output rate of the NMEA-GX-RMC message on port SPI
<i>CFG-MSGOUT-NMEA_ID_RMC_UART1</i>	0x209100ac	U1	-	-	Output rate of the NMEA-GX-RMC message on port UART1
<i>CFG-MSGOUT-NMEA_ID_VTG_I2C</i>	0x209100b0	U1	-	-	Output rate of the NMEA-GX-VTG message on port I2C
<i>CFG-MSGOUT-NMEA_ID_VTG_SPI</i>	0x209100b4	U1	-	-	Output rate of the NMEA-GX-VTG message on port SPI
<i>CFG-MSGOUT-NMEA_ID_VTG_UART1</i>	0x209100b1	U1	-	-	Output rate of the NMEA-GX-VTG message on port UART1
<i>CFG-MSGOUT-NMEA_ID_ZDA_I2C</i>	0x209100d8	U1	-	-	Output rate of the NMEA-GX-ZDA message on port I2C
<i>CFG-MSGOUT-NMEA_ID_ZDA_SPI</i>	0x209100dc	U1	-	-	Output rate of the NMEA-GX-ZDA message on port SPI
<i>CFG-MSGOUT-NMEA_ID_ZDA_UART1</i>	0x209100d9	U1	-	-	Output rate of the NMEA-GX-ZDA message on port UART1
<i>CFG-MSGOUT-NMEA_NAV2_ID_GGA_I2C</i>	0x20910661	U1	-	-	Output rate of the NMEA-NAV2-GX-GGA message on port I2C
<i>CFG-MSGOUT-NMEA_NAV2_ID_GGA_SPI</i>	0x20910665	U1	-	-	Output rate of the NMEA-NAV2-GX-GGA message on port SPI
<i>CFG-MSGOUT-NMEA_NAV2_ID_GGA_UART1</i>	0x20910662	U1	-	-	Output rate of the NMEA-NAV2-GX-GGA message on port UART1
<i>CFG-MSGOUT-NMEA_NAV2_ID_GLL_I2C</i>	0x20910670	U1	-	-	Output rate of the NMEA-NAV2-GX-GLL message on port I2C
<i>CFG-MSGOUT-NMEA_NAV2_ID_GLL_SPI</i>	0x20910674	U1	-	-	Output rate of the NMEA-NAV2-GX-GLL message on port SPI
<i>CFG-MSGOUT-NMEA_NAV2_ID_GLL_UART1</i>	0x20910671	U1	-	-	Output rate of the NMEA-NAV2-GX-GLL message on port UART1

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGGOUT-NMEA_NAV2_ID_GNS_I2C</i>	0x2091065c	U1	-	-	Output rate of the NMEA-NAV2-GX-GNS message on port I2C
<i>CFG-MSGGOUT-NMEA_NAV2_ID_GNS_SPI</i>	0x20910660	U1	-	-	Output rate of the NMEA-NAV2-GX-GNS message on port SPI
<i>CFG-MSGGOUT-NMEA_NAV2_ID_GNS_UART1</i>	0x2091065d	U1	-	-	Output rate of the NMEA-NAV2-GX-GNS message on port UART1
<i>CFG-MSGGOUT-NMEA_NAV2_ID_GSA_I2C</i>	0x20910666	U1	-	-	Output rate of the NMEA-NAV2-GX-GSA message on port I2C
<i>CFG-MSGGOUT-NMEA_NAV2_ID_GSA_SPI</i>	0x2091066a	U1	-	-	Output rate of the NMEA-NAV2-GX-GSA message on port SPI
<i>CFG-MSGGOUT-NMEA_NAV2_ID_GSA_UART1</i>	0x20910667	U1	-	-	Output rate of the NMEA-NAV2-GX-GSA message on port UART1
<i>CFG-MSGGOUT-NMEA_NAV2_ID_RMC_I2C</i>	0x20910652	U1	-	-	Output rate of the NMEA-NAV2-GX-RMC message on port I2C
<i>CFG-MSGGOUT-NMEA_NAV2_ID_RMC_SPI</i>	0x20910656	U1	-	-	Output rate of the NMEA-NAV2-GX-RMC message on port SPI
<i>CFG-MSGGOUT-NMEA_NAV2_ID_RMC_UART1</i>	0x20910653	U1	-	-	Output rate of the NMEA-NAV2-GX-RMC message on port UART1
<i>CFG-MSGGOUT-NMEA_NAV2_ID_VTG_I2C</i>	0x20910657	U1	-	-	Output rate of the NMEA-NAV2-GX-VTG message on port I2C
<i>CFG-MSGGOUT-NMEA_NAV2_ID_VTG_SPI</i>	0x2091065b	U1	-	-	Output rate of the NMEA-NAV2-GX-VTG message on port SPI
<i>CFG-MSGGOUT-NMEA_NAV2_ID_VTG_UART1</i>	0x20910658	U1	-	-	Output rate of the NMEA-NAV2-GX-VTG message on port UART1
<i>CFG-MSGGOUT-NMEA_NAV2_ID_ZDA_I2C</i>	0x2091067f	U1	-	-	Output rate of the NMEA-NAV2-GX-ZDA message on port I2C
<i>CFG-MSGGOUT-NMEA_NAV2_ID_ZDA_SPI</i>	0x20910683	U1	-	-	Output rate of the NMEA-NAV2-GX-ZDA message on port SPI
<i>CFG-MSGGOUT-NMEA_NAV2_ID_ZDA_UART1</i>	0x20910680	U1	-	-	Output rate of the NMEA-NAV2-GX-ZDA message on port UART1
<i>CFG-MSGGOUT-PUBX_ID_POLYP_I2C</i>	0x209100ec	U1	-	-	Output rate of the NMEA-GX-PUBX00 message on port I2C
<i>CFG-MSGGOUT-PUBX_ID_POLYP_SPI</i>	0x209100f0	U1	-	-	Output rate of the NMEA-GX-PUBX00 message on port SPI
<i>CFG-MSGGOUT-PUBX_ID_POLYP_UART1</i>	0x209100ed	U1	-	-	Output rate of the NMEA-GX-PUBX00 message on port UART1
<i>CFG-MSGGOUT-PUBX_ID_POLYS_I2C</i>	0x209100f1	U1	-	-	Output rate of the NMEA-GX-PUBX03 message on port I2C
<i>CFG-MSGGOUT-PUBX_ID_POLYS_SPI</i>	0x209100f5	U1	-	-	Output rate of the NMEA-GX-PUBX03 message on port SPI
<i>CFG-MSGGOUT-PUBX_ID_POLYS_UART1</i>	0x209100f2	U1	-	-	Output rate of the NMEA-GX-PUBX03 message on port UART1
<i>CFG-MSGGOUT-PUBX_ID_POLYT_I2C</i>	0x209100f6	U1	-	-	Output rate of the NMEA-GX-PUBX04 message on port I2C
<i>CFG-MSGGOUT-PUBX_ID_POLYT_SPI</i>	0x209100fa	U1	-	-	Output rate of the NMEA-GX-PUBX04 message on port SPI
<i>CFG-MSGGOUT-PUBX_ID_POLYT_UART1</i>	0x209100f7	U1	-	-	Output rate of the NMEA-GX-PUBX04 message on port UART1
<i>CFG-MSGGOUT-UBX_MON_COMMS_I2C</i>	0x2091034f	U1	-	-	Output rate of the UBX-MON-COMMS message on port I2C
<i>CFG-MSGGOUT-UBX_MON_COMMS_SPI</i>	0x20910353	U1	-	-	Output rate of the UBX-MON-COMMS message on port SPI

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGOUT-UBX_MON_COMMS_UART1</i>	0x20910350	U1	-	-	Output rate of the UBX-MON-COMMS message on port UART1
<i>CFG-MSGOUT-UBX_MON_HW3_I2C</i>	0x20910354	U1	-	-	Output rate of the UBX-MON-HW3 message on port I2C
<i>CFG-MSGOUT-UBX_MON_HW3_SPI</i>	0x20910358	U1	-	-	Output rate of the UBX-MON-HW3 message on port SPI
<i>CFG-MSGOUT-UBX_MON_HW3_UART1</i>	0x20910355	U1	-	-	Output rate of the UBX-MON-HW3 message on port UART1
<i>CFG-MSGOUT-UBX_MON_HW_I2C</i>	0x209101b4	U1	-	-	Output rate of the UBX-MON-HW message on port I2C
<i>CFG-MSGOUT-UBX_MON_HW_SPI</i>	0x209101b8	U1	-	-	Output rate of the UBX-MON-HW message on port SPI
<i>CFG-MSGOUT-UBX_MON_HW_UART1</i>	0x209101b5	U1	-	-	Output rate of the UBX-MON-HW message on port UART1
<i>CFG-MSGOUT-UBX_MON_IO_I2C</i>	0x209101a5	U1	-	-	Output rate of the UBX-MON-IO message on port I2C
<i>CFG-MSGOUT-UBX_MON_IO_SPI</i>	0x209101a9	U1	-	-	Output rate of the UBX-MON-IO message on port SPI
<i>CFG-MSGOUT-UBX_MON_IO_UART1</i>	0x209101a6	U1	-	-	Output rate of the UBX-MON-IO message on port UART1
<i>CFG-MSGOUT-UBX_MON_MSGPP_I2C</i>	0x20910196	U1	-	-	Output rate of the UBX-MON-MSGPP message on port I2C
<i>CFG-MSGOUT-UBX_MON_MSGPP_SPI</i>	0x2091019a	U1	-	-	Output rate of the UBX-MON-MSGPP message on port SPI
<i>CFG-MSGOUT-UBX_MON_MSGPP_UART1</i>	0x20910197	U1	-	-	Output rate of the UBX-MON-MSGPP message on port UART1
<i>CFG-MSGOUT-UBX_MON_RF_I2C</i>	0x20910359	U1	-	-	Output rate of the UBX-MON-RF message on port I2C
<i>CFG-MSGOUT-UBX_MON_RF_SPI</i>	0x2091035d	U1	-	-	Output rate of the UBX-MON-RF message on port SPI
<i>CFG-MSGOUT-UBX_MON_RF_UART1</i>	0x2091035a	U1	-	-	Output rate of the UBX-MON-RF message on port UART1
<i>CFG-MSGOUT-UBX_MON_RXBUF_I2C</i>	0x209101a0	U1	-	-	Output rate of the UBX-MON-RXBUF message on port I2C
<i>CFG-MSGOUT-UBX_MON_RXBUF_SPI</i>	0x209101a4	U1	-	-	Output rate of the UBX-MON-RXBUF message on port SPI
<i>CFG-MSGOUT-UBX_MON_RXBUF_UART1</i>	0x209101a1	U1	-	-	Output rate of the UBX-MON-RXBUF message on port UART1
<i>CFG-MSGOUT-UBX_MON_RXR_I2C</i>	0x20910187	U1	-	-	Output rate of the UBX-MON-RXR message on port I2C
<i>CFG-MSGOUT-UBX_MON_RXR_SPI</i>	0x2091018b	U1	-	-	Output rate of the UBX-MON-RXR message on port SPI
<i>CFG-MSGOUT-UBX_MON_RXR_UART1</i>	0x20910188	U1	-	-	Output rate of the UBX-MON-RXR message on port UART1
<i>CFG-MSGOUT-UBX_MON_SPAN_I2C</i>	0x2091038b	U1	-	-	Output rate of the UBX-MON-SPAN message on port I2C
<i>CFG-MSGOUT-UBX_MON_SPAN_SPI</i>	0x2091038f	U1	-	-	Output rate of the UBX-MON-SPAN message on port SPI
<i>CFG-MSGOUT-UBX_MON_SPAN_UART1</i>	0x2091038c	U1	-	-	Output rate of the UBX-MON-SPAN message on port UART1
<i>CFG-MSGOUT-UBX_MON_SYS_I2C</i>	0x2091069d	U1	-	-	Output rate of the UBX-MON-SYS message on port I2C

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGOUT-UBX_MON_SYS_SPI</i>	0x209106a1	U1	-	-	Output rate of the UBX-MON-SYS message on port SPI
<i>CFG-MSGOUT-UBX_MON_SYS_UART1</i>	0x2091069e	U1	-	-	Output rate of the UBX-MON-SYS message on port UART1
<i>CFG-MSGOUT-UBX_MON_TXBUF_I2C</i>	0x2091019b	U1	-	-	Output rate of the UBX-MON-TXBUF message on port I2C
<i>CFG-MSGOUT-UBX_MON_TXBUF_SPI</i>	0x2091019f	U1	-	-	Output rate of the UBX-MON-TXBUF message on port SPI
<i>CFG-MSGOUT-UBX_MON_TXBUF_UART1</i>	0x2091019c	U1	-	-	Output rate of the UBX-MON-TXBUF message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_CLOCK_I2C</i>	0x20910430	U1	-	-	Output rate of the UBX-NAV2-CLOCK message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_CLOCK_SPI</i>	0x20910434	U1	-	-	Output rate of the UBX-NAV2-CLOCK message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_CLOCK_UART1</i>	0x20910431	U1	-	-	Output rate of the UBX-NAV2-CLOCK message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_COV_I2C</i>	0x20910435	U1	-	-	Output rate of the UBX-NAV2-COV message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_COV_SPI</i>	0x20910439	U1	-	-	Output rate of the UBX-NAV2-COV message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_COV_UART1</i>	0x20910436	U1	-	-	Output rate of the UBX-NAV2-COV message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_DOP_I2C</i>	0x20910465	U1	-	-	Output rate of the UBX-NAV2-DOP message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_DOP_SPI</i>	0x20910469	U1	-	-	Output rate of the UBX-NAV2-DOP message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_DOP_UART1</i>	0x20910466	U1	-	-	Output rate of the UBX-NAV2-DOP message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_EOE_I2C</i>	0x20910565	U1	-	-	Output rate of the UBX-NAV2-EOE message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_EOE_SPI</i>	0x20910569	U1	-	-	Output rate of the UBX-NAV2-EOE message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_EOE_UART1</i>	0x20910566	U1	-	-	Output rate of the UBX-NAV2-EOE message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_POSECEF_I2C</i>	0x20910480	U1	-	-	Output rate of the UBX-NAV2-POSECEF message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_POSECEF_SPI</i>	0x20910484	U1	-	-	Output rate of the UBX-NAV2-POSECEF message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_POSECEF_UART1</i>	0x20910481	U1	-	-	Output rate of the UBX-NAV2-POSECEF message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_POSLLH_I2C</i>	0x20910485	U1	-	-	Output rate of the UBX-NAV2-POSLLH message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_POSLLH_SPI</i>	0x20910489	U1	-	-	Output rate of the UBX-NAV2-POSLLH message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_POSLLH_UART1</i>	0x20910486	U1	-	-	Output rate of the UBX-NAV2-POSLLH message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_PVT_I2C</i>	0x20910490	U1	-	-	Output rate of the UBX-NAV2-PVT message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_PVT_SPI</i>	0x20910494	U1	-	-	Output rate of the UBX-NAV2-PVT message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_PVT_UART1</i>	0x20910491	U1	-	-	Output rate of the UBX-NAV2-PVT message on port UART1

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGOUT-UBX_NAV2_SAT_I2C</i>	0x20910495	U1	-	-	Output rate of the UBX-NAV2-SAT message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_SAT_SPI</i>	0x20910499	U1	-	-	Output rate of the UBX-NAV2-SAT message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_SAT_UART1</i>	0x20910496	U1	-	-	Output rate of the UBX-NAV2-SAT message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_SBAS_I2C</i>	0x20910500	U1	-	-	Output rate of the UBX-NAV2-SBAS message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_SBAS_SPI</i>	0x20910504	U1	-	-	Output rate of the UBX-NAV2-SBAS message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_SBAS_UART1</i>	0x20910501	U1	-	-	Output rate of the UBX-NAV2-SBAS message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_SIG_I2C</i>	0x20910505	U1	-	-	Output rate of the UBX-NAV2-SIG message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_SIG_SPI</i>	0x20910509	U1	-	-	Output rate of the UBX-NAV2-SIG message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_SIG_UART1</i>	0x20910506	U1	-	-	Output rate of the UBX-NAV2-SIG message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_STATUS_I2C</i>	0x20910515	U1	-	-	Output rate of the UBX-NAV2-STATUS message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_STATUS_SPI</i>	0x20910519	U1	-	-	Output rate of the UBX-NAV2-STATUS message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_STATUS_UART1</i>	0x20910516	U1	-	-	Output rate of the UBX-NAV2-STATUS message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_TIMEBDS_I2C</i>	0x20910525	U1	-	-	Output rate of the UBX-NAV2-TIMEBDS message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_TIMEBDS_SPI</i>	0x20910529	U1	-	-	Output rate of the UBX-NAV2-TIMEBDS message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_TIMEBDS_UART1</i>	0x20910526	U1	-	-	Output rate of the UBX-NAV2-TIMEBDS message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_TIMEGAL_I2C</i>	0x20910530	U1	-	-	Output rate of the UBX-NAV2-TIMEGAL message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_TIMEGAL_SPI</i>	0x20910534	U1	-	-	Output rate of the UBX-NAV2-TIMEGAL message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_TIMEGAL_UART1</i>	0x20910531	U1	-	-	Output rate of the UBX-NAV2-TIMEGAL message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_TIMEGLO_I2C</i>	0x20910535	U1	-	-	Output rate of the UBX-NAV2-TIMEGLO message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_TIMEGLO_SPI</i>	0x20910539	U1	-	-	Output rate of the UBX-NAV2-TIMEGLO message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_TIMEGLO_UART1</i>	0x20910536	U1	-	-	Output rate of the UBX-NAV2-TIMEGLO message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_TIMEGPS_I2C</i>	0x20910540	U1	-	-	Output rate of the UBX-NAV2-TIMEGPS message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_TIMEGPS_SPI</i>	0x20910544	U1	-	-	Output rate of the UBX-NAV2-TIMEGPS message on port SPI
<i>CFG-MSGOUT-UBX_NAV2_TIMEGPS_UART1</i>	0x20910541	U1	-	-	Output rate of the UBX-NAV2-TIMEGPS message on port UART1
<i>CFG-MSGOUT-UBX_NAV2_TIMELS_I2C</i>	0x20910545	U1	-	-	Output rate of the UBX-NAV2-TIMELS message on port I2C
<i>CFG-MSGOUT-UBX_NAV2_TIMELS_SPI</i>	0x20910549	U1	-	-	Output rate of the UBX-NAV2-TIMELS message on port SPI



Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGGOUT-UBX_NAV2_TIMELS_UART1</i>	0x20910546	U1	-	-	Output rate of the UBX-NAV2-TIMELS message on port UART1
<i>CFG-MSGGOUT-UBX_NAV2_TIMENAVIC_I2C</i>	0x209106a7	U1	-	-	Output rate of the UBX-NAV2-TIMENAVIC message on port I2C
<i>CFG-MSGGOUT-UBX_NAV2_TIMENAVIC_SPI</i>	0x209106ab	U1	-	-	Output rate of the UBX-NAV2-TIMENAVIC message on port SPI
<i>CFG-MSGGOUT-UBX_NAV2_TIMENAVIC_UART1</i>	0x209106a8	U1	-	-	Output rate of the UBX-NAV2-TIMENAVIC message on port UART1
<i>CFG-MSGGOUT-UBX_NAV2_TIMEUTC_I2C</i>	0x20910550	U1	-	-	Output rate of the UBX-NAV2-TIMEUTC message on port I2C
<i>CFG-MSGGOUT-UBX_NAV2_TIMEUTC_SPI</i>	0x20910554	U1	-	-	Output rate of the UBX-NAV2-TIMEUTC message on port SPI
<i>CFG-MSGGOUT-UBX_NAV2_TIMEUTC_UART1</i>	0x20910551	U1	-	-	Output rate of the UBX-NAV2-TIMEUTC message on port UART1
<i>CFG-MSGGOUT-UBX_NAV2_VELECEF_I2C</i>	0x20910555	U1	-	-	Output rate of the UBX-NAV2-VELECEF message on port I2C
<i>CFG-MSGGOUT-UBX_NAV2_VELECEF_SPI</i>	0x20910559	U1	-	-	Output rate of the UBX-NAV2-VELECEF message on port SPI
<i>CFG-MSGGOUT-UBX_NAV2_VELECEF_UART1</i>	0x20910556	U1	-	-	Output rate of the UBX-NAV2-VELECEF message on port UART1
<i>CFG-MSGGOUT-UBX_NAV2_VELNED_I2C</i>	0x20910560	U1	-	-	Output rate of the UBX-NAV2-VELNED message on port I2C
<i>CFG-MSGGOUT-UBX_NAV2_VELNED_SPI</i>	0x20910564	U1	-	-	Output rate of the UBX-NAV2-VELNED message on port SPI
<i>CFG-MSGGOUT-UBX_NAV2_VELNED_UART1</i>	0x20910561	U1	-	-	Output rate of the UBX-NAV2-VELNED message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_CLOCK_I2C</i>	0x20910065	U1	-	-	Output rate of the UBX-NAV-CLOCK message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_CLOCK_SPI</i>	0x20910069	U1	-	-	Output rate of the UBX-NAV-CLOCK message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_CLOCK_UART1</i>	0x20910066	U1	-	-	Output rate of the UBX-NAV-CLOCK message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_COV_I2C</i>	0x20910083	U1	-	-	Output rate of the UBX-NAV-COV message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_COV_SPI</i>	0x20910087	U1	-	-	Output rate of the UBX-NAV-COV message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_COV_UART1</i>	0x20910084	U1	-	-	Output rate of the UBX-NAV-COV message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_DOP_I2C</i>	0x20910038	U1	-	-	Output rate of the UBX-NAV-DOP message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_DOP_SPI</i>	0x2091003c	U1	-	-	Output rate of the UBX-NAV-DOP message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_DOP_UART1</i>	0x20910039	U1	-	-	Output rate of the UBX-NAV-DOP message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_EOE_I2C</i>	0x2091015f	U1	-	-	Output rate of the UBX-NAV-EOE message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_EOE_SPI</i>	0x20910163	U1	-	-	Output rate of the UBX-NAV-EOE message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_EOE_UART1</i>	0x20910160	U1	-	-	Output rate of the UBX-NAV-EOE message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_NMI_I2C</i>	0x20910590	U1	-	-	Output rate of the UBX-NAV-NMI message on port I2C

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGOUT-UBX_NAV_NMI_SPI</i>	0x20910594	U1	-	-	Output rate of the UBX-NAV-NMI message on port SPI
<i>CFG-MSGOUT-UBX_NAV_NMI_UART1</i>	0x20910591	U1	-	-	Output rate of the UBX-NAV-NMI message on port UART1
<i>CFG-MSGOUT-UBX_NAV_ORB_I2C</i>	0x20910010	U1	-	-	Output rate of the UBX-NAV-ORB message on port I2C
<i>CFG-MSGOUT-UBX_NAV_ORB_SPI</i>	0x20910014	U1	-	-	Output rate of the UBX-NAV-ORB message on port SPI
<i>CFG-MSGOUT-UBX_NAV_ORB_UART1</i>	0x20910011	U1	-	-	Output rate of the UBX-NAV-ORB message on port UART1
<i>CFG-MSGOUT-UBX_NAV_POSECEF_I2C</i>	0x20910024	U1	-	-	Output rate of the UBX-NAV-POSECEF message on port I2C
<i>CFG-MSGOUT-UBX_NAV_POSECEF_SPI</i>	0x20910028	U1	-	-	Output rate of the UBX-NAV-POSECEF message on port SPI
<i>CFG-MSGOUT-UBX_NAV_POSECEF_UART1</i>	0x20910025	U1	-	-	Output rate of the UBX-NAV-POSECEF message on port UART1
<i>CFG-MSGOUT-UBX_NAV_POSLLH_I2C</i>	0x20910029	U1	-	-	Output rate of the UBX-NAV-POSLLH message on port I2C
<i>CFG-MSGOUT-UBX_NAV_POSLLH_SPI</i>	0x2091002d	U1	-	-	Output rate of the UBX-NAV-POSLLH message on port SPI
<i>CFG-MSGOUT-UBX_NAV_POSLLH_UART1</i>	0x2091002a	U1	-	-	Output rate of the UBX-NAV-POSLLH message on port UART1
<i>CFG-MSGOUT-UBX_NAV_PVT_I2C</i>	0x20910006	U1	-	-	Output rate of the UBX-NAV-PVT message on port I2C
<i>CFG-MSGOUT-UBX_NAV_PVT_SPI</i>	0x2091000a	U1	-	-	Output rate of the UBX-NAV-PVT message on port SPI
<i>CFG-MSGOUT-UBX_NAV_PVT_UART1</i>	0x20910007	U1	-	-	Output rate of the UBX-NAV-PVT message on port UART1
<i>CFG-MSGOUT-UBX_NAV_SAT_I2C</i>	0x20910015	U1	-	-	Output rate of the UBX-NAV-SAT message on port I2C
<i>CFG-MSGOUT-UBX_NAV_SAT_SPI</i>	0x20910019	U1	-	-	Output rate of the UBX-NAV-SAT message on port SPI
<i>CFG-MSGOUT-UBX_NAV_SAT_UART1</i>	0x20910016	U1	-	-	Output rate of the UBX-NAV-SAT message on port UART1
<i>CFG-MSGOUT-UBX_NAV_SBAS_I2C</i>	0x2091006a	U1	-	-	Output rate of the UBX-NAV-SBAS message on port I2C
<i>CFG-MSGOUT-UBX_NAV_SBAS_SPI</i>	0x2091006e	U1	-	-	Output rate of the UBX-NAV-SBAS message on port SPI
<i>CFG-MSGOUT-UBX_NAV_SBAS_UART1</i>	0x2091006b	U1	-	-	Output rate of the UBX-NAV-SBAS message on port UART1
<i>CFG-MSGOUT-UBX_NAV_SIG_I2C</i>	0x20910345	U1	-	-	Output rate of the UBX-NAV-SIG message on port I2C
<i>CFG-MSGOUT-UBX_NAV_SIG_SPI</i>	0x20910349	U1	-	-	Output rate of the UBX-NAV-SIG message on port SPI
<i>CFG-MSGOUT-UBX_NAV_SIG_UART1</i>	0x20910346	U1	-	-	Output rate of the UBX-NAV-SIG message on port UART1
<i>CFG-MSGOUT-UBX_NAV_STATUS_I2C</i>	0x2091001a	U1	-	-	Output rate of the UBX-NAV-STATUS message on port I2C
<i>CFG-MSGOUT-UBX_NAV_STATUS_SPI</i>	0x2091001e	U1	-	-	Output rate of the UBX-NAV-STATUS message on port SPI
<i>CFG-MSGOUT-UBX_NAV_STATUS_UART1</i>	0x2091001b	U1	-	-	Output rate of the UBX-NAV-STATUS message on port UART1

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGGOUT-UBX_NAV_TIMEBDS_I2C</i>	0x20910051	U1	-	-	Output rate of the UBX-NAV-TIMEBDS message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_TIMEBDS_SPI</i>	0x20910055	U1	-	-	Output rate of the UBX-NAV-TIMEBDS message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_TIMEBDS_UART1</i>	0x20910052	U1	-	-	Output rate of the UBX-NAV-TIMEBDS message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_TIMEGAL_I2C</i>	0x20910056	U1	-	-	Output rate of the UBX-NAV-TIMEGAL message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_TIMEGAL_SPI</i>	0x2091005a	U1	-	-	Output rate of the UBX-NAV-TIMEGAL message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_TIMEGAL_UART1</i>	0x20910057	U1	-	-	Output rate of the UBX-NAV-TIMEGAL message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_TIMEGLO_I2C</i>	0x2091004c	U1	-	-	Output rate of the UBX-NAV-TIMEGLO message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_TIMEGLO_SPI</i>	0x20910050	U1	-	-	Output rate of the UBX-NAV-TIMEGLO message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_TIMEGLO_UART1</i>	0x2091004d	U1	-	-	Output rate of the UBX-NAV-TIMEGLO message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_TIMEGPS_I2C</i>	0x20910047	U1	-	-	Output rate of the UBX-NAV-TIMEGPS message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_TIMEGPS_SPI</i>	0x2091004b	U1	-	-	Output rate of the UBX-NAV-TIMEGPS message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_TIMEGPS_UART1</i>	0x20910048	U1	-	-	Output rate of the UBX-NAV-TIMEGPS message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_TIMELS_I2C</i>	0x20910060	U1	-	-	Output rate of the UBX-NAV-TIMELS message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_TIMELS_SPI</i>	0x20910064	U1	-	-	Output rate of the UBX-NAV-TIMELS message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_TIMELS_UART1</i>	0x20910061	U1	-	-	Output rate of the UBX-NAV-TIMELS message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_TIMENAVIC_I2C</i>	0x209106a2	U1	-	-	Output rate of the UBX-NAV-TIMENAVIC message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_TIMENAVIC_SPI</i>	0x209106a6	U1	-	-	Output rate of the UBX-NAV-TIMENAVIC message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_TIMENAVIC_UART1</i>	0x209106a3	U1	-	-	Output rate of the UBX-NAV-TIMENAVIC message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_TIMEQZSS_I2C</i>	0x20910386	U1	-	-	Output rate of the UBX-NAV-TIMEQZSS message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_TIMEQZSS_SPI</i>	0x2091038a	U1	-	-	Output rate of the UBX-NAV-TIMEQZSS message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_TIMEQZSS_UART1</i>	0x20910387	U1	-	-	Output rate of the UBX-NAV-TIMEQZSS message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_TIMEUTC_I2C</i>	0x2091005b	U1	-	-	Output rate of the UBX-NAV-TIMEUTC message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_TIMEUTC_SPI</i>	0x2091005f	U1	-	-	Output rate of the UBX-NAV-TIMEUTC message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_TIMEUTC_UART1</i>	0x2091005c	U1	-	-	Output rate of the UBX-NAV-TIMEUTC message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_VELECEF_I2C</i>	0x2091003d	U1	-	-	Output rate of the UBX-NAV-VELECEF message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_VELECEF_SPI</i>	0x20910041	U1	-	-	Output rate of the UBX-NAV-VELECEF message on port SPI

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGGOUT-UBX_NAV_VELECEF_UART1</i>	0x2091003e	U1	-	-	Output rate of the UBX-NAV-VELECEF message on port UART1
<i>CFG-MSGGOUT-UBX_NAV_VELNED_I2C</i>	0x20910042	U1	-	-	Output rate of the UBX-NAV-VELNED message on port I2C
<i>CFG-MSGGOUT-UBX_NAV_VELNED_SPI</i>	0x20910046	U1	-	-	Output rate of the UBX-NAV-VELNED message on port SPI
<i>CFG-MSGGOUT-UBX_NAV_VELNED_UART1</i>	0x20910043	U1	-	-	Output rate of the UBX-NAV-VELNED message on port UART1
<i>CFG-MSGGOUT-UBX_RXM_MEASX_I2C</i>	0x20910204	U1	-	-	Output rate of the UBX-RXM-MEASX message on port I2C
<i>CFG-MSGGOUT-UBX_RXM_MEASX_SPI</i>	0x20910208	U1	-	-	Output rate of the UBX-RXM-MEASX message on port SPI
<i>CFG-MSGGOUT-UBX_RXM_MEASX_UART1</i>	0x20910205	U1	-	-	Output rate of the UBX-RXM-MEASX message on port UART1
<i>CFG-MSGGOUT-UBX_RXM_RAWX_I2C</i>	0x209102a4	U1	-	-	Output rate of the UBX-RXM-RAWX message on port I2C
<i>CFG-MSGGOUT-UBX_RXM_RAWX_SPI</i>	0x209102a8	U1	-	-	Output rate of the UBX-RXM-RAWX message on port SPI
<i>CFG-MSGGOUT-UBX_RXM_RAWX_UART1</i>	0x209102a5	U1	-	-	Output rate of the UBX-RXM-RAWX message on port UART1
<i>CFG-MSGGOUT-UBX_RXM_RLM_I2C</i>	0x2091025e	U1	-	-	Output rate of the UBX-RXM-RLM message on port I2C
<i>CFG-MSGGOUT-UBX_RXM_RLM_SPI</i>	0x20910262	U1	-	-	Output rate of the UBX-RXM-RLM message on port SPI
<i>CFG-MSGGOUT-UBX_RXM_RLM_UART1</i>	0x2091025f	U1	-	-	Output rate of the UBX-RXM-RLM message on port UART1
<i>CFG-MSGGOUT-UBX_RXM_SFRBX_I2C</i>	0x20910231	U1	-	-	Output rate of the UBX-RXM-SFRBX message on port I2C
<i>CFG-MSGGOUT-UBX_RXM_SFRBX_SPI</i>	0x20910235	U1	-	-	Output rate of the UBX-RXM-SFRBX message on port SPI
<i>CFG-MSGGOUT-UBX_RXM_SFRBX_UART1</i>	0x20910232	U1	-	-	Output rate of the UBX-RXM-SFRBX message on port UART1
<i>CFG-MSGGOUT-UBX_SEC_SIGLOG_I2C</i>	0x20910689	U1	-	-	Output rate of the UBX-SEC-SIGLOG message on port I2C
<i>CFG-MSGGOUT-UBX_SEC_SIGLOG_SPI</i>	0x2091068d	U1	-	-	Output rate of the UBX-SEC-SIGLOG message on port SPI
<i>CFG-MSGGOUT-UBX_SEC_SIGLOG_UART1</i>	0x2091068a	U1	-	-	Output rate of the UBX-SEC-SIGLOG message on port UART1
<i>CFG-MSGGOUT-UBX_SEC_SIG_I2C</i>	0x20910634	U1	-	-	Output rate of the UBX-SEC-SIG message on port I2C
<i>CFG-MSGGOUT-UBX_SEC_SIG_SPI</i>	0x20910638	U1	-	-	Output rate of the UBX-SEC-SIG message on port SPI
<i>CFG-MSGGOUT-UBX_SEC_SIG_UART1</i>	0x20910635	U1	-	-	Output rate of the UBX-SEC-SIG message on port UART1
<i>CFG-MSGGOUT-UBX_TIM_SVIN_I2C</i>	0x20910097	U1	-	-	Output rate of the UBX-TIM-SVIN message on port I2C
<i>CFG-MSGGOUT-UBX_TIM_SVIN_SPI</i>	0x2091009b	U1	-	-	Output rate of the UBX-TIM-SVIN message on port SPI
<i>CFG-MSGGOUT-UBX_TIM_SVIN_UART1</i>	0x20910098	U1	-	-	Output rate of the UBX-TIM-SVIN message on port UART1
<i>CFG-MSGGOUT-UBX_TIM_TM2_I2C</i>	0x20910178	U1	-	-	Output rate of the UBX-TIM-TM2 message on port I2C

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-MSGOUT-UBX_TIM_TM2_SPI</i>	0x2091017c	U1	-	-	Output rate of the UBX-TIM-TM2 message on port SPI
<i>CFG-MSGOUT-UBX_TIM_TM2_UART1</i>	0x20910179	U1	-	-	Output rate of the UBX-TIM-TM2 message on port UART1
<i>CFG-MSGOUT-UBX_TIM_TP_I2C</i>	0x2091017d	U1	-	-	Output rate of the UBX-TIM-TP message on port I2C
<i>CFG-MSGOUT-UBX_TIM_TP_SPI</i>	0x20910181	U1	-	-	Output rate of the UBX-TIM-TP message on port SPI
<i>CFG-MSGOUT-UBX_TIM_TP_UART1</i>	0x2091017e	U1	-	-	Output rate of the UBX-TIM-TP message on port UART1
<i>CFG-MSGOUT-UBX_TIM_VRFY_I2C</i>	0x20910092	U1	-	-	Output rate of the UBX-TIM-VRFY message on port I2C
<i>CFG-MSGOUT-UBX_TIM_VRFY_SPI</i>	0x20910096	U1	-	-	Output rate of the UBX-TIM-VRFY message on port SPI
<i>CFG-MSGOUT-UBX_TIM_VRFY_UART1</i>	0x20910093	U1	-	-	Output rate of the UBX-TIM-VRFY message on port UART1

**Table 15: CFG-MSGOUT configuration items**

#### 4.9.9 CFG-NAV2: Secondary output configuration

This group contains configuration items related to the secondary (NAV2) output.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-NAV2-OUT_ENABLED</i>	0x10170001	L	-	-	Enable secondary (NAV2) output Enables the secondary output (GNSS standalone output). It can be used simultaneously with the available primary output (high precision, sensor fusion or time mode output).

**Table 16: CFG-NAV2 configuration items**

#### 4.9.10 CFG-NAVMASK: Satellite Mask Configuration

This can be used to mask out defined satellites to not be used.

The satellites can be specified directly by GNSS system, or when entering a part of sky view in given azimuth and elevation coordinates.

It can be used to block certain portions of sky that are known to introduce signal distortions such as multi-path, etc.

Recommended to be used for receivers that are stationary.

Please note, the satellites may be blocked also by [CFG-NAVSPG-INFIL\\_MINELEV](#) key.

SBAS can be specified using [CFG-SBAS-PRNSCANMASK](#) key.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-NAVMASK-SV_MASK_GPS</i>	0x50180013	X8	-	-	Satellite mask for the GPS system

Configuration item	Key ID	Type	Scale	Unit	Description
<p>Every bit corresponds to a satellite in GPS system.</p> <p>Each bit of a mask corresponds to a satellite with same number:</p> <p>bit 0: reserved</p> <p>bit 1: SV #1</p> <p>bit 2: SV #2</p> <p>...</p> <p>bit 31: SV #31</p> <p>bit 32: SV #32</p> <p>bit 33 - 63: reserved</p> <p>The meaning of the bits:</p> <p>1: SV allowed</p> <p>0: SV blocked</p> <p>See <a href="#">Table 18</a> below for a list of possible constants for this item.</p>					
<p><i>CFG-NAVMASK-SV_MASK_GAL</i></p> <p>Every bit corresponds to a satellite in GALILEO system.</p> <p>Each bit of a mask corresponds to a satellite with same number:</p> <p>bit 0: reserved</p> <p>bit 1: SV #1</p> <p>bit 2: SV #2</p> <p>...</p> <p>bit 35: SV #35</p> <p>bit 36: SV #36</p> <p>bit 37 - 63: reserved</p> <p>The meaning of the bits:</p> <p>1: SV allowed</p> <p>0: SV blocked</p> <p>See <a href="#">Table 19</a> below for a list of possible constants for this item.</p>	0x50180014	X8	-	-	Satellite mask for the GALILEO system
<p><i>CFG-NAVMASK-SV_MASK_GLO</i></p> <p>Every bit corresponds to a satellite in GLONASS system.</p> <p>Each bit of a mask corresponds to a satellite with same number:</p> <p>bit 0: reserved</p> <p>bit 1: SV #1</p> <p>bit 2: SV #2</p> <p>...</p> <p>bit 31: SV #31</p> <p>bit 32: SV #32</p> <p>bit 33 - 63: reserved</p> <p>The meaning of the bits:</p> <p>1: SV allowed</p> <p>0: SV blocked</p> <p>See <a href="#">Table 20</a> below for a list of possible constants for this item.</p>	0x50180015	X8	-	-	Satellite mask for the GLONASS system
<p><i>CFG-NAVMASK-SV_MASK_BDS</i></p> <p>Every bit corresponds to a satellite in BeiDou system.</p> <p>Each bit of a mask corresponds to a satellite with same number:</p> <p>bit 0: reserved</p> <p>bit 1: SV #1</p> <p>bit 2: SV #2</p> <p>...</p> <p>bit 31: SV #31</p> <p>bit 32: SV #32</p> <p>bit 33 - 63: reserved</p> <p>The meaning of the bits:</p> <p>1: SV allowed</p> <p>0: SV blocked</p> <p>See <a href="#">Table 21</a> below for a list of possible constants for this item.</p>	0x50180016	X8	-	-	Satellite mask for the BeiDou system

Configuration item	Key ID	Type	Scale	Unit	Description
<p>Every bit corresponds to a satellite in BeiDou system.</p> <p>Each bit of a mask corresponds to a satellite with same number:</p> <p>bit 0: reserved</p> <p>bit 1: SV #1</p> <p>bit 2: SV #2</p> <p>...</p> <p>bit 62: SV #62</p> <p>bit 63: SV #63</p> <p>The meaning of the bits:</p> <p>1: SV allowed</p> <p>0: SV blocked</p> <p>See <a href="#">Table 21</a> below for a list of possible constants for this item.</p>					
<p><i>CFG-NAVMASK-SV_MASK_QZSS</i></p> <p>Every bit corresponds to a satellite in QZSS system.</p> <p>Each bit of a mask corresponds to a satellite with same number:</p> <p>bit 0: reserved</p> <p>bit 1: SV #1</p> <p>bit 2: SV #2</p> <p>...</p> <p>bit 9: SV #9</p> <p>bit 10: SV #10</p> <p>bit 11 - 63: reserved</p> <p>The meaning of the bits:</p> <p>1: SV allowed</p> <p>0: SV blocked</p> <p>See <a href="#">Table 22</a> below for a list of possible constants for this item.</p>	0x50180017	X8	-	-	Satellite mask for the QZSS system
<p><i>CFG-NAVMASK-SV_MASK_NAVIC</i></p> <p>Every bit corresponds to a satellite in NavIC system.</p> <p>Each bit of a mask corresponds to a satellite with same number:</p> <p>bit 0: reserved</p> <p>bit 1: SV #1</p> <p>bit 2: SV #2</p> <p>...</p> <p>bit 13: SV #13</p> <p>bit 14: SV #14</p> <p>bit 15 - 63: reserved</p> <p>The meaning of the bits:</p> <p>1: SV allowed</p> <p>0: SV blocked</p> <p>See <a href="#">Table 23</a> below for a list of possible constants for this item.</p>	0x50180018	X8	-	-	Satellite mask for the NavIC system
<p><i>CFG-NAVMASK-EL_MASK_000_020</i></p> <p>Elevation masks for azimuth range <math>0 \leq az &lt; 20</math> deg</p>	0x50180001	X8	-	-	Elevation masks for azimuth range $0 \leq az < 20$ deg

Configuration item	Key ID	Type	Scale	Unit	Description
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 0 &lt;= az &lt; 5 deg</p> <p>mask 0000 0000 ffff 0000: 5 &lt;= az &lt; 10 deg</p> <p>mask 0000 ffff 0000 0000: 10 &lt;= az &lt; 15 deg</p> <p>mask ffff 0000 0000 0000: 15 &lt;= az &lt; 20 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 24</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_020_040</i>	0x50180002	X8	-	-	Elevation masks for azimuth range 20 <= az < 40 deg
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 20 &lt;= az &lt; 25 deg</p> <p>mask 0000 0000 ffff 0000: 25 &lt;= az &lt; 30 deg</p> <p>mask 0000 ffff 0000 0000: 30 &lt;= az &lt; 35 deg</p> <p>mask ffff 0000 0000 0000: 35 &lt;= az &lt; 40 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 25</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_040_060</i>	0x50180003	X8	-	-	Elevation masks for azimuth range 40 <= az < 60 deg



Configuration item	Key ID	Type	Scale	Unit	Description
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 40 &lt;= az &lt; 45 deg                      mask 0000 0000 ffff 0000: 45 &lt;= az &lt; 50 deg                      mask 0000 ffff 0000 0000: 50 &lt;= az &lt; 55 deg                      mask ffff 0000 0000 0000: 55 &lt;= az &lt; 60 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg                      bit 1: mask 0002: 10 &lt;= el &lt; 15 deg                      bit 2: mask 0004: 15 &lt;= el &lt; 20 deg                      ...                      bit 14: mask 4000: 75 &lt;= el &lt; 80 deg                      bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector                      0: SV blocked in this sector</p> <p>See <a href="#">Table 26</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_060_080</i>	0x50180004	X8	-	-	Elevation masks for azimuth range 60 <= az < 80 deg
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 60 &lt;= az &lt; 65 deg                      mask 0000 0000 ffff 0000: 65 &lt;= az &lt; 70 deg                      mask 0000 ffff 0000 0000: 70 &lt;= az &lt; 75 deg                      mask ffff 0000 0000 0000: 75 &lt;= az &lt; 80 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg                      bit 1: mask 0002: 10 &lt;= el &lt; 15 deg                      bit 2: mask 0004: 15 &lt;= el &lt; 20 deg                      ...                      bit 14: mask 4000: 75 &lt;= el &lt; 80 deg                      bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector                      0: SV blocked in this sector</p> <p>See <a href="#">Table 27</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_080_100</i>	0x50180005	X8	-	-	Elevation masks for azimuth range 80 <= az < 100 deg

Configuration item	Key ID	Type	Scale	Unit	Description
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 80 &lt;= az &lt; 85 deg</p> <p>mask 0000 0000 ffff 0000: 85 &lt;= az &lt; 90 deg</p> <p>mask 0000 ffff 0000 0000: 90 &lt;= az &lt; 95 deg</p> <p>mask ffff 0000 0000 0000: 95 &lt;= az &lt; 100 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 28</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_100_120</i>	0x50180006	X8	-	-	Elevation masks for azimuth range 100 <= az < 120 deg
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 100 &lt;= az &lt; 105 deg</p> <p>mask 0000 0000 ffff 0000: 105 &lt;= az &lt; 110 deg</p> <p>mask 0000 ffff 0000 0000: 110 &lt;= az &lt; 115 deg</p> <p>mask ffff 0000 0000 0000: 115 &lt;= az &lt; 120 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 29</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_120_140</i>	0x50180007	X8	-	-	Elevation masks for azimuth range 120 <= az < 140 deg

Configuration item	Key ID	Type	Scale	Unit	Description
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 120 &lt;= az &lt; 125 deg</p> <p>mask 0000 0000 ffff 0000: 125 &lt;= az &lt; 130 deg</p> <p>mask 0000 ffff 0000 0000: 130 &lt;= az &lt; 135 deg</p> <p>mask ffff 0000 0000 0000: 135 &lt;= az &lt; 140 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 30</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_140_160</i>	0x50180008	X8	-	-	Elevation masks for azimuth range 140 <= az < 160 deg
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 140 &lt;= az &lt; 145 deg</p> <p>mask 0000 0000 ffff 0000: 145 &lt;= az &lt; 150 deg</p> <p>mask 0000 ffff 0000 0000: 150 &lt;= az &lt; 155 deg</p> <p>mask ffff 0000 0000 0000: 155 &lt;= az &lt; 160 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 31</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_160_180</i>	0x50180009	X8	-	-	Elevation masks for azimuth range 160 <= az < 180 deg

Configuration item	Key ID	Type	Scale	Unit	Description
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 160 &lt;= az &lt; 165 deg</p> <p>mask 0000 0000 ffff 0000: 165 &lt;= az &lt; 170 deg</p> <p>mask 0000 ffff 0000 0000: 170 &lt;= az &lt; 175 deg</p> <p>mask ffff 0000 0000 0000: 175 &lt;= az &lt; 180 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 32</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_180_200</i>	0x5018000a	X8	-	-	Elevation masks for azimuth range 180 <= az < 200 deg
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 180 &lt;= az &lt; 185 deg</p> <p>mask 0000 0000 ffff 0000: 185 &lt;= az &lt; 190 deg</p> <p>mask 0000 ffff 0000 0000: 190 &lt;= az &lt; 195 deg</p> <p>mask ffff 0000 0000 0000: 195 &lt;= az &lt; 200 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 33</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_200_220</i>	0x5018000b	X8	-	-	Elevation masks for azimuth range 200 <= az < 220 deg

Configuration item	Key ID	Type	Scale	Unit	Description
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 200 &lt;= az &lt; 205 deg</p> <p>mask 0000 0000 ffff 0000: 205 &lt;= az &lt; 210 deg</p> <p>mask 0000 ffff 0000 0000: 210 &lt;= az &lt; 215 deg</p> <p>mask ffff 0000 0000 0000: 215 &lt;= az &lt; 220 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 34</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_220_240</i>	0x5018000c	X8	-	-	Elevation masks for azimuth range 220 <= az < 240 deg
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 220 &lt;= az &lt; 225 deg</p> <p>mask 0000 0000 ffff 0000: 225 &lt;= az &lt; 230 deg</p> <p>mask 0000 ffff 0000 0000: 230 &lt;= az &lt; 235 deg</p> <p>mask ffff 0000 0000 0000: 235 &lt;= az &lt; 240 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 35</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_240_260</i>	0x5018000d	X8	-	-	Elevation masks for azimuth range 240 <= az < 260 deg

Configuration item	Key ID	Type	Scale	Unit	Description
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 240 &lt;= az &lt; 245 deg</p> <p>mask 0000 0000 ffff 0000: 245 &lt;= az &lt; 250 deg</p> <p>mask 0000 ffff 0000 0000: 250 &lt;= az &lt; 255 deg</p> <p>mask ffff 0000 0000 0000: 255 &lt;= az &lt; 260 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 36</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_260_280</i>	0x5018000e	X8	-	-	Elevation masks for azimuth range 260 <= az < 280 deg
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 260 &lt;= az &lt; 265 deg</p> <p>mask 0000 0000 ffff 0000: 265 &lt;= az &lt; 270 deg</p> <p>mask 0000 ffff 0000 0000: 270 &lt;= az &lt; 275 deg</p> <p>mask ffff 0000 0000 0000: 275 &lt;= az &lt; 280 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 37</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_280_300</i>	0x5018000f	X8	-	-	Elevation masks for azimuth range 280 <= az < 300 deg

Configuration item	Key ID	Type	Scale	Unit	Description
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 280 &lt;= az &lt; 285 deg</p> <p>mask 0000 0000 ffff 0000: 285 &lt;= az &lt; 290 deg</p> <p>mask 0000 ffff 0000 0000: 290 &lt;= az &lt; 295 deg</p> <p>mask ffff 0000 0000 0000: 295 &lt;= az &lt; 300 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 38</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_300_320</i>	0x50180010	X8	-	-	Elevation masks for azimuth range 300 <= az < 320 deg
<p>Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits:</p> <p>mask 0000 0000 0000 ffff: 300 &lt;= az &lt; 305 deg</p> <p>mask 0000 0000 ffff 0000: 305 &lt;= az &lt; 310 deg</p> <p>mask 0000 ffff 0000 0000: 310 &lt;= az &lt; 315 deg</p> <p>mask ffff 0000 0000 0000: 315 &lt;= az &lt; 320 deg</p> <p>Each bit of a mask corresponds to an elevation range:</p> <p>bit 0: mask 0001: 0 &lt;= el &lt; 10 deg</p> <p>bit 1: mask 0002: 10 &lt;= el &lt; 15 deg</p> <p>bit 2: mask 0004: 15 &lt;= el &lt; 20 deg</p> <p>...</p> <p>bit 14: mask 4000: 75 &lt;= el &lt; 80 deg</p> <p>bit 15: mask 8000: 80 &lt;= el &lt;= 90 deg</p> <p>The meaning of the bits:</p> <p>1: SV allowed in this sector</p> <p>0: SV blocked in this sector</p> <p>See <a href="#">Table 39</a> below for a list of possible constants for this item.</p>					
<i>CFG-NAVMASK-EL_MASK_320_340</i>	0x50180011	X8	-	-	Elevation masks for azimuth range 320 <= az < 340 deg

Configuration item	Key ID	Type	Scale	Unit	Description
Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits: mask 0000 0000 0000 ffff: 320 <= az < 325 deg mask 0000 0000 ffff 0000: 325 <= az < 330 deg mask 0000 ffff 0000 0000: 330 <= az < 335 deg mask ffff 0000 0000 0000: 335 <= az < 340 deg  Each bit of a mask corresponds to an elevation range: bit 0: mask 0001: 0 <= el < 10 deg bit 1: mask 0002: 10 <= el < 15 deg bit 2: mask 0004: 15 <= el < 20 deg ... bit 14: mask 4000: 75 <= el < 80 deg bit 15: mask 8000: 80 <= el <= 90 deg  The meaning of the bits: 1: SV allowed in this sector 0: SV blocked in this sector  See <a href="#">Table 40</a> below for a list of possible constants for this item.					
CFG-NAVMASK-EL_MASK_340_360	0x50180012	X8	-	-	Elevation masks for azimuth range 340 <= az < 360 deg
Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits: mask 0000 0000 0000 ffff: 340 <= az < 345 deg mask 0000 0000 ffff 0000: 345 <= az < 350 deg mask 0000 ffff 0000 0000: 350 <= az < 355 deg mask ffff 0000 0000 0000: 355 <= az < 360 deg  Each bit of a mask corresponds to an elevation range: bit 0: mask 0001: 0 <= el < 10 deg bit 1: mask 0002: 10 <= el < 15 deg bit 2: mask 0004: 15 <= el < 20 deg ... bit 14: mask 4000: 75 <= el < 80 deg bit 15: mask 8000: 80 <= el <= 90 deg  The meaning of the bits: 1: SV allowed in this sector 0: SV blocked in this sector  See <a href="#">Table 41</a> below for a list of possible constants for this item.					

CFG-NAVMASK-EL_MASK_340_360	0x50180012	X8	-	-	Elevation masks for azimuth range 340 <= az < 360 deg
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Elevation masks of four azimuth ranges, every 5 deg. Each mask has a size of 16 bits: mask 0000 0000 0000 ffff: 340 <= az < 345 deg mask 0000 0000 ffff 0000: 345 <= az < 350 deg mask 0000 ffff 0000 0000: 350 <= az < 355 deg mask ffff 0000 0000 0000: 355 <= az < 360 deg  Each bit of a mask corresponds to an elevation range: bit 0: mask 0001: 0 <= el < 10 deg bit 1: mask 0002: 10 <= el < 15 deg bit 2: mask 0004: 15 <= el < 20 deg ... bit 14: mask 4000: 75 <= el < 80 deg bit 15: mask 8000: 80 <= el <= 90 deg  The meaning of the bits: 1: SV allowed in this sector 0: SV blocked in this sector  See <a href="#">Table 41</a> below for a list of possible constants for this item.					
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**Table 17: CFG-NAVMASK configuration items**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All GPS satellites allowed

**Table 18: Constants for CFG-NAVMASK-SV\_MASK\_GPS**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All GALILEO satellites allowed

**Table 19: Constants for CFG-NAVMASK-SV\_MASK\_GAL**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All GLONASS satellites allowed

**Table 20: Constants for CFG-NAVMASK-SV\_MASK\_GLO**



Constant	Value	Description
EMPTY	0xffffffffffffffff	All BeiDou satellites allowed

**Table 21: Constants for CFG-NAVMASK-SV\_MASK\_BDS**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All QZSS satellites allowed

**Table 22: Constants for CFG-NAVMASK-SV\_MASK\_QZSS**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All NavIC satellites allowed

**Table 23: Constants for CFG-NAVMASK-SV\_MASK\_NAVIC**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_01	0x000000000010000	only allowed sector: $5 \leq az < 10 \text{ deg} / 0 \leq el < 10 \text{ deg}$
EXMPL_02	0x0000004000000000	only allowed sector: $10 \leq az < 15 \text{ deg} / 55 \leq el < 60 \text{ deg}$

**Table 24: Constants for CFG-NAVMASK-EL\_MASK\_000\_020**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_03	0x0000000000002000	only allowed sector: $20 \leq az < 25 \text{ deg} / 70 \leq el < 75 \text{ deg}$
EXMPL_04	0x0080000000000000	only allowed sector: $35 \leq az < 40 \text{ deg} / 40 \leq el < 45 \text{ deg}$

**Table 25: Constants for CFG-NAVMASK-EL\_MASK\_020\_040**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_05	0x0000000000000001	only allowed sector: $40 \leq az < 45 \text{ deg} / 0 \leq el < 10 \text{ deg}$
EXMPL_06	0x0000800000000000	only allowed sector: $50 \leq az < 55 \text{ deg} / 80 \leq el \leq 90 \text{ deg}$

**Table 26: Constants for CFG-NAVMASK-EL\_MASK\_040\_060**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_07	0x000000000400000	only allowed sector: $65 \leq az < 70 \text{ deg} / 35 \leq el < 40 \text{ deg}$
EXMPL_08	0x0000100000000000	only allowed sector: $70 \leq az < 75 \text{ deg} / 65 \leq el < 70 \text{ deg}$

**Table 27: Constants for CFG-NAVMASK-EL\_MASK\_060\_080**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_09	0x0000000000008000	only allowed sector: $80 \leq az < 85 \text{ deg} / 80 \leq el \leq 90 \text{ deg}$
EXMPL_10	0x0000000800000000	only allowed sector: $90 \leq az < 95 \text{ deg} / 20 \leq el < 25 \text{ deg}$

**Table 28: Constants for CFG-NAVMASK-EL\_MASK\_080\_100**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_11	0x0000000000000020	only allowed sector: $100 \leq az < 105 \text{ deg} / 30 \leq el < 35 \text{ deg}$
EXMPL_12	0x0000400000000000	only allowed sector: $110 \leq az < 115 \text{ deg} / 75 \leq el < 80 \text{ deg}$

**Table 29: Constants for CFG-NAVMASK-EL\_MASK\_100\_120**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_13	0x00000000000040000	only allowed sector: 125 <= az < 130 deg / 15 <= el < 20 deg
EXMPL_14	0x04000000000000000	only allowed sector: 135 <= az < 140 deg / 55 <= el < 60 deg

**Table 30: Constants for CFG-NAVMASK-EL\_MASK\_120\_140**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_15	0x0000000010000000	only allowed sector: 145 <= az < 150 deg / 45 <= el < 50 deg
EXMPL_16	0x00020000000000000	only allowed sector: 155 <= az < 160 deg / 10 <= el < 55 deg

**Table 31: Constants for CFG-NAVMASK-EL\_MASK\_140\_160**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_17	0x0000000010000000	only allowed sector: 165 <= az < 170 deg / 25 <= el < 30 deg
EXMPL_18	0x08000000000000000	only allowed sector: 175 <= az < 180 deg / 60 <= el < 65 deg

**Table 32: Constants for CFG-NAVMASK-EL\_MASK\_160\_180**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_19	0x0000000000000200	only allowed sector: 180 <= az < 185 deg / 50 <= el < 55 deg
EXMPL_20	0x00000100000000000	only allowed sector: 190 <= az < 195 deg / 25 <= el < 30 deg

**Table 33: Constants for CFG-NAVMASK-EL\_MASK\_180\_200**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_21	0x0000000200000000	only allowed sector: 205 <= az < 210 deg / 70 <= el < 75 deg
EXMPL_22	0x04000000000000000	only allowed sector: 215 <= az < 220 deg / 55 <= el < 60 deg

**Table 34: Constants for CFG-NAVMASK-EL\_MASK\_200\_220**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_23	0x0000000000000200	only allowed sector: 220 <= az < 225 deg / 50 <= el < 55 deg
EXMPL_24	0x00800000000000000	only allowed sector: 235 <= az < 240 deg / 40 <= el < 45 deg

**Table 35: Constants for CFG-NAVMASK-EL\_MASK\_220\_240**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_25	0x0000000100000000	only allowed sector: 245 <= az < 250 deg / 65 <= el < 70 deg
EXMPL_26	0x00000040000000000	only allowed sector: 250 <= az < 255 deg / 15 <= el < 20 deg

**Table 36: Constants for CFG-NAVMASK-EL\_MASK\_240\_260**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_27	0x0000000000004000	only allowed sector: 260 <= az < 265 deg / 75 <= el < 80 deg
EXMPL_28	0x0000000002000000	only allowed sector: 265 <= az < 270 deg / 30 <= el < 35 deg

**Table 37: Constants for CFG-NAVMASK-EL\_MASK\_260\_280**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_29	0x000000001000000	only allowed sector: 285 <= az < 290 deg / 45 <= el < 50 deg
EXMPL_30	0x0000008000000000	only allowed sector: 290 <= az < 295 deg / 40 <= el < 45 deg

**Table 38: Constants for CFG-NAVMASK-EL\_MASK\_280\_300**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_31	0x0000008000000000	only allowed sector: 310 <= az < 315 deg / 20 <= el < 25 deg
EXMPL_32	0x0010000000000000	only allowed sector: 315 <= az < 320 deg / 25 <= el < 30 deg

**Table 39: Constants for CFG-NAVMASK-EL\_MASK\_300\_320**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_33	0x0000002000000000	only allowed sector: 330 <= az < 335 deg / 10 <= el < 15 deg
EXMPL_34	0x0000040000000000	only allowed sector: 330 <= az < 335 deg / 55 <= el < 60 deg

**Table 40: Constants for CFG-NAVMASK-EL\_MASK\_320\_340**

Constant	Value	Description
EMPTY	0xffffffffffffffff	All sectors allowed
EXMPL_35	0x0000000000000040	only allowed sector: 340 <= az < 345 deg / 35 <= el < 40 deg
EXMPL_36	0x0000000800000000	only allowed sector: 345 <= az < 350 deg / 80 <= el <= 90 deg

**Table 41: Constants for CFG-NAVMASK-EL\_MASK\_340\_360**

#### 4.9.11 CFG-NAVSPG: Standard precision navigation configuration

This group contains configuration items related to the operation of the receiver at standard precision, including configuring position fix mode, ionospheric model selection and other related items.

Configuration item	Key ID	Type	Scale	Unit	Description
CFG-NAVSPG-FIXMODE	0x20110011	E1	-	-	Position fix mode
See <a href="#">Table 43</a> below for a list of possible constants for this item.					
CFG-NAVSPG-INIFIX3D	0x10110013	L	-	-	Initial fix must be a 3D fix
CFG-NAVSPG-WKNROLLOVER	0x30110017	U2	-	-	GPS week rollover number
GPS week numbers are set correctly from this week up to 1024 weeks after this week.					
The range is from 1 to 4096.					
CFG-NAVSPG-USE_PPP	0x10110019	L	-	-	Use precise point positioning (PPP)
CFG-NAVSPG-UTCSTANDARD	0x2011001c	E1	-	-	UTC standard to be used
See section GNSS time base in the integration manual.					
See <a href="#">Table 44</a> below for a list of possible constants for this item.					
CFG-NAVSPG-DYNMODEL	0x20110021	E1	-	-	Dynamic platform model
See <a href="#">Table 45</a> below for a list of possible constants for this item.					
CFG-NAVSPG-ACKAIDING	0x10110025	L	-	-	Acknowledge assistance input messages
CFG-NAVSPG-USE_USRDAT	0x10110061	L	-	-	Use user geodetic datum parameters
User specified geodetic system can be used instead of the receiver's default WGS84 ellipsoid. All of the CFG-NAVSPG-USERDAT_* user geodetic datum parameters listed here must be configured before enabling the user specified geodetic system.					

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-NAVSPG-USRDAT_MAJA</i>	0x50110062	R8	-	m	Geodetic datum semi-major axis Accepted range is from 6,300,000.0 to 6,500,000.0 meters
<i>CFG-NAVSPG-USRDAT_FLAT</i>	0x50110063	R8	-	-	Geodetic datum 1.0 / flattening Accepted range is 0.0 to 500.0.
<i>CFG-NAVSPG-USRDAT_DX</i>	0x40110064	R4	-	m	Geodetic datum X axis shift at the origin Accepted range is +/- 5000.0 meters.
<i>CFG-NAVSPG-USRDAT_DY</i>	0x40110065	R4	-	m	Geodetic datum Y axis shift at the origin Accepted range is +/- 5000.0 meters.
<i>CFG-NAVSPG-USRDAT_DZ</i>	0x40110066	R4	-	m	Geodetic datum Z axis shift at the origin Accepted range is +/- 5000.0 meters.
<i>CFG-NAVSPG-USRDAT_ROTX</i>	0x40110067	R4	-	arcsec	Geodetic datum rotation about the X axis Accepted range is +/- 20.0 milli arc seconds.
<i>CFG-NAVSPG-USRDAT_ROTY</i>	0x40110068	R4	-	arcsec	Geodetic datum rotation about the Y axis () Accepted range is +/- 20.0 milli-arc seconds.
<i>CFG-NAVSPG-USRDAT_ROTZ</i>	0x40110069	R4	-	arcsec	Geodetic datum rotation about the Z axis Accepted range is +/- 20.0 milli-arc seconds.
<i>CFG-NAVSPG-USRDAT_SCALE</i>	0x4011006a	R4	-	ppm	Geodetic datum scale factor Accepted range is 0.0 to 50.0 parts per million.
<i>CFG-NAVSPG-INFIL_MINSVS</i>	0x201100a1	U1	-	-	Minimum number of satellites for navigation
<i>CFG-NAVSPG-INFIL_MAXSVS</i>	0x201100a2	U1	-	-	Maximum number of satellites for navigation
<i>CFG-NAVSPG-INFIL_MINCNO</i>	0x201100a3	U1	-	dBHz	Minimum satellite signal level for navigation
<i>CFG-NAVSPG-INFIL_MINELEV</i>	0x201100a4	I1	-	deg	Minimum elevation for a GNSS satellite to be used in navigation
<i>CFG-NAVSPG-INFIL_NCNOTHRS</i>	0x201100aa	U1	-	-	Number of satellites required to have C/N0 above <i>CFG-NAVSPG-INFIL_CNOTHRS</i> for a fix to be attempted
<i>CFG-NAVSPG-INFIL_CNOTHRS</i>	0x201100ab	U1	-	-	C/N0 threshold for deciding whether to attempt a fix
<i>CFG-NAVSPG-OUTFIL_PDOP</i>	0x301100b1	U2	0.1	-	Output filter position DOP mask (threshold)
<i>CFG-NAVSPG-OUTFIL_TDOP</i>	0x301100b2	U2	0.1	-	Output filter time DOP mask (threshold)
<i>CFG-NAVSPG-OUTFIL_PACC</i>	0x301100b3	U2	-	m	Output filter position accuracy mask (threshold)
<i>CFG-NAVSPG-OUTFIL_TACC</i>	0x301100b4	U2	-	m	Output filter time accuracy mask (threshold)
<i>CFG-NAVSPG-OUTFIL_FACC</i>	0x301100b5	U2	0.01	m/s	Output filter frequency accuracy mask (threshold)
<i>CFG-NAVSPG-CONSTR_ALT</i>	0x401100c1	I4	0.01	m	Fixed altitude (mean sea level) for 2D fix mode
<i>CFG-NAVSPG-CONSTR_ALTVAR</i>	0x401100c2	U4	0.0001	m <sup>2</sup>	Fixed altitude variance for 2D mode
<i>CFG-NAVSPG-CONSTR_DGNSSSTO</i>	0x201100c4	U1	-	s	DGNSS timeout

**Table 42: CFG-NAVSPG configuration items**

Constant	Value	Description
<i>2DONLY</i>	1	2D only
<i>3DONLY</i>	2	3D only
<i>AUTO</i>	3	Auto 2D/3D

**Table 43: Constants for CFG-NAVSPG-FIXMODE**

Constant	Value	Description
<i>AUTO</i>	0	Automatic; receiver selects based on GNSS configuration
<i>USNO</i>	3	UTC as operated by the U.S. Naval Observatory (USNO); derived from GPS time
<i>EU</i>	5	UTC as combined from multiple European laboratories; derived from Galileo time
<i>SU</i>	6	UTC as operated by the former Soviet Union (SU); derived from GLONASS time
<i>NTSC</i>	7	UTC as operated by the National Time Service Center (NTSC), China; derived from BeiDou time
<i>NPLI</i>	8	UTC as operated by the National Physics Laboratory, India (NPLI); derived from NavIC time
<i>NICT</i>	9	UTC as operated by the National Institute of Information and Communications Technology, Japan (NICT); derived from QZSS time

**Table 44: Constants for CFG-NAVSPG-UTCSTANDARD**

Constant	Value	Description
<i>PORT</i>	0	Portable
<i>STAT</i>	2	Stationary
<i>PED</i>	3	Pedestrian
<i>AUTOMOT</i>	4	Automotive
<i>SEA</i>	5	Sea
<i>AIR1</i>	6	Airborne with <1g acceleration
<i>AIR2</i>	7	Airborne with <2g acceleration
<i>AIR4</i>	8	Airborne with <4g acceleration
<i>WRIST</i>	9	Wrist-worn watch (not available in all products)
<i>BIKE</i>	10	Motorbike (not available in all products)
<i>MOWER</i>	11	Robotic lawn mower (not available in all products)
<i>ESCOOTER</i>	12	E-scooter (not available in all products)
<i>RAIL</i>	13	Rail vehicles (trains, trams) (not available in all products)

**Table 45: Constants for CFG-NAVSPG-DYNMODEL**

#### 4.9.12 CFG-NMEA: NMEA protocol configuration

This group configures the [NMEA protocol](#). See section [NMEA protocol configuration](#) for a detailed description of the configuration effects on NMEA output.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-NMEA-PROTVR</i>	0x20930001	E1	-	-	NMEA protocol version
See <a href="#">Table 47</a> below for a list of possible constants for this item.					
<i>CFG-NMEA-MAXSVS</i>	0x20930002	E1	-	-	Maximum number of SVs to report per Talker ID
See <a href="#">Table 48</a> below for a list of possible constants for this item.					
<i>CFG-NMEA-COMPAT</i>	0x10930003	L	-	-	Enable compatibility mode
This might be needed for certain applications, e.g. for an NMEA parser that expects a fixed number of digits in position coordinates.					
<i>CFG-NMEA-CONSIDER</i>	0x10930004	L	-	-	Enable considering mode
This affects the way the used satellite count in NMEA output is calculated. If set, also considered but rejected satellites (e.g. RAIMED) are counted as used satellites as well.					

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-NMEA-LIMIT82</i>	0x10930005	L	-	-	Enable strict limit to 82 characters maximum NMEA message length
<i>CFG-NMEA-HIGHPREC</i>	0x10930006	L	-	-	Enable high precision mode This flag cannot be set in conjunction with either <i>CFG-NMEA-COMPAT</i> or <i>CFG-NMEA-LIMIT82</i> mode.
<i>CFG-NMEA-SVNUMBERING</i>	0x20930007	E1	-	-	Display configuration for SVs that do not have value defined in NMEA 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 <a href="#">Satellite Numbering</a> . See <a href="#">Table 49</a> below for a list of possible constants for this item.
<i>CFG-NMEA-FILT_GPS</i>	0x10930011	L	-	-	Disable reporting of GPS satellites
<i>CFG-NMEA-FILT_SBAS</i>	0x10930012	L	-	-	Disable reporting of SBAS satellites
<i>CFG-NMEA-FILT_GAL</i>	0x10930013	L	-	-	Disable reporting of Galileo satellites
<i>CFG-NMEA-FILT_QZSS</i>	0x10930015	L	-	-	Disable reporting of QZSS satellites
<i>CFG-NMEA-FILT_GLO</i>	0x10930016	L	-	-	Disable reporting of GLONASS satellites
<i>CFG-NMEA-FILT_BDS</i>	0x10930017	L	-	-	Disable reporting of BeiDou satellites
<i>CFG-NMEA-FILT_NAVIC</i>	0x10930018	L	-	-	Disable reporting of NavIC satellites
<i>CFG-NMEA-OUT_INVFIX</i>	0x10930021	L	-	-	Enable position output for failed or invalid fixes
<i>CFG-NMEA-OUT_MSKFIX</i>	0x10930022	L	-	-	Enable position output for invalid fixes
<i>CFG-NMEA-OUT_INVTIME</i>	0x10930023	L	-	-	Enable time output for invalid times
<i>CFG-NMEA-OUT_INVDATE</i>	0x10930024	L	-	-	Enable date output for invalid dates
<i>CFG-NMEA-OUT_ONLYGPS</i>	0x10930025	L	-	-	Restrict output to GPS satellites only
<i>CFG-NMEA-OUT_FROZENCOG</i>	0x10930026	L	-	-	Enable course over ground output even if it is frozen
<i>CFG-NMEA-MAINTALKERID</i>	0x20930031	E1	-	-	Main Talker ID 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 <a href="#">CFG-SIGNAL</a> ). This field enables the main Talker ID to be overridden. See <a href="#">Table 50</a> below for a list of possible constants for this item.
<i>CFG-NMEA-GSVTALKERID</i>	0x20930032	E1	-	-	Talker ID for GSV NMEA messages 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. See <a href="#">Table 51</a> below for a list of possible constants for this item.
<i>CFG-NMEA-BDSTALKERID</i>	0x30930033	U2	-	-	BeiDou Talker ID Sets the two ASCII characters that should be used for the BeiDou Talker ID. If these are set to zero, the receiver uses the default BeiDou Talker ID.

**Table 46: CFG-NMEA configuration items**

Constant	Value	Description
<i>V21</i>	21	NMEA protocol version 2.1
<i>V23</i>	23	NMEA protocol version 2.3
<i>V40</i>	40	NMEA protocol version 4.0 (not available in all products)
<i>V41</i>	41	NMEA protocol version 4.10 (not available in all products)
<i>V411</i>	42	NMEA protocol version 4.11 (not available in all products)

**Table 47: Constants for CFG-NMEA-PROTVER**

Constant	Value	Description
<i>UNLIM</i>	0	Unlimited
<i>8SVS</i>	8	8 SVs
<i>12SVS</i>	12	12 SVs
<i>16SVS</i>	16	16 SVs

**Table 48: Constants for CFG-NMEA-MAXSVS**

Constant	Value	Description
<i>STRICT</i>	0	Strict - satellites are not output
<i>EXTENDED</i>	1	Extended - use proprietary numbering

**Table 49: Constants for CFG-NMEA-SVNUMBERING**

Constant	Value	Description
<i>AUTO</i>	0	Main Talker ID is not overridden
<i>GP</i>	1	Set main Talker ID to 'GP'
<i>GL</i>	2	Set main Talker ID to 'GL'
<i>GN</i>	3	Set main Talker ID to 'GN'
<i>GA</i>	4	Set main Talker ID to 'GA' (not available in all products)
<i>GB</i>	5	Set main Talker ID to 'GB' (not available in all products)
<i>GQ</i>	7	Set main Talker ID to 'GQ' (not available in all products)

**Table 50: Constants for CFG-NMEA-MAINTALKERID**

Constant	Value	Description
<i>GNSS</i>	0	Use GNSS-specific Talker ID (as defined by NMEA)
<i>MAIN</i>	1	Use the main Talker ID

**Table 51: Constants for CFG-NMEA-GSVTALKERID**

### 4.9.13 CFG-RATE: Navigation and measurement rate configuration

The configuration items in this group allow the user to alter the rate at which navigation solutions (and the measurements that they depend on) are generated by the receiver. The calculation of the navigation solution is aligned to the top of a second zero (first second of the week) of the configured reference time system. The navigation period is an integer multiple of the measurement period.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-RATE-MEAS</i>	0x30210001	U2	0.001	s	Nominal time between GNSS measurements E.g. 100 ms results in 10 Hz measurement rate, 1000 ms = 1 Hz measurement rate.
<i>CFG-RATE-NAV</i>	0x30210002	U2	-	-	Ratio of number of measurements to number of navigation solutions E.g. 5 means five measurements for every navigation solution. The minimum value is 1. The maximum value is 127.
<i>CFG-RATE-TIMeref</i>	0x20210003	E1	-	-	Time system to which measurements are aligned See <a href="#">Table 53</a> below for a list of possible constants for this item.

**Table 52: CFG-RATE configuration items**

Constant	Value	Description
<i>UTC</i>	0	Align measurements to UTC time
<i>GPS</i>	1	Align measurements to GPS time
<i>GLO</i>	2	Align measurements to GLONASS time

Constant	Value	Description
<i>BDS</i>	3	Align measurements to BeiDou time
<i>GAL</i>	4	Align measurements to Galileo time
<i>NAVIC</i>	5	Align measurements to NavIC time

**Table 53: Constants for CFG-RATE-TIMEREF**

#### 4.9.14 CFG-RINV: Remote inventory

The remote inventory enables storing user-defined data in the receiver's non-volatile memory. The data can be either binary or a string of ASCII characters. In the latter case, it can optionally be output at startup after the boot screen.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-RINV-DUMP</i>	0x10c70001	L	-	-	Dump data at startup When true, data is dumped to the interface at startup, unless CFG-RINV-BINARY is set.
<i>CFG-RINV-BINARY</i>	0x10c70002	L	-	-	Data is binary When true, the data is treated as binary data.
<i>CFG-RINV-DATA_SIZE</i>	0x20c70003	U1	-	-	Size of data Size of data to store/stored in the remote inventory (maximum 30 bytes).
<i>CFG-RINV-CHUNK0</i>	0x50c70004	X8	-	-	Data bytes 1-8 (LSB) Data to store/stored in remote inventory - max 8 bytes, left-most in LSB, e.g. string ABCD will appear as 0x44434241.
<i>CFG-RINV-CHUNK1</i>	0x50c70005	X8	-	-	Data bytes 9-16 Data to store/stored in remote inventory - max 8 bytes, left-most in LSB, e.g. string ABCD will appear as 0x44434241.
<i>CFG-RINV-CHUNK2</i>	0x50c70006	X8	-	-	Data bytes 17-24 Data to store/stored in remote inventory - max 8 bytes, left-most in LSB, e.g. string ABCD will appear as 0x44434241.
<i>CFG-RINV-CHUNK3</i>	0x50c70007	X8	-	-	Data bytes 25-30 (MSB) Data to store/stored in remote inventory - max 6 bytes, left-most in LSB, e.g. string ABCD will appear as 0x44434241.

**Table 54: CFG-RINV configuration items**

#### 4.9.15 CFG-SBAS: SBAS configuration

This group configures the SBAS receiver subsystem (i.e. WAAS, EGNOS, MSAS). See SBAS configuration settings description in the integration manual for a detailed description of how these settings affect receiver operation.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-SBAS-USE_TESTMODE</i>	0x10360002	L	-	-	Use SBAS data when it is in test mode (SBAS msg 0)
<i>CFG-SBAS-ACCEPT_NOT_IN_PRNMASK</i>	0x30360008	X2	-	-	Accept corrections from SBAS SV, even if not self included in PRN MASK (Message Type 1) If enabled, the receiver will still use the SBAS data, even when the SBAS SV itself is not included in its PRN MASK. This is only useful for BDSBAS and not compatible with current EGNOS implementation. See <a href="#">Table 56</a> below for a list of possible constants for this item.
<i>CFG-SBAS-USE_IONOONLY</i>	0x10360007	L	-	-	Use SBAS ionosphere correction only
<i>CFG-SBAS-PRNSCANMASK</i>	0x50360006	X8	-	-	SBAS PRN search configuration This configuration item determines which SBAS PRNs should be searched. Setting it to 0 indicates auto-scanning all SBAS PRNs. For non-zero values the bits correspond to the allocated SBAS PRNs ranging from PRN120 (bit 0) to PRN158 (bit 38), where a bit set enables searching for the corresponding PRN. See <a href="#">Table 57</a> below for a list of possible constants for this item.

**Table 55: CFG-SBAS configuration items**



Constant	Value	Description
WAAS	0x01	WAAS bit
1 = Use WAAS provider Id.		
EGNOS	0x02	EGNOS bit
1 = Use EGNOS provider Id.		
MSAS	0x04	MSAS bit
1 = Use MSAS provider Id.		
GAGAN	0x08	GAGAN bit
1 = Use GAGAN provider Id.		
SDCM	0x10	SDCM bit
1 = Use SDCM provider Id.		
BDSBAS	0x20	BDSBAS bit
1 = Use BDSBAS provider Id.		
KASS	0x40	KASS bit
1 = Use KASS provider Id.		

**Table 56: Constants for CFG-SBAS-ACCEPT\_NOT\_IN\_PRNMASK**

Constant	Value	Description
ALL	0x0000000000000000	Enable search for all SBAS PRNs
PRN120	0x0000000000000001	Enable search for SBAS PRN120
PRN121	0x0000000000000002	Enable search for SBAS PRN121
PRN122	0x0000000000000004	Enable search for SBAS PRN122
PRN123	0x0000000000000008	Enable search for SBAS PRN123
PRN124	0x0000000000000010	Enable search for SBAS PRN124
PRN125	0x0000000000000020	Enable search for SBAS PRN125
PRN126	0x0000000000000040	Enable search for SBAS PRN126
PRN127	0x0000000000000080	Enable search for SBAS PRN127
PRN128	0x0000000000000100	Enable search for SBAS PRN128
PRN129	0x0000000000000200	Enable search for SBAS PRN129
PRN130	0x0000000000000400	Enable search for SBAS PRN130
PRN131	0x0000000000000800	Enable search for SBAS PRN131
PRN132	0x0000000000001000	Enable search for SBAS PRN132
PRN133	0x0000000000002000	Enable search for SBAS PRN133
PRN134	0x0000000000004000	Enable search for SBAS PRN134
PRN135	0x0000000000008000	Enable search for SBAS PRN135
PRN136	0x0000000000010000	Enable search for SBAS PRN136
PRN137	0x0000000000020000	Enable search for SBAS PRN137
PRN138	0x0000000000040000	Enable search for SBAS PRN138
PRN139	0x0000000000080000	Enable search for SBAS PRN139
PRN140	0x0000000000100000	Enable search for SBAS PRN140
PRN141	0x0000000000200000	Enable search for SBAS PRN141
PRN142	0x0000000000400000	Enable search for SBAS PRN142
PRN143	0x0000000000800000	Enable search for SBAS PRN143

Constant	Value	Description
<i>PRN144</i>	0x0000000001000000	Enable search for SBAS PRN144
<i>PRN145</i>	0x0000000002000000	Enable search for SBAS PRN145
<i>PRN146</i>	0x0000000004000000	Enable search for SBAS PRN146
<i>PRN147</i>	0x0000000008000000	Enable search for SBAS PRN147
<i>PRN148</i>	0x0000000010000000	Enable search for SBAS PRN148
<i>PRN149</i>	0x0000000020000000	Enable search for SBAS PRN149
<i>PRN150</i>	0x0000000040000000	Enable search for SBAS PRN150
<i>PRN151</i>	0x0000000080000000	Enable search for SBAS PRN151
<i>PRN152</i>	0x0000000100000000	Enable search for SBAS PRN152
<i>PRN153</i>	0x0000000200000000	Enable search for SBAS PRN153
<i>PRN154</i>	0x0000000400000000	Enable search for SBAS PRN154
<i>PRN155</i>	0x0000000800000000	Enable search for SBAS PRN155
<i>PRN156</i>	0x0000001000000000	Enable search for SBAS PRN156
<i>PRN157</i>	0x0000002000000000	Enable search for SBAS PRN157
<i>PRN158</i>	0x0000004000000000	Enable search for SBAS PRN158

**Table 57: Constants for CFG-SBAS-PRNSCANMASK**

#### 4.9.16 CFG-SEC: Security configuration

Security configuration.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-SEC-CFG_LOCK</i>	0x10f60009	L	-	-	Configuration lockdown When set, the receiver configuration is locked and cannot be changed any more.
<i>CFG-SEC-CFG_LOCK_UNLOCKGRP1</i>	0x30f6000a	U2	-	-	Configuration lockdown exempted group 1 This item can be set before enabling the configuration lockdown. It enables writing to the specified group even after the configuration lockdown has been enabled.
<i>CFG-SEC-CFG_LOCK_UNLOCKGRP2</i>	0x30f6000b	U2	-	-	Configuration lockdown exempted group 2 This item can be set before enabling the configuration lockdown. It enables writing to the specified group even after the configuration lockdown has been enabled.
<i>CFG-SEC-JAMDET_SENSITIVITY_HI</i>	0x10f60051	L	-	-	When set, go for a more sensitive jamming detection (at the cost of increased false alarm rate).

**Table 58: CFG-SEC configuration items**

#### 4.9.17 CFG-SIGNAL: Satellite systems (GNSS) signal configuration

The enable items for individual signals are governed by their corresponding constellation enable item. It is necessary that at least one signal from a major GNSS constellation is enabled. See GNSS signal configuration in the integration manual for more details.

Configuration specific to a GNSS system is available in other groups (e.g. CFG-SBAS).

Note that changes to any items within this group triggers a reset to the GNSS subsystem. The reset takes some time, so wait first for the acknowledgement from the receiver and then 0.5 seconds before sending the next command.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-SIGNAL-GPS_ENA</i>	0x1031001f	L	-	-	GPS enable

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-SIGNAL-GPS_L1CA_ENA</i>	0x10310001	L	-	-	GPS L1C/A
<i>CFG-SIGNAL-GPS_L5_ENA</i>	0x10310004	L	-	-	GPS L5
<i>CFG-SIGNAL-SBAS_ENA</i>	0x10310020	L	-	-	SBAS enable
<i>CFG-SIGNAL-SBAS_L1CA_ENA</i>	0x10310005	L	-	-	SBAS L1C/A
<i>CFG-SIGNAL-GAL_ENA</i>	0x10310021	L	-	-	Galileo enable
<i>CFG-SIGNAL-GAL_E1_ENA</i>	0x10310007	L	-	-	Galileo E1
<i>CFG-SIGNAL-GAL_E5A_ENA</i>	0x10310009	L	-	-	Galileo E5a
<i>CFG-SIGNAL-BDS_ENA</i>	0x10310022	L	-	-	BeiDou Enable
<i>CFG-SIGNAL-BDS_B1C_ENA</i>	0x1031000f	L	-	-	BeiDou B1C
<i>CFG-SIGNAL-BDS_B2A_ENA</i>	0x10310028	L	-	-	BeiDou B2a
<i>CFG-SIGNAL-QZSS_ENA</i>	0x10310024	L	-	-	QZSS enable
<i>CFG-SIGNAL-QZSS_L1CA_ENA</i>	0x10310012	L	-	-	QZSS L1C/A
<i>CFG-SIGNAL-QZSS_L5_ENA</i>	0x10310017	L	-	-	QZSS L5
<i>CFG-SIGNAL-GLO_ENA</i>	0x10310025	L	-	-	GLONASS enable
<i>CFG-SIGNAL-GLO_L1_ENA</i>	0x10310018	L	-	-	GLONASS L1
<i>CFG-SIGNAL-NAVIC_ENA</i>	0x10310026	L	-	-	NavIC enable
<i>CFG-SIGNAL-NAVIC_L5_ENA</i>	0x1031001d	L	-	-	NavIC L5

**Table 59: CFG-SIGNAL configuration items**

#### 4.9.18 CFG-SPI: Configuration of the SPI interface

Settings needed to configure the SPI communication interface.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-SPI-MAXFF</i>	0x20640001	U1	-	-	Number of bytes containing 0xFF to receive before switching off reception. Range: 0 (mechanism off) - 63
<i>CFG-SPI-CPOLARITY</i>	0x10640002	L	-	-	Clock polarity select: 0: Active High Clock, SCLK idles low, 1: Active Low Clock, SCLK idles high
<i>CFG-SPI-CPHASE</i>	0x10640003	L	-	-	Clock phase select: 0: Data captured on first edge of SCLK, 1: Data captured on second edge of SCLK
<i>CFG-SPI-EXTENDEDTIMEOUT</i>	0x10640005	L	-	-	Flag to disable timeouting the interface after 1.5s
<i>CFG-SPI-ENABLED</i>	0x10640006	L	-	-	Flag to indicate if the SPI interface should be enabled

**Table 60: CFG-SPI configuration items**

#### 4.9.19 CFG-SPIINPROT: Input protocol configuration of the SPI interface

Input protocol enable flags of the SPI interface.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-SPIINPROT-UBX</i>	0x10790001	L	-	-	Flag to indicate if UBX should be an input protocol on SPI

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-SPIINPROT-NMEA</i>	0x10790002	L	-	-	Flag to indicate if NMEA should be an input protocol on SPI

**Table 61: CFG-SPIINPROT configuration items**

#### 4.9.20 CFG-SPIOUTPROT: Output protocol configuration of the SPI interface

Output protocol enable flags of the SPI interface.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-SPIOUTPROT-UBX</i>	0x107a0001	L	-	-	Flag to indicate if UBX should be an output protocol on SPI
<i>CFG-SPIOUTPROT-NMEA</i>	0x107a0002	L	-	-	Flag to indicate if NMEA should be an output protocol on SPI

**Table 62: CFG-SPIOUTPROT configuration items**

#### 4.9.21 CFG-TMODE: Time mode configuration

Configuration for operation of the receiver in Time mode. The position referred to in the configuration items is that of the Antenna Reference Point (ARP).

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-TMODE-MODE</i>	0x20030001	E1	-	-	Receiver mode
See <a href="#">Table 64</a> below for a list of possible constants for this item.					
<i>CFG-TMODE-POS_TYPE</i>	0x20030002	E1	-	-	Determines whether the ARP position is given in ECEF or LAT/LON/HEIGHT?
See <a href="#">Table 65</a> below for a list of possible constants for this item.					
<i>CFG-TMODE-ECEF_X</i>	0x40030003	I4	-	cm	ECEF X coordinate of the ARP position.
This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=ECEF.					
<i>CFG-TMODE-ECEF_Y</i>	0x40030004	I4	-	cm	ECEF Y coordinate of the ARP position.
This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=ECEF.					
<i>CFG-TMODE-ECEF_Z</i>	0x40030005	I4	-	cm	ECEF Z coordinate of the ARP position.
This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=ECEF.					
<i>CFG-TMODE-ECEF_X_HP</i>	0x20030006	I1	0.1	mm	High-precision ECEF X coordinate of the ARP position.
Accepted range is -99 to +99.					
This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=ECEF.					
<i>CFG-TMODE-ECEF_Y_HP</i>	0x20030007	I1	0.1	mm	High-precision ECEF Y coordinate of the ARP position.
Accepted range is -99 to +99.					
This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=ECEF.					
<i>CFG-TMODE-ECEF_Z_HP</i>	0x20030008	I1	0.1	mm	High-precision ECEF Z coordinate of the ARP position.
Accepted range is -99 to +99.					
This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=ECEF.					
<i>CFG-TMODE-LAT</i>	0x40030009	I4	1e-7	deg	Latitude of the ARP position.
This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=LLH.					
<i>CFG-TMODE-LON</i>	0x4003000a	I4	1e-7	deg	Longitude of the ARP position.
This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=LLH.					
<i>CFG-TMODE-HEIGHT</i>	0x4003000b	I4	-	cm	Height of the ARP position.
This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=LLH.					

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-TMODE-LAT_HP</i>	0x2003000c	I1	1e-9	deg	High-precision latitude of the ARP position Accepted range is -99 to +99. This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=LLH.
<i>CFG-TMODE-LON_HP</i>	0x2003000d	I1	1e-9	deg	High-precision longitude of the ARP position. Accepted range is -99 to +99. This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=LLH.
<i>CFG-TMODE-HEIGHT_HP</i>	0x2003000e	I1	0.1	mm	High-precision height of the ARP position. Accepted range is -99 to +99. This will only be used if CFG-TMODE-MODE=FIXED and CFG-TMODE-POS_TYPE=LLH.
<i>CFG-TMODE-FIXED_POS_ACC</i>	0x4003000f	U4	0.1	mm	Fixed position 3D accuracy
<i>CFG-TMODE-SVIN_MIN_DUR</i>	0x40030010	U4	-	s	Survey-in minimum duration This will only be used if CFG-TMODE-MODE=SURVEY_IN.
<i>CFG-TMODE-SVIN_ACC_LIMIT</i>	0x40030011	U4	0.1	mm	Survey-in position accuracy limit This will only be used if CFG-TMODE-MODE=SURVEY_IN.

**Table 63: CFG-TMODE configuration items**

Constant	Value	Description
<i>DISABLED</i>	0	Disabled
<i>SURVEY_IN</i>	1	Survey in
<i>FIXED</i>	2	Fixed mode (true ARP position information required)

**Table 64: Constants for CFG-TMODE-MODE**

Constant	Value	Description
<i>ECEF</i>	0	Position is ECEF
<i>LLH</i>	1	Position is Lat/Lon/Height

**Table 65: Constants for CFG-TMODE-POS\_TYPE**

#### 4.9.22 CFG-TP: Time pulse configuration

Use this group to configure the generation of time pulses.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-TP-PULSE_DEF</i>	0x20050023	E1	-	-	Determines whether the time pulse is interpreted as frequency or period See <a href="#">Table 67</a> below for a list of possible constants for this item.
<i>CFG-TP-PULSE_LENGTH_DEF</i>	0x20050030	E1	-	-	Determines whether the time pulse length is interpreted as length[us] or pulse ratio[%] See <a href="#">Table 68</a> below for a list of possible constants for this item.
<i>CFG-TP-ANT_CABLEDELAY</i>	0x30050001	I2	1e-9	s	Antenna cable delay in [ns]
<i>CFG-TP-PERIOD_TP1</i>	0x40050002	U4	1e-6	s	Time pulse period (TP1) in [us] This is used only if CFG-TP-PULSE_DEF=PERIOD.
<i>CFG-TP-PERIOD_LOCK_TP1</i>	0x40050003	U4	1e-6	s	Time pulse period when locked to GNSS time (TP1) in [us] Only used if CFG-TP-PULSE_DEF=PERIOD and CFG-TP-USE_LOCKED_TP1 is set.
<i>CFG-TP-FREQ_TP1</i>	0x40050024	U4	-	Hz	Time pulse frequency (TP1) in [Hz] This is used only if CFG-TP-PULSE_DEF=FREQ.
<i>CFG-TP-FREQ_LOCK_TP1</i>	0x40050025	U4	-	Hz	Time pulse frequency when locked to GNSS time (TP1) in [Hz]

Configuration item	Key ID	Type	Scale	Unit	Description
Only used if CFG-TP-PULSE_DEF=FREQ and CFG-TP-USE_LOCKED_TP1 is set.					
CFG-TP-LEN_TP1	0x40050004	U4	1e-6	s	Time pulse length (TP1) in [us]
Only used if CFG-TP-PULSE_LENGTH_DEF=LENGTH is set.					
CFG-TP-LEN_LOCK_TP1	0x40050005	U4	1e-6	s	Time pulse length when locked to GNSS time (TP1) in [us]
Only used if CFG-TP-PULSE_LENGTH_DEF=LENGTH and CFG-TP-USE_LOCKED_TP1 is set.					
CFG-TP-DUTY_TP1	0x5005002a	R8	-	%	Time pulse duty cycle (TP1) in [%]
Only used if CFG-TP-PULSE_LENGTH_DEF=RATIO is set.					
CFG-TP-DUTY_LOCK_TP1	0x5005002b	R8	-	%	Time pulse duty cycle when locked to GNSS time (TP1) in [%]
Only used if CFG-TP-PULSE_LENGTH_DEF=RATIO and CFG-TP-USE_LOCKED_TP1 are set.					
CFG-TP-USER_DELAY_TP1	0x40050006	I4	1e-9	s	User-configurable time pulse delay (TP1) in [ns]
CFG-TP-TP1_ENA	0x10050007	L	-	-	Enable the time pulse (TP1) if pin associated with time pulse is assigned for another function, the other function takes precedence. Must be set for frequency-time products.
CFG-TP-SYNC_GNSS_TP1	0x10050008	L	-	-	Sync time pulse to GNSS time or local clock (TP1) If set, sync to GNSS if GNSS time is valid. Otherwise, use local clock. This flag can be unset only in Timing product variants.
CFG-TP-USE_LOCKED_TP1	0x10050009	L	-	-	Use locked parameters when possible (TP1) If set, use CFG-TP-PERIOD_LOCK_TP1 and CFG-TP-LEN_LOCK_TP1 as soon as GNSS time is valid. Otherwise, use CFG-TP-PERIOD_TP1 and CFG-TP-LEN_TP1.
CFG-TP-ALIGN_TO_TOW_TP1	0x1005000a	L	-	-	Align time pulse to top of second (TP1) To use this feature, CFG-TP-SYNC_GNSS_TP1 must be set. Time pulse period must be an integer fraction of 1 second.
CFG-TP-POL_TP1	0x1005000b	L	-	-	Set time pulse polarity (TP1) false (0) : falling edge at top of second. true (1) : rising edge at top of second.
CFG-TP-TIMEGRID_TP1	0x2005000c	E1	-	-	Time grid to use (TP1) Only relevant if CFG-TP-SYNC_GNSS_TP1 is set. Note that configured GNSS time is estimated by the receiver if locked to any GNSS system. If the receiver has a valid GNSS fix it attempts to steer the TP to the specified time grid even if the specified time is not based on information from the constellation's satellites. To ensure timing based purely on a given GNSS, restrict the supported constellations in CFG-SIGNAL-*. See <a href="#">Table 69</a> below for a list of possible constants for this item.
CFG-TP-DRSTR_TP1	0x20050035	E1	-	-	Set drive strength of TP1 Time Pulse pin 1 (TP1) can support 4 possible drive strength cases: 2, 4, 8 and 12 mA See <a href="#">Table 70</a> below for a list of possible constants for this item.

**Table 66: CFG-TP configuration items**

Constant	Value	Description
PERIOD	0	Time pulse period [us]
FREQ	1	Time pulse frequency [Hz]

**Table 67: Constants for CFG-TP-PULSE\_DEF**

Constant	Value	Description
RATIO	0	Time pulse ratio

Constant	Value	Description
<i>LENGTH</i>	1	Time pulse length

**Table 68: Constants for CFG-TP-PULSE\_LENGTH\_DEF**

Constant	Value	Description
<i>UTC</i>	0	UTC time reference
<i>GPS</i>	1	GPS time reference
<i>GLO</i>	2	GLONASS time reference
<i>BDS</i>	3	BeiDou time reference
<i>GAL</i>	4	Galileo time reference
<i>NAVIC</i>	5	NavIC time reference

**Table 69: Constants for CFG-TP-TIMEGRID\_TP1**

Constant	Value	Description
<i>DRIVE_STRENGTH_2MA</i>	0	2 mA drive strength
<i>DRIVE_STRENGTH_4MA</i>	1	4 mA drive strength
<i>DRIVE_STRENGTH_8MA</i>	2	8 mA drive strength
<i>DRIVE_STRENGTH_12MA</i>	3	12 mA drive strength

**Table 70: Constants for CFG-TP-DRSTR\_TP1**

### 4.9.23 CFG-TXREADY: TX ready configuration

Configuration of the TX ready pin.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-TXREADY-ENABLED</i>	0x10a20001	L	-	-	Flag to indicate if TX ready pin mechanism should be enabled
<i>CFG-TXREADY-POLARITY</i>	0x10a20002	L	-	-	The polarity of the TX ready pin: false:high-active, true:low-active
<i>CFG-TXREADY-PIN</i>	0x20a20003	U1	-	-	Pin number to use for the TX ready functionality
<i>CFG-TXREADY-THRESHOLD</i>	0x30a20004	U2	-	-	Amount of data that should be ready on the interface before triggering the TX ready pin  The value is amount of 8-byte chunks. For example, value of 250 sets the trigger to 2000 bytes.
<i>CFG-TXREADY-INTERFACE</i>	0x20a20005	E1	-	-	Interface where the TX ready feature should be linked to

See [Table 72](#) below for a list of possible constants for this item.

**Table 71: CFG-TXREADY configuration items**

Constant	Value	Description
<i>I2C</i>	0	I2C interface
<i>SPI</i>	1	SPI interface

**Table 72: Constants for CFG-TXREADY-INTERFACE**

### 4.9.24 CFG-UART1: Configuration of the UART1 interface

Settings needed to configure the UART1 communication interface.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-UART1-BAUDRATE</i>	0x40520001	U4	-	-	The baud rate that should be configured on the UART1

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-UART1-STOPBITS</i>	0x20520002	E1	-	-	Number of stopbits that should be used on UART1
See <a href="#">Table 74</a> below for a list of possible constants for this item.					
<i>CFG-UART1-DATABITS</i>	0x20520003	E1	-	-	Number of databits that should be used on UART1
See <a href="#">Table 75</a> below for a list of possible constants for this item.					
<i>CFG-UART1-PARITY</i>	0x20520004	E1	-	-	Parity mode that should be used on UART1
See <a href="#">Table 76</a> below for a list of possible constants for this item.					
<i>CFG-UART1-ENABLED</i>	0x10520005	L	-	-	Flag to indicate if the UART1 should be enabled

**Table 73: CFG-UART1 configuration items**

Constant	Value	Description
<i>HALF</i>	0	0.5 stopbits
<i>ONE</i>	1	1.0 stopbits
<i>ONEHALF</i>	2	1.5 stopbits
<i>TWO</i>	3	2.0 stopbits

**Table 74: Constants for CFG-UART1-STOPBITS**

Constant	Value	Description
<i>EIGHT</i>	0	8 databits
<i>SEVEN</i>	1	7 databits

**Table 75: Constants for CFG-UART1-DATABITS**

Constant	Value	Description
<i>NONE</i>	0	No parity bit
<i>ODD</i>	1	Add an odd parity bit
<i>EVEN</i>	2	Add an even parity bit

**Table 76: Constants for CFG-UART1-PARITY**

#### 4.9.25 CFG-UART1INPROT: Input protocol configuration of the UART1 interface

Input protocol enable flags of the UART1 interface.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-UART1INPROT-UBX</i>	0x10730001	L	-	-	Flag to indicate if UBX should be an input protocol on UART1
<i>CFG-UART1INPROT-NMEA</i>	0x10730002	L	-	-	Flag to indicate if NMEA should be an input protocol on UART1

**Table 77: CFG-UART1INPROT configuration items**

#### 4.9.26 CFG-UART1OUTPROT: Output protocol configuration of the UART1 interface

Output protocol enable flags of the UART1 interface.

Configuration item	Key ID	Type	Scale	Unit	Description
<i>CFG-UART1OUTPROT-UBX</i>	0x10740001	L	-	-	Flag to indicate if UBX should be an output protocol on UART1
<i>CFG-UART1OUTPROT-NMEA</i>	0x10740002	L	-	-	Flag to indicate if NMEA should be an output protocol on UART1

**Table 78: CFG-UART1OUTPROT configuration items**



## 4.10 Legacy UBX message fields reference

The following table lists the legacy UBX message fields and the corresponding configuration item. Note that the mapping from [UBX-CFG](#) message fields to configuration items is not necessarily 1:1 and that some legacy UBX-CFG messages may not be available for certain products.

UBX message and field	Configuration item(s)
<b>UBX-CFG-ANT</b>	
UBX-CFG-ANT.ocd	CFG-HW-ANT_CFG_OPENDET
UBX-CFG-ANT.pdwnOnSCD	CFG-HW-ANT_CFG_PWRDOWN
UBX-CFG-ANT.pinOCD	CFG-HW-ANT_SUP_OPEN_PIN
UBX-CFG-ANT.pinSCD	CFG-HW-ANT_SUP_SHORT_PIN
UBX-CFG-ANT.pinSwitch	CFG-HW-ANT_SUP_SWITCH_PIN
UBX-CFG-ANT.recovery	CFG-HW-ANT_CFG_RECOVER
UBX-CFG-ANT.scd	CFG-HW-ANT_CFG_SHORTDET
UBX-CFG-ANT.svcs	CFG-HW-ANT_CFG_VOLTCTRL
<b>UBX-CFG-DAT</b>	
UBX-CFG-DAT.dX	CFG-NAVSPG-USRDAT_DX
UBX-CFG-DAT.dY	CFG-NAVSPG-USRDAT_DY
UBX-CFG-DAT.dZ	CFG-NAVSPG-USRDAT_DZ
UBX-CFG-DAT.flat	CFG-NAVSPG-USRDAT_FLAT
UBX-CFG-DAT.majA	CFG-NAVSPG-USE_USRDAT, CFG-NAVSPG-USRDAT_MAJA
UBX-CFG-DAT.rotX	CFG-NAVSPG-USRDAT_ROTX
UBX-CFG-DAT.rotY	CFG-NAVSPG-USRDAT_ROTY
UBX-CFG-DAT.rotZ	CFG-NAVSPG-USRDAT_ROTZ
UBX-CFG-DAT.scale	CFG-NAVSPG-USRDAT_SCALE
<b>UBX-CFG-GNSS</b>	
UBX-CFG-GNSS.gnssId	CFG-SIGNAL-GPS_ENA, CFG-SIGNAL-SBAS_ENA, CFG-SIGNAL-BDS_ENA, CFG-SIGNAL-QZSS_ENA, CFG-SIGNAL-GLO_ENA
<b>UBX-CFG-INF</b>	
UBX-CFG-INF.infMsgMask	CFG-INFMSG-UBX_I2C, CFG-INFMSG-UBX_UART1, CFG-INFMSG-UBX_SPI, CFG-INFMSG-NMEA_I2C, CFG-INFMSG-NMEA_UART1, CFG-INFMSG-NMEA_SPI
UBX-CFG-INF.protocolID	CFG-INFMSG-UBX_UART1, CFG-INFMSG-UBX_SPI, CFG-INFMSG-NMEA_I2C, CFG-INFMSG-NMEA_UART1, CFG-INFMSG-NMEA_SPI
<b>UBX-CFG-MOT</b>	
UBX-CFG-MOT.gnssDistThdl	CFG-MOT-GNSSDIST_THRS
UBX-CFG-MOT.gnssSpeedThdl	CFG-MOT-GNSSSPEED_THRS
<b>UBX-CFG-NAV5</b>	
UBX-CFG-NAV5.cnoThresh	CFG-NAVSPG-INFIL_CNOTHR
UBX-CFG-NAV5.cnoThreshNumSVs	CFG-NAVSPG-INFIL_NCNOTHR
UBX-CFG-NAV5.dgnssTimeout	CFG-NAVSPG-CONSTR_DGNSSSTO
UBX-CFG-NAV5.dynModel	CFG-NAVSPG-DYNMODEL
UBX-CFG-NAV5.fixMode	CFG-NAVSPG-FIXMODE
UBX-CFG-NAV5.fixedAlt	CFG-NAVSPG-CONSTR_ALT
UBX-CFG-NAV5.fixedAltVar	CFG-NAVSPG-CONSTR_ALTVAR

<b>UBX message and field</b>	<b>Configuration item(s)</b>
UBX-CFG-NAV5.minElev	CFG-NAVSPG-INFIL_MINELEV
UBX-CFG-NAV5.pAcc	CFG-NAVSPG-OUTFIL_PACC
UBX-CFG-NAV5.pDop	CFG-NAVSPG-OUTFIL_PDOP
UBX-CFG-NAV5.staticHoldMaxDist	CFG-MOT-GNSSDIST_THRS
UBX-CFG-NAV5.staticHoldThresh	CFG-MOT-GNSSSPEED_THRS
UBX-CFG-NAV5.tAcc	CFG-NAVSPG-OUTFIL_TACC, CFG-NAVSPG-OUTFIL_FACC
UBX-CFG-NAV5.tDop	CFG-NAVSPG-OUTFIL_TDOP
UBX-CFG-NAV5.utcStandard	CFG-NAVSPG-UTCSTANDARD
<b>UBX-CFG-NAVX5</b>	
UBX-CFG-NAVX5.ackAiding	CFG-NAVSPG-ACKAIDING
UBX-CFG-NAVX5.iniFix3D	CFG-NAVSPG-INIFIX3D
UBX-CFG-NAVX5.maxSVs	CFG-NAVSPG-INFIL_MAXSVS
UBX-CFG-NAVX5.minCNO	CFG-NAVSPG-INFIL_MINCNO
UBX-CFG-NAVX5.minSVs	CFG-NAVSPG-INFIL_MINSVS
UBX-CFG-NAVX5.usePPP	CFG-NAVSPG-USE_PPP
UBX-CFG-NAVX5.wknRollover	CFG-NAVSPG-WKNROLLOVER
<b>UBX-CFG-NMEA</b>	
UBX-CFG-NMEA.bdsTalkerId	CFG-NMEA-BDSTALKERID
UBX-CFG-NMEA.beidou	CFG-NMEA-FILT_BDS
UBX-CFG-NMEA.compat	CFG-NMEA-COMPAT
UBX-CFG-NMEA.consider	CFG-NMEA-CONSIDER
UBX-CFG-NMEA.dateFilt	CFG-NMEA-OUT_INVDATE
UBX-CFG-NMEA.galileo	CFG-NMEA-FILT_GAL
UBX-CFG-NMEA.glonass	CFG-NMEA-FILT_GLO
UBX-CFG-NMEA.gps	CFG-NMEA-FILT_GPS
UBX-CFG-NMEA.gpsOnlyFilter	CFG-NMEA-OUT_ONLYGPS
UBX-CFG-NMEA.gsvTalkerId	CFG-NMEA-GSVTALKERID
UBX-CFG-NMEA.highPrec	CFG-NMEA-HIGHPREC
UBX-CFG-NMEA.limit82	CFG-NMEA-LIMIT82
UBX-CFG-NMEA.mainTalkerId	CFG-NMEA-MAINTALKERID
UBX-CFG-NMEA.mskPosFilt	CFG-NMEA-OUT_MSKFIX
UBX-CFG-NMEA.nmeaVersion	CFG-NMEA-PROTVER
UBX-CFG-NMEA.numSV	CFG-NMEA-MAXSVS
UBX-CFG-NMEA.posFilt	CFG-NMEA-OUT_INVFIX
UBX-CFG-NMEA.qzss	CFG-NMEA-FILT_QZSS
UBX-CFG-NMEA.sbas	CFG-NMEA-FILT_SBAS
UBX-CFG-NMEA.svNumbering	CFG-NMEA-SVNUMBERING
UBX-CFG-NMEA.timeFilt	CFG-NMEA-OUT_INVTIME
UBX-CFG-NMEA.trackFilt	CFG-NMEA-OUT_FROZENCOC
<b>UBX-CFG-PRT</b>	
UBX-CFG-PRT.en	CFG-TXREADY-ENABLED
UBX-CFG-PRT.extendedTxTimeout	CFG-I2C-EXTENDEDTIMEOUT
UBX-CFG-PRT.inNmea	CFG-I2CINPROT-NMEA
UBX-CFG-PRT.inProtoMask	CFG-I2C-ENABLED

UBX message and field	Configuration item(s)
UBX-CFG-PRT.inUbx	CFG-I2CINPROT-UBX
UBX-CFG-PRT.outNmea	CFG-I2COUTPROT-NMEA
UBX-CFG-PRT.outProtoMask	CFG-I2C-ENABLED
UBX-CFG-PRT.outUbx	CFG-I2COUTPROT-UBX
UBX-CFG-PRT.pin	CFG-TXREADY-PIN
UBX-CFG-PRT.pol	CFG-TXREADY-POLARITY
UBX-CFG-PRT.slaveAddr	CFG-I2C-ADDRESS
UBX-CFG-PRT.thres	CFG-TXREADY-THRESHOLD
UBX-CFG-PRT.en	CFG-TXREADY-ENABLED
UBX-CFG-PRT.extendedTxTimeout	CFG-SPI-EXTENDEDTIMEOUT
UBX-CFG-PRT.ffCnt	CFG-SPI-MAXFF
UBX-CFG-PRT.inNmea	CFG-SPIINPROT-NMEA
UBX-CFG-PRT.inProtoMask	CFG-SPI-ENABLED
UBX-CFG-PRT.inUbx	CFG-SPIINPROT-UBX
UBX-CFG-PRT.outNmea	CFG-SPIOUTPROT-NMEA
UBX-CFG-PRT.outProtoMask	CFG-SPI-ENABLED
UBX-CFG-PRT.outUbx	CFG-SPIOUTPROT-UBX
UBX-CFG-PRT.pin	CFG-TXREADY-PIN
UBX-CFG-PRT.pol	CFG-TXREADY-POLARITY
UBX-CFG-PRT.spiMode	CFG-SPI-CPOLARITY, CFG-SPI-CPHASE
UBX-CFG-PRT.thres	CFG-TXREADY-THRESHOLD
UBX-CFG-PRT.baudRate	CFG-UART1-BAUDRATE
UBX-CFG-PRT.charLen	CFG-UART1-DATABITS
UBX-CFG-PRT.inNmea	CFG-UART1INPROT-NMEA
UBX-CFG-PRT.inProtoMask	CFG-UART1-ENABLED
UBX-CFG-PRT.inUbx	CFG-UART1INPROT-UBX
UBX-CFG-PRT.nStopBits	CFG-UART1-STOPBITS
UBX-CFG-PRT.outNmea	CFG-UART1OUTPROT-NMEA
UBX-CFG-PRT.outProtoMask	CFG-UART1-ENABLED
UBX-CFG-PRT.outUbx	CFG-UART1OUTPROT-UBX
UBX-CFG-PRT.parity	CFG-UART1-PARITY
<b>UBX-CFG-RATE</b>	
UBX-CFG-RATE.measRate	CFG-RATE-MEAS
UBX-CFG-RATE.navRate	CFG-RATE-NAV
UBX-CFG-RATE.timeRef	CFG-RATE-TIMEREf
<b>UBX-CFG-RINV</b>	
UBX-CFG-RINV.data	CFG-RINV-DATA_SIZE, CFG-RINV-CHUNK0, CFG-RINV-CHUNK1, CFG-RINV-CHUNK2, CFG-RINV-CHUNK3
UBX-CFG-RINV.flags	CFG-RINV-DUMP, CFG-RINV-BINARY
<b>UBX-CFG-SBAS</b>	
UBX-CFG-SBAS.scanmode1	CFG-SBAS-PRNSCANMASK
UBX-CFG-SBAS.test	CFG-SBAS-USE_TESTMODE
<b>UBX-CFG-TMODE3</b>	
UBX-CFG-TMODE3.ecefXOrLat	CFG-TMODE-ECEF_X, CFG-TMODE-LAT

UBX message and field	Configuration item(s)
UBX-CFG-TMODE3.ecefXOrLatHP	CFG-TMODE-ECEF_X_HP, CFG-TMODE-LAT_HP
UBX-CFG-TMODE3.ecefYOrLon	CFG-TMODE-ECEF_Y, CFG-TMODE-LON
UBX-CFG-TMODE3.ecefYOrLonHP	CFG-TMODE-ECEF_Y_HP, CFG-TMODE-LON_HP
UBX-CFG-TMODE3.ecefZOrAlt	CFG-TMODE-ECEF_Z, CFG-TMODE-HEIGHT
UBX-CFG-TMODE3.ecefZOrAltHP	CFG-TMODE-ECEF_Z_HP, CFG-TMODE-HEIGHT_HP
UBX-CFG-TMODE3.fixedPosAcc	CFG-TMODE-FIXED_POS_ACC
UBX-CFG-TMODE3.flags	CFG-TMODE-MODE, CFG-TMODE-POS_TYPE
UBX-CFG-TMODE3.svinAccLimit	CFG-TMODE-SVIN_ACC_LIMIT
UBX-CFG-TMODE3.svinMinDur	CFG-TMODE-SVIN_MIN_DUR
<b>UBX-CFG-TP5</b>	
UBX-CFG-TP5.active	CFG-TP-TP1_ENA
UBX-CFG-TP5.alignToTow	CFG-TP-ALIGN_TO_TOW_TP1
UBX-CFG-TP5.antCableDelay	CFG-TP-ANT_CABLEDELAY
UBX-CFG-TP5.freqPeriod	CFG-TP-PERIOD_TP1, CFG-TP-FREQ_TP1
UBX-CFG-TP5.freqPeriodLock	CFG-TP-PERIOD_LOCK_TP1, CFG-TP-FREQ_LOCK_TP1
UBX-CFG-TP5.gridUtcGnss	CFG-TP-TIMEGRID_TP1
UBX-CFG-TP5.isFreq	CFG-TP-PULSE_DEF
UBX-CFG-TP5.isLength	CFG-TP-PULSE_LENGTH_DEF
UBX-CFG-TP5.lockGnssFreq	CFG-TP-SYNC_GNSS_TP1
UBX-CFG-TP5.lockedOtherSet	CFG-TP-USE_LOCKED_TP1
UBX-CFG-TP5.polarity	CFG-TP-POL_TP1
UBX-CFG-TP5.pulseLenRatio	CFG-TP-LEN_TP1, CFG-TP-DUTY_TP1
UBX-CFG-TP5.pulseLenRatioLock	CFG-TP-LEN_LOCK_TP1, CFG-TP-DUTY_LOCK_TP1
UBX-CFG-TP5.userConfigDelay	CFG-TP-USER_DELAY_TP1

**Table 79: Legacy UBX message fields and the corresponding configuration items**

## Configuration defaults

The following tables contain the configuration defaults for the firmware. Some of these values may be changed in production. Refer to the integration manual for product-specific details.

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-BDS-USE_GEO_PRN</a>	0x10340014	L	-	-	1 (true)

**Table 80: CFG-BDS configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-HW-ANT_CFG_VOLTCTRL</a>	0x10a3002e	L	-	-	0 (false)
<a href="#">CFG-HW-ANT_CFG_SHORTDET</a>	0x10a3002f	L	-	-	0 (false)
<a href="#">CFG-HW-ANT_CFG_SHORTDET_POL</a>	0x10a30030	L	-	-	1 (true)
<a href="#">CFG-HW-ANT_CFG_OPENDET</a>	0x10a30031	L	-	-	0 (false)
<a href="#">CFG-HW-ANT_CFG_OPENDET_POL</a>	0x10a30032	L	-	-	1 (true)
<a href="#">CFG-HW-ANT_CFG_PWRDOWN</a>	0x10a30033	L	-	-	0 (false)
<a href="#">CFG-HW-ANT_CFG_PWRDOWN_POL</a>	0x10a30034	L	-	-	1 (true)
<a href="#">CFG-HW-ANT_CFG_RECOVER</a>	0x10a30035	L	-	-	0 (false)
<a href="#">CFG-HW-ANT_SUP_SWITCH_PIN</a>	0x20a30036	U1	-	-	7
<a href="#">CFG-HW-ANT_SUP_SHORT_PIN</a>	0x20a30037	U1	-	-	6
<a href="#">CFG-HW-ANT_SUP_OPEN_PIN</a>	0x20a30038	U1	-	-	5
<a href="#">CFG-HW-ANT_ON_SHORT_US</a>	0x30a3003c	U2	-	-	500
<a href="#">CFG-HW-ANT_SUP_ENGINE</a>	0x20a30054	E1	-	-	0 (EXT)
<a href="#">CFG-HW-ANT_SUP_SHORT_THR</a>	0x20a30055	U1	-	mV	0
<a href="#">CFG-HW-ANT_SUP_OPEN_THR</a>	0x20a30056	U1	-	mV	0
<a href="#">CFG-HW-RF_LNA_MODE</a>	0x20a30057	E1	-	-	0 (NORMAL)

**Table 81: CFG-HW configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-I2C-ADDRESS</a>	0x20510001	U1	-	-	132
<a href="#">CFG-I2C-EXTENDEDTIMEOUT</a>	0x10510002	L	-	-	0 (false)
<a href="#">CFG-I2C-ENABLED</a>	0x10510003	L	-	-	0 (false)

**Table 82: CFG-I2C configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-I2CINPROT-UBX</a>	0x10710001	L	-	-	1 (true)
<a href="#">CFG-I2CINPROT-NMEA</a>	0x10710002	L	-	-	1 (true)

**Table 83: CFG-I2CINPROT configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-I2COUTPROT-UBX</a>	0x10720001	L	-	-	1 (true)
<a href="#">CFG-I2COUTPROT-NMEA</a>	0x10720002	L	-	-	1 (true)

**Table 84: CFG-I2COUTPROT configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-INFMSG-UBX_I2C</a>	0x20920001	X1	-	-	0x00

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-INFMSG-UBX_UART1	0x20920002	X1	-	-	0x00
CFG-INFMSG-UBX_SPI	0x20920005	X1	-	-	0x00
CFG-INFMSG-NMEA_I2C	0x20920006	X1	-	-	0x07 (ERROR   WARNING   NOTICE)
CFG-INFMSG-NMEA_UART1	0x20920007	X1	-	-	0x07 (ERROR   WARNING   NOTICE)
CFG-INFMSG-NMEA_SPI	0x2092000a	X1	-	-	0x07 (ERROR   WARNING   NOTICE)

**Table 85: CFG-INFMSG configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-MOT-GNSSSPEED_THRS	0x20250038	U1	0.01	m/s	0
CFG-MOT-GNSSDIST_THRS	0x3025003b	U2	1.0	m	0

**Table 86: CFG-MOT configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-MSGOUT-NMEA_ID_DTM_I2C	0x209100a6	U1	-	-	0
CFG-MSGOUT-NMEA_ID_DTM_SPI	0x209100aa	U1	-	-	0
CFG-MSGOUT-NMEA_ID_DTM_UART1	0x209100a7	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GBS_I2C	0x209100dd	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GBS_SPI	0x209100e1	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GBS_UART1	0x209100de	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GGA_I2C	0x209100ba	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GGA_SPI	0x209100be	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GGA_UART1	0x209100bb	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GLL_I2C	0x209100c9	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GLL_SPI	0x209100cd	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GLL_UART1	0x209100ca	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GNS_I2C	0x209100b5	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GNS_SPI	0x209100b9	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GNS_UART1	0x209100b6	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GRS_I2C	0x209100ce	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GRS_SPI	0x209100d2	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GRS_UART1	0x209100cf	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GSA_I2C	0x209100bf	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GSA_SPI	0x209100c3	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GSA_UART1	0x209100c0	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GST_I2C	0x209100d3	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GST_SPI	0x209100d7	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GST_UART1	0x209100d4	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GSV_I2C	0x209100c4	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GSV_SPI	0x209100c8	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GSV_UART1	0x209100c5	U1	-	-	1
CFG-MSGOUT-NMEA_ID_RLM_I2C	0x20910400	U1	-	-	0

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-MSGOUT-NMEA_ID_RLM_SPI	0x20910404	U1	-	-	0
CFG-MSGOUT-NMEA_ID_RLM_UART1	0x20910401	U1	-	-	0
CFG-MSGOUT-NMEA_ID_RMC_I2C	0x209100ab	U1	-	-	1
CFG-MSGOUT-NMEA_ID_RMC_SPI	0x209100af	U1	-	-	1
CFG-MSGOUT-NMEA_ID_RMC_UART1	0x209100ac	U1	-	-	1
CFG-MSGOUT-NMEA_ID_VTG_I2C	0x209100b0	U1	-	-	1
CFG-MSGOUT-NMEA_ID_VTG_SPI	0x209100b4	U1	-	-	1
CFG-MSGOUT-NMEA_ID_VTG_UART1	0x209100b1	U1	-	-	1
CFG-MSGOUT-NMEA_ID_ZDA_I2C	0x209100d8	U1	-	-	1
CFG-MSGOUT-NMEA_ID_ZDA_SPI	0x209100dc	U1	-	-	1
CFG-MSGOUT-NMEA_ID_ZDA_UART1	0x209100d9	U1	-	-	1
CFG-MSGOUT-NMEA_NAV2_ID_GGA_I2C	0x20910661	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GGA_SPI	0x20910665	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GGA_UART1	0x20910662	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GLL_I2C	0x20910670	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GLL_SPI	0x20910674	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GLL_UART1	0x20910671	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GNS_I2C	0x2091065c	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GNS_SPI	0x20910660	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GNS_UART1	0x2091065d	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GSA_I2C	0x20910666	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GSA_SPI	0x2091066a	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_GSA_UART1	0x20910667	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_RMC_I2C	0x20910652	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_RMC_SPI	0x20910656	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_RMC_UART1	0x20910653	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_VTG_I2C	0x20910657	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_VTG_SPI	0x2091065b	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_VTG_UART1	0x20910658	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_ZDA_I2C	0x2091067f	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_ZDA_SPI	0x20910683	U1	-	-	0
CFG-MSGOUT-NMEA_NAV2_ID_ZDA_UART1	0x20910680	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYP_I2C	0x209100ec	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYP_SPI	0x209100f0	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYP_UART1	0x209100ed	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYS_I2C	0x209100f1	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYS_SPI	0x209100f5	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYS_UART1	0x209100f2	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYT_I2C	0x209100f6	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYT_SPI	0x209100fa	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYT_UART1	0x209100f7	U1	-	-	0

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-MSGOUT-UBX_MON_COMMS_I2C	0x2091034f	U1	-	-	0
CFG-MSGOUT-UBX_MON_COMMS_SPI	0x20910353	U1	-	-	0
CFG-MSGOUT-UBX_MON_COMMS_UART1	0x20910350	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW3_I2C	0x20910354	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW3_SPI	0x20910358	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW3_UART1	0x20910355	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW_I2C	0x209101b4	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW_SPI	0x209101b8	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW_UART1	0x209101b5	U1	-	-	0
CFG-MSGOUT-UBX_MON_IO_I2C	0x209101a5	U1	-	-	0
CFG-MSGOUT-UBX_MON_IO_SPI	0x209101a9	U1	-	-	0
CFG-MSGOUT-UBX_MON_IO_UART1	0x209101a6	U1	-	-	0
CFG-MSGOUT-UBX_MON_MSGPP_I2C	0x20910196	U1	-	-	0
CFG-MSGOUT-UBX_MON_MSGPP_SPI	0x2091019a	U1	-	-	0
CFG-MSGOUT-UBX_MON_MSGPP_UART1	0x20910197	U1	-	-	0
CFG-MSGOUT-UBX_MON_RF_I2C	0x20910359	U1	-	-	0
CFG-MSGOUT-UBX_MON_RF_SPI	0x2091035d	U1	-	-	0
CFG-MSGOUT-UBX_MON_RF_UART1	0x2091035a	U1	-	-	0
CFG-MSGOUT-UBX_MON_RXBUF_I2C	0x209101a0	U1	-	-	0
CFG-MSGOUT-UBX_MON_RXBUF_SPI	0x209101a4	U1	-	-	0
CFG-MSGOUT-UBX_MON_RXBUF_UART1	0x209101a1	U1	-	-	0
CFG-MSGOUT-UBX_MON_RXR_I2C	0x20910187	U1	-	-	0
CFG-MSGOUT-UBX_MON_RXR_SPI	0x2091018b	U1	-	-	0
CFG-MSGOUT-UBX_MON_RXR_UART1	0x20910188	U1	-	-	0
CFG-MSGOUT-UBX_MON_SPAN_I2C	0x2091038b	U1	-	-	0
CFG-MSGOUT-UBX_MON_SPAN_SPI	0x2091038f	U1	-	-	0
CFG-MSGOUT-UBX_MON_SPAN_UART1	0x2091038c	U1	-	-	0
CFG-MSGOUT-UBX_MON_SYS_I2C	0x2091069d	U1	-	-	0
CFG-MSGOUT-UBX_MON_SYS_SPI	0x209106a1	U1	-	-	0
CFG-MSGOUT-UBX_MON_SYS_UART1	0x2091069e	U1	-	-	0
CFG-MSGOUT-UBX_MON_TXBUF_I2C	0x2091019b	U1	-	-	0
CFG-MSGOUT-UBX_MON_TXBUF_SPI	0x2091019f	U1	-	-	0
CFG-MSGOUT-UBX_MON_TXBUF_UART1	0x2091019c	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_CLOCK_I2C	0x20910430	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_CLOCK_SPI	0x20910434	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_CLOCK_UART1	0x20910431	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_COV_I2C	0x20910435	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_COV_SPI	0x20910439	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_COV_UART1	0x20910436	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_DOP_I2C	0x20910465	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_DOP_SPI	0x20910469	U1	-	-	0



Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-MSGOUT-UBX_NAV2_DOP_UART1	0x20910466	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_EOE_I2C	0x20910565	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_EOE_SPI	0x20910569	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_EOE_UART1	0x20910566	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_POSECEF_I2C	0x20910480	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_POSECEF_SPI	0x20910484	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_POSECEF_UART1	0x20910481	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_POSLLH_I2C	0x20910485	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_POSLLH_SPI	0x20910489	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_POSLLH_UART1	0x20910486	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_PVT_I2C	0x20910490	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_PVT_SPI	0x20910494	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_PVT_UART1	0x20910491	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_SAT_I2C	0x20910495	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_SAT_SPI	0x20910499	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_SAT_UART1	0x20910496	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_SBAS_I2C	0x20910500	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_SBAS_SPI	0x20910504	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_SBAS_UART1	0x20910501	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_SIG_I2C	0x20910505	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_SIG_SPI	0x20910509	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_SIG_UART1	0x20910506	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_STATUS_I2C	0x20910515	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_STATUS_SPI	0x20910519	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_STATUS_UART1	0x20910516	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEBDS_I2C	0x20910525	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEBDS_SPI	0x20910529	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEBDS_UART1	0x20910526	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEGAL_I2C	0x20910530	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEGAL_SPI	0x20910534	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEGAL_UART1	0x20910531	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEGLO_I2C	0x20910535	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEGLO_SPI	0x20910539	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEGLO_UART1	0x20910536	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEGPS_I2C	0x20910540	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEGPS_SPI	0x20910544	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEGPS_UART1	0x20910541	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMELS_I2C	0x20910545	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMELS_SPI	0x20910549	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMELS_UART1	0x20910546	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMENAVIC_I2C	0x209106a7	U1	-	-	0

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-MSGOUT-UBX_NAV2_TIMENAVIC_SPI	0x209106ab	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMENAVIC_UART1	0x209106a8	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEUTC_I2C	0x20910550	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEUTC_SPI	0x20910554	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_TIMEUTC_UART1	0x20910551	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_VELECEF_I2C	0x20910555	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_VELECEF_SPI	0x20910559	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_VELECEF_UART1	0x20910556	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_VELNED_I2C	0x20910560	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_VELNED_SPI	0x20910564	U1	-	-	0
CFG-MSGOUT-UBX_NAV2_VELNED_UART1	0x20910561	U1	-	-	0
CFG-MSGOUT-UBX_NAV_CLOCK_I2C	0x20910065	U1	-	-	0
CFG-MSGOUT-UBX_NAV_CLOCK_SPI	0x20910069	U1	-	-	0
CFG-MSGOUT-UBX_NAV_CLOCK_UART1	0x20910066	U1	-	-	0
CFG-MSGOUT-UBX_NAV_COV_I2C	0x20910083	U1	-	-	0
CFG-MSGOUT-UBX_NAV_COV_SPI	0x20910087	U1	-	-	0
CFG-MSGOUT-UBX_NAV_COV_UART1	0x20910084	U1	-	-	0
CFG-MSGOUT-UBX_NAV_DOP_I2C	0x20910038	U1	-	-	0
CFG-MSGOUT-UBX_NAV_DOP_SPI	0x2091003c	U1	-	-	0
CFG-MSGOUT-UBX_NAV_DOP_UART1	0x20910039	U1	-	-	0
CFG-MSGOUT-UBX_NAV_EOE_I2C	0x2091015f	U1	-	-	0
CFG-MSGOUT-UBX_NAV_EOE_SPI	0x20910163	U1	-	-	0
CFG-MSGOUT-UBX_NAV_EOE_UART1	0x20910160	U1	-	-	0
CFG-MSGOUT-UBX_NAV_NMI_I2C	0x20910590	U1	-	-	0
CFG-MSGOUT-UBX_NAV_NMI_SPI	0x20910594	U1	-	-	0
CFG-MSGOUT-UBX_NAV_NMI_UART1	0x20910591	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ORB_I2C	0x20910010	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ORB_SPI	0x20910014	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ORB_UART1	0x20910011	U1	-	-	0
CFG-MSGOUT-UBX_NAV_POSECEF_I2C	0x20910024	U1	-	-	0
CFG-MSGOUT-UBX_NAV_POSECEF_SPI	0x20910028	U1	-	-	0
CFG-MSGOUT-UBX_NAV_POSECEF_UART1	0x20910025	U1	-	-	0
CFG-MSGOUT-UBX_NAV_POSLLH_I2C	0x20910029	U1	-	-	0
CFG-MSGOUT-UBX_NAV_POSLLH_SPI	0x2091002d	U1	-	-	0
CFG-MSGOUT-UBX_NAV_POSLLH_UART1	0x2091002a	U1	-	-	0
CFG-MSGOUT-UBX_NAV_PVT_I2C	0x20910006	U1	-	-	0
CFG-MSGOUT-UBX_NAV_PVT_SPI	0x2091000a	U1	-	-	0
CFG-MSGOUT-UBX_NAV_PVT_UART1	0x20910007	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SAT_I2C	0x20910015	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SAT_SPI	0x20910019	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SAT_UART1	0x20910016	U1	-	-	0

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-MSGOUT-UBX_NAV_SBAS_I2C	0x2091006a	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SBAS_SPI	0x2091006e	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SBAS_UART1	0x2091006b	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SIG_I2C	0x20910345	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SIG_SPI	0x20910349	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SIG_UART1	0x20910346	U1	-	-	0
CFG-MSGOUT-UBX_NAV_STATUS_I2C	0x2091001a	U1	-	-	0
CFG-MSGOUT-UBX_NAV_STATUS_SPI	0x2091001e	U1	-	-	0
CFG-MSGOUT-UBX_NAV_STATUS_UART1	0x2091001b	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEBDS_I2C	0x20910051	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEBDS_SPI	0x20910055	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEBDS_UART1	0x20910052	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGAL_I2C	0x20910056	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGAL_SPI	0x2091005a	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGAL_UART1	0x20910057	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGLO_I2C	0x2091004c	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGLO_SPI	0x20910050	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGLO_UART1	0x2091004d	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGPS_I2C	0x20910047	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGPS_SPI	0x2091004b	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGPS_UART1	0x20910048	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMELS_I2C	0x20910060	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMELS_SPI	0x20910064	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMELS_UART1	0x20910061	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMENAVIC_I2C	0x209106a2	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMENAVIC_SPI	0x209106a6	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMENAVIC_UART1	0x209106a3	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEQZSS_I2C	0x20910386	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEQZSS_SPI	0x2091038a	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEQZSS_UART1	0x20910387	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEUTC_I2C	0x2091005b	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEUTC_SPI	0x2091005f	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEUTC_UART1	0x2091005c	U1	-	-	0
CFG-MSGOUT-UBX_NAV_VELECEF_I2C	0x2091003d	U1	-	-	0
CFG-MSGOUT-UBX_NAV_VELECEF_SPI	0x20910041	U1	-	-	0
CFG-MSGOUT-UBX_NAV_VELECEF_UART1	0x2091003e	U1	-	-	0
CFG-MSGOUT-UBX_NAV_VELNED_I2C	0x20910042	U1	-	-	0
CFG-MSGOUT-UBX_NAV_VELNED_SPI	0x20910046	U1	-	-	0
CFG-MSGOUT-UBX_NAV_VELNED_UART1	0x20910043	U1	-	-	0
CFG-MSGOUT-UBX_RXM_MEASX_I2C	0x20910204	U1	-	-	0
CFG-MSGOUT-UBX_RXM_MEASX_SPI	0x20910208	U1	-	-	0

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-MSGOUT-UBX_RXM_MEASX_UART1	0x20910205	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RAWX_I2C	0x209102a4	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RAWX_SPI	0x209102a8	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RAWX_UART1	0x209102a5	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RLM_I2C	0x2091025e	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RLM_SPI	0x20910262	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RLM_UART1	0x2091025f	U1	-	-	0
CFG-MSGOUT-UBX_RXM_SFRBX_I2C	0x20910231	U1	-	-	0
CFG-MSGOUT-UBX_RXM_SFRBX_SPI	0x20910235	U1	-	-	0
CFG-MSGOUT-UBX_RXM_SFRBX_UART1	0x20910232	U1	-	-	0
CFG-MSGOUT-UBX_SEC_SIGLOG_I2C	0x20910689	U1	-	-	0
CFG-MSGOUT-UBX_SEC_SIGLOG_SPI	0x2091068d	U1	-	-	0
CFG-MSGOUT-UBX_SEC_SIGLOG_UART1	0x2091068a	U1	-	-	0
CFG-MSGOUT-UBX_SEC_SIG_I2C	0x20910634	U1	-	-	0
CFG-MSGOUT-UBX_SEC_SIG_SPI	0x20910638	U1	-	-	0
CFG-MSGOUT-UBX_SEC_SIG_UART1	0x20910635	U1	-	-	0
CFG-MSGOUT-UBX_TIM_SVIN_I2C	0x20910097	U1	-	-	0
CFG-MSGOUT-UBX_TIM_SVIN_SPI	0x2091009b	U1	-	-	0
CFG-MSGOUT-UBX_TIM_SVIN_UART1	0x20910098	U1	-	-	0
CFG-MSGOUT-UBX_TIM_TM2_I2C	0x20910178	U1	-	-	0
CFG-MSGOUT-UBX_TIM_TM2_SPI	0x2091017c	U1	-	-	0
CFG-MSGOUT-UBX_TIM_TM2_UART1	0x20910179	U1	-	-	0
CFG-MSGOUT-UBX_TIM_TP_I2C	0x2091017d	U1	-	-	0
CFG-MSGOUT-UBX_TIM_TP_SPI	0x20910181	U1	-	-	0
CFG-MSGOUT-UBX_TIM_TP_UART1	0x2091017e	U1	-	-	0
CFG-MSGOUT-UBX_TIM_VRFY_I2C	0x20910092	U1	-	-	0
CFG-MSGOUT-UBX_TIM_VRFY_SPI	0x20910096	U1	-	-	0
CFG-MSGOUT-UBX_TIM_VRFY_UART1	0x20910093	U1	-	-	0

**Table 87: CFG-MSGOUT configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-NAV2-OUT_ENABLED	0x10170001	L	-	-	0 (false)

**Table 88: CFG-NAV2 configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-NAVMASK-SV_MASK_GPS	0x50180013	X8	-	-	0xfffffffffffffff (EMPTY)
CFG-NAVMASK-SV_MASK_GAL	0x50180014	X8	-	-	0xfffffffffffffff (EMPTY)
CFG-NAVMASK-SV_MASK_GLO	0x50180015	X8	-	-	0xfffffffffffffff (EMPTY)
CFG-NAVMASK-SV_MASK_BDS	0x50180016	X8	-	-	0xfffffffffffffff (EMPTY)
CFG-NAVMASK-SV_MASK_QZSS	0x50180017	X8	-	-	0xfffffffffffffff (EMPTY)
CFG-NAVMASK-SV_MASK_NAVIC	0x50180018	X8	-	-	0xfffffffffffffff (EMPTY)
CFG-NAVMASK-EL_MASK_000_020	0x50180001	X8	-	-	0xfffffffffffffff (EMPTY   EXMPL_01   EXMPL_02)

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-NAVMASK-EL_MASK_020_040	0x50180002	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_03   EXMPL_04)
CFG-NAVMASK-EL_MASK_040_060	0x50180003	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_05   EXMPL_06)
CFG-NAVMASK-EL_MASK_060_080	0x50180004	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_07   EXMPL_08)
CFG-NAVMASK-EL_MASK_080_100	0x50180005	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_09   EXMPL_10)
CFG-NAVMASK-EL_MASK_100_120	0x50180006	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_11   EXMPL_12)
CFG-NAVMASK-EL_MASK_120_140	0x50180007	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_13   EXMPL_14)
CFG-NAVMASK-EL_MASK_140_160	0x50180008	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_15   EXMPL_16)
CFG-NAVMASK-EL_MASK_160_180	0x50180009	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_17   EXMPL_18)
CFG-NAVMASK-EL_MASK_180_200	0x5018000a	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_19   EXMPL_20)
CFG-NAVMASK-EL_MASK_200_220	0x5018000b	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_21   EXMPL_22)
CFG-NAVMASK-EL_MASK_220_240	0x5018000c	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_23   EXMPL_24)
CFG-NAVMASK-EL_MASK_240_260	0x5018000d	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_25   EXMPL_26)
CFG-NAVMASK-EL_MASK_260_280	0x5018000e	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_27   EXMPL_28)
CFG-NAVMASK-EL_MASK_280_300	0x5018000f	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_29   EXMPL_30)
CFG-NAVMASK-EL_MASK_300_320	0x50180010	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_31   EXMPL_32)
CFG-NAVMASK-EL_MASK_320_340	0x50180011	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_33   EXMPL_34)
CFG-NAVMASK-EL_MASK_340_360	0x50180012	X8	-	-	0xffffffffffffff (EMPTY   EXMPL_35   EXMPL_36)

**Table 89: CFG-NAVMASK configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-NAVSPG-FIXMODE	0x20110011	E1	-	-	3 (AUTO)
CFG-NAVSPG-INIFIX3D	0x10110013	L	-	-	0 (false)
CFG-NAVSPG-WKNRROLLOVER	0x30110017	U2	-	-	2249
CFG-NAVSPG-USE_PPP	0x10110019	L	-	-	1 (true)
CFG-NAVSPG-UTCSTANDARD	0x2011001c	E1	-	-	0 (AUTO)
CFG-NAVSPG-DYNMODEL	0x20110021	E1	-	-	2 (STAT)
CFG-NAVSPG-ACKAIDING	0x10110025	L	-	-	0 (false)
CFG-NAVSPG-USE_USRDAT	0x10110061	L	-	-	0 (false)
CFG-NAVSPG-USRDAT_MAJA	0x50110062	R8	-	m	6378137
CFG-NAVSPG-USRDAT_FLAT	0x50110063	R8	-	-	298.25722356300002502
CFG-NAVSPG-USRDAT_DX	0x40110064	R4	-	m	0
CFG-NAVSPG-USRDAT_DY	0x40110065	R4	-	m	0

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-NAVSPG-USRDAT_DZ	0x40110066	R4	-	m	0
CFG-NAVSPG-USRDAT_ROTX	0x40110067	R4	-	arcsec	0
CFG-NAVSPG-USRDAT_ROTY	0x40110068	R4	-	arcsec	0
CFG-NAVSPG-USRDAT_ROTZ	0x40110069	R4	-	arcsec	0
CFG-NAVSPG-USRDAT_SCALE	0x4011006a	R4	-	ppm	0
CFG-NAVSPG-INFIL_MINSVS	0x201100a1	U1	-	-	1
CFG-NAVSPG-INFIL_MAXSVS	0x201100a2	U1	-	-	32
CFG-NAVSPG-INFIL_MINCNO	0x201100a3	U1	-	dBHz	9
CFG-NAVSPG-INFIL_MINELEV	0x201100a4	I1	-	deg	10
CFG-NAVSPG-INFIL_NCNOTHRS	0x201100aa	U1	-	-	0
CFG-NAVSPG-INFIL_CNOTHRS	0x201100ab	U1	-	-	0
CFG-NAVSPG-OUTFIL_PDOP	0x301100b1	U2	0.1	-	250
CFG-NAVSPG-OUTFIL_TDOP	0x301100b2	U2	0.1	-	250
CFG-NAVSPG-OUTFIL_PACC	0x301100b3	U2	-	m	100
CFG-NAVSPG-OUTFIL_TACC	0x301100b4	U2	-	m	350
CFG-NAVSPG-OUTFIL_FACC	0x301100b5	U2	0.01	m/s	150
CFG-NAVSPG-CONSTR_ALT	0x401100c1	I4	0.01	m	0
CFG-NAVSPG-CONSTR_ALTVAR	0x401100c2	U4	0.0001	m <sup>2</sup>	10000
CFG-NAVSPG-CONSTR_DGNSSTO	0x201100c4	U1	-	s	60

**Table 90: CFG-NAVSPG configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-NMEA-PROTVR	0x20930001	E1	-	-	42 (V411)
CFG-NMEA-MAXSVS	0x20930002	E1	-	-	0 (UNLIM)
CFG-NMEA-COMPAT	0x10930003	L	-	-	0 (false)
CFG-NMEA-CONSIDER	0x10930004	L	-	-	1 (true)
CFG-NMEA-LIMIT82	0x10930005	L	-	-	0 (false)
CFG-NMEA-HIGHPREC	0x10930006	L	-	-	0 (false)
CFG-NMEA-SVNUMBERING	0x20930007	E1	-	-	0 (STRICT)
CFG-NMEA-FILT_GPS	0x10930011	L	-	-	0 (false)
CFG-NMEA-FILT_SBAS	0x10930012	L	-	-	0 (false)
CFG-NMEA-FILT_GAL	0x10930013	L	-	-	0 (false)
CFG-NMEA-FILT_QZSS	0x10930015	L	-	-	0 (false)
CFG-NMEA-FILT_GLO	0x10930016	L	-	-	0 (false)
CFG-NMEA-FILT_BDS	0x10930017	L	-	-	0 (false)
CFG-NMEA-FILT_NAVIC	0x10930018	L	-	-	0 (false)
CFG-NMEA-OUT_INVFIX	0x10930021	L	-	-	0 (false)
CFG-NMEA-OUT_MSKFIX	0x10930022	L	-	-	0 (false)
CFG-NMEA-OUT_INVTIME	0x10930023	L	-	-	0 (false)
CFG-NMEA-OUT_INVDATE	0x10930024	L	-	-	0 (false)
CFG-NMEA-OUT_ONLYGPS	0x10930025	L	-	-	0 (false)

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-NMEA-OUT_FROZENCOG</a>	0x10930026	L	-	-	0 (false)
<a href="#">CFG-NMEA-MAINTALKERID</a>	0x20930031	E1	-	-	0 (AUTO)
<a href="#">CFG-NMEA-GSVTALKERID</a>	0x20930032	E1	-	-	0 (GNSS)
<a href="#">CFG-NMEA-BDSTALKERID</a>	0x30930033	U2	-	-	0

**Table 91: CFG-NMEA configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-RATE-MEAS</a>	0x30210001	U2	0.001	s	1000
<a href="#">CFG-RATE-NAV</a>	0x30210002	U2	-	-	1
<a href="#">CFG-RATE-TIMEREFF</a>	0x20210003	E1	-	-	1 (GPS)

**Table 92: CFG-RATE configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-RINV-DUMP</a>	0x10c70001	L	-	-	0 (false)
<a href="#">CFG-RINV-BINARY</a>	0x10c70002	L	-	-	0 (false)
<a href="#">CFG-RINV-DATA_SIZE</a>	0x20c70003	U1	-	-	22
<a href="#">CFG-RINV-CHUNK0</a>	0x50c70004	X8	-	-	0x203a656369746f4e ("Notice: ")
<a href="#">CFG-RINV-CHUNK1</a>	0x50c70005	X8	-	-	0x2061746164206f6e ("no data ")
<a href="#">CFG-RINV-CHUNK2</a>	0x50c70006	X8	-	-	0x0000216465766173 ("saved!\0\0")
<a href="#">CFG-RINV-CHUNK3</a>	0x50c70007	X8	-	-	0x0000000000000000

**Table 93: CFG-RINV configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-SBAS-USE_TESTMODE</a>	0x10360002	L	-	-	0 (false)
<a href="#">CFG-SBAS-ACCEPT_NOT_IN_PRNMASK</a>	0x30360008	X2	-	-	0x0000
<a href="#">CFG-SBAS-USE_IONOONLY</a>	0x10360007	L	-	-	1 (true)
<a href="#">CFG-SBAS-PRNSCANMASK</a>	0x50360006	X8	-	-	0x0000000000003ab88 (ALL   PRN123   PRN127   PRN128   PRN129   PRN131   PRN133   PRN135   PRN136   PRN137)

**Table 94: CFG-SBAS configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-SEC-CFG_LOCK</a>	0x10f60009	L	-	-	0 (false)
<a href="#">CFG-SEC-CFG_LOCK_UNLOCKGRP1</a>	0x30f6000a	U2	-	-	0
<a href="#">CFG-SEC-CFG_LOCK_UNLOCKGRP2</a>	0x30f6000b	U2	-	-	0
<a href="#">CFG-SEC-JAMDET_SENSITIVITY_HI</a>	0x10f60051	L	-	-	1 (true)

**Table 95: CFG-SEC configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-SIGNAL-GPS_ENA</a>	0x1031001f	L	-	-	1 (true)
<a href="#">CFG-SIGNAL-GPS_L1CA_ENA</a>	0x10310001	L	-	-	1 (true)
<a href="#">CFG-SIGNAL-GPS_L5_ENA</a>	0x10310004	L	-	-	0 (false)
<a href="#">CFG-SIGNAL-SBAS_ENA</a>	0x10310020	L	-	-	1 (true)

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-SIGNAL-SBAS_L1CA_ENA	0x10310005	L	-	-	1 (true)
CFG-SIGNAL-GAL_ENA	0x10310021	L	-	-	1 (true)
CFG-SIGNAL-GAL_E1_ENA	0x10310007	L	-	-	1 (true)
CFG-SIGNAL-GAL_E5A_ENA	0x10310009	L	-	-	1 (true)
CFG-SIGNAL-BDS_ENA	0x10310022	L	-	-	1 (true)
CFG-SIGNAL-BDS_B1C_ENA	0x1031000f	L	-	-	1 (true)
CFG-SIGNAL-BDS_B2A_ENA	0x10310028	L	-	-	1 (true)
CFG-SIGNAL-QZSS_ENA	0x10310024	L	-	-	1 (true)
CFG-SIGNAL-QZSS_L1CA_ENA	0x10310012	L	-	-	1 (true)
CFG-SIGNAL-QZSS_L5_ENA	0x10310017	L	-	-	1 (true)
CFG-SIGNAL-GLO_ENA	0x10310025	L	-	-	1 (true)
CFG-SIGNAL-GLO_L1_ENA	0x10310018	L	-	-	0 (false)
CFG-SIGNAL-NAVIC_ENA	0x10310026	L	-	-	1 (true)
CFG-SIGNAL-NAVIC_L5_ENA	0x1031001d	L	-	-	0 (false)

**Table 96: CFG-SIGNAL configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-SPI-MAXFF	0x20640001	U1	-	-	50
CFG-SPI-CPOLARITY	0x10640002	L	-	-	0 (false)
CFG-SPI-CPHASE	0x10640003	L	-	-	0 (false)
CFG-SPI-EXTENDEDTIMEOUT	0x10640005	L	-	-	0 (false)
CFG-SPI-ENABLED	0x10640006	L	-	-	0 (false)

**Table 97: CFG-SPI configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-SPIINPROT-UBX	0x10790001	L	-	-	1 (true)
CFG-SPIINPROT-NMEA	0x10790002	L	-	-	1 (true)

**Table 98: CFG-SPIINPROT configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-SPIOUTPROT-UBX	0x107a0001	L	-	-	1 (true)
CFG-SPIOUTPROT-NMEA	0x107a0002	L	-	-	1 (true)

**Table 99: CFG-SPIOUTPROT configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-TMODE-MODE	0x20030001	E1	-	-	0 (DISABLED)
CFG-TMODE-POS_TYPE	0x20030002	E1	-	-	0 (ECEP)
CFG-TMODE-ECEF_X	0x40030003	I4	-	cm	0
CFG-TMODE-ECEF_Y	0x40030004	I4	-	cm	0
CFG-TMODE-ECEF_Z	0x40030005	I4	-	cm	0
CFG-TMODE-ECEF_X_HP	0x20030006	I1	0.1	mm	0
CFG-TMODE-ECEF_Y_HP	0x20030007	I1	0.1	mm	0
CFG-TMODE-ECEF_Z_HP	0x20030008	I1	0.1	mm	0
CFG-TMODE-LAT	0x40030009	I4	1e-7	deg	0



Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-TMODE-LON	0x4003000a	I4	1e-7	deg	0
CFG-TMODE-HEIGHT	0x4003000b	I4	-	cm	0
CFG-TMODE-LAT_HP	0x2003000c	I1	1e-9	deg	0
CFG-TMODE-LON_HP	0x2003000d	I1	1e-9	deg	0
CFG-TMODE-HEIGHT_HP	0x2003000e	I1	0.1	mm	0
CFG-TMODE-FIXED_POS_ACC	0x4003000f	U4	0.1	mm	0
CFG-TMODE-SVIN_MIN_DUR	0x40030010	U4	-	s	0
CFG-TMODE-SVIN_ACC_LIMIT	0x40030011	U4	0.1	mm	0

**Table 100: CFG-TMODE configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-TP-PULSE_DEF	0x20050023	E1	-	-	0 (PERIOD)
CFG-TP-PULSE_LENGTH_DEF	0x20050030	E1	-	-	1 (LENGTH)
CFG-TP-ANT_CABLEDELAY	0x30050001	I2	1e-9	s	50
CFG-TP-PERIOD_TP1	0x40050002	U4	1e-6	s	1000000
CFG-TP-PERIOD_LOCK_TP1	0x40050003	U4	1e-6	s	1000000
CFG-TP-FREQ_TP1	0x40050024	U4	-	Hz	1
CFG-TP-FREQ_LOCK_TP1	0x40050025	U4	-	Hz	1
CFG-TP-LEN_TP1	0x40050004	U4	1e-6	s	0
CFG-TP-LEN_LOCK_TP1	0x40050005	U4	1e-6	s	100000
CFG-TP-DUTY_TP1	0x5005002a	R8	-	%	0
CFG-TP-DUTY_LOCK_TP1	0x5005002b	R8	-	%	10
CFG-TP-USER_DELAY_TP1	0x40050006	I4	1e-9	s	0
CFG-TP-TP1_ENA	0x10050007	L	-	-	1 (true)
CFG-TP-SYNC_GNSS_TP1	0x10050008	L	-	-	1 (true)
CFG-TP-USE_LOCKED_TP1	0x10050009	L	-	-	1 (true)
CFG-TP-ALIGN_TO_TOW_TP1	0x1005000a	L	-	-	1 (true)
CFG-TP-POL_TP1	0x1005000b	L	-	-	1 (true)
CFG-TP-TIMEGRID_TP1	0x2005000c	E1	-	-	1 (GPS)
CFG-TP-DRSTR_TP1	0x20050035	E1	-	-	1 (DRIVE_STRENGTH_4MA)

**Table 101: CFG-TP configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-TXREADY-ENABLED	0x10a20001	L	-	-	0 (false)
CFG-TXREADY-POLARITY	0x10a20002	L	-	-	0 (false)
CFG-TXREADY-PIN	0x20a20003	U1	-	-	0
CFG-TXREADY-THRESHOLD	0x30a20004	U2	-	-	0
CFG-TXREADY-INTERFACE	0x20a20005	E1	-	-	0 (I2C)

**Table 102: CFG-TXREADY configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
CFG-UART1-BAUDRATE	0x40520001	U4	-	-	38400
CFG-UART1-STOPBITS	0x20520002	E1	-	-	1 (ONE)

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-UART1-DATABITS</a>	0x20520003	E1	-	-	0 (EIGHT)
<a href="#">CFG-UART1-PARITY</a>	0x20520004	E1	-	-	0 (NONE)
<a href="#">CFG-UART1-ENABLED</a>	0x10520005	L	-	-	1 (true)

**Table 103: CFG-UART1 configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-UART1INPROT-UBX</a>	0x10730001	L	-	-	1 (true)
<a href="#">CFG-UART1INPROT-NMEA</a>	0x10730002	L	-	-	1 (true)

**Table 104: CFG-UART1INPROT configuration defaults**

Configuration item	Key ID	Type	Scale	Unit	Default value
<a href="#">CFG-UART1OUTPROT-UBX</a>	0x10740001	L	-	-	1 (true)
<a href="#">CFG-UART1OUTPROT-NMEA</a>	0x10740002	L	-	-	1 (true)

**Table 105: CFG-UART1OUTPROT configuration defaults**

## Related documents

- [1] NEO-F10T Data sheet, UBX-22022576
- [2] NEO-F10T integration manual, UBX-22018271
- [3] Radio Resource LCS Protocol (RRLP), (3GPP TS 44.031 version 11.0.0 Release 11)
- [4] NMEA 0183 Standard for Interfacing Marine Electronic Devices, Version 4.11, November 2018



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## Revision history

Revision	Date	Status / Comments
R01	21-Mar-2023	TIM 3.01 release For legacy revisions, see UBX-22017941 for TIM3.00
R02	18-Dec-2024	Message versions reviewed and updated

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