



# u-blox ZED-F9K

## Interface Description

### Abstract

The Interface Description describes the UBX (ver. 30.00), NMEA and RTCM protocols and serves as a reference manual for the u-blox ZED-F9K positioning receiver.

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# Preface

## 1 Document Overview

The Interface Description is a reference describing the messages used by the u-blox receiver and is organized by the specific NMEA, UBX, and RTCM messages.

## 2 Firmware and Protocol Versions

The protocol version defines a set of messages that are applicable across various u-blox products. Each firmware used by a u-blox receiver supports a specific protocol version, which is not configurable.

The following sections will explain how to decode the shown information to get the firmware and the protocol version.

### 2.1 How to Determine the Version and the Location of the Firmware

The u-blox receiver contains a firmware in two different locations:

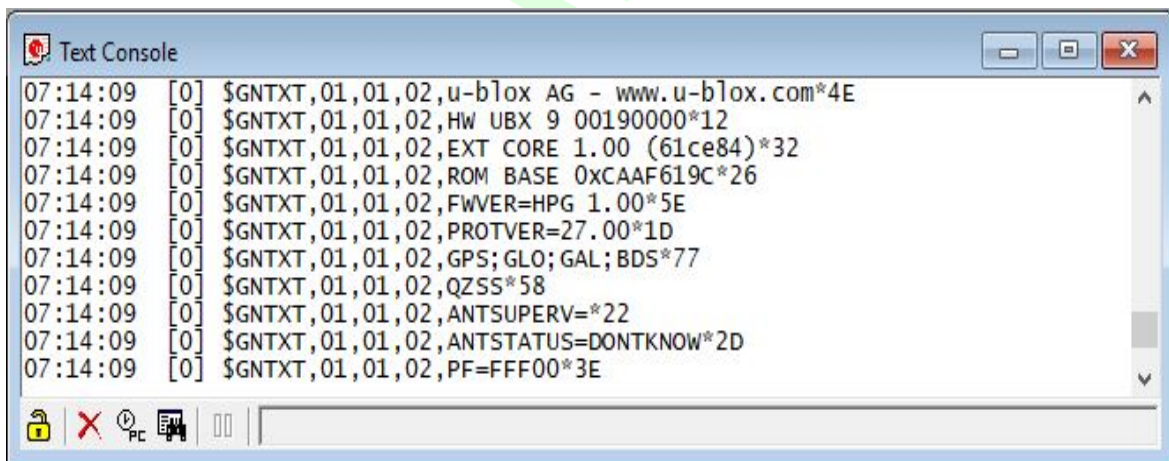
- Internal ROM
- External Flash memory

The location and the version of the currently running firmware can be found in the boot screen or in the UBX-MON-VER message.

#### 2.1.1 Decoding the Boot Screen (for Protocol Version 24 and Above)

Boot screen for a u-blox receiver running from Flash:

Note: F9P example shown for illustrative purposes



#### Possible lines in the boot screen and their meanings:

Entry	Description
u-blox AG - www.u-blox.com	Start of the boot screen
HW UBX 9 00190000	Hardware version of the u-blox receiver (u-blox 9 receiver)
EXT CORE 1.00 (61ce84)	Firmware version 1.00 downloaded from <b>Flash</b> (revision number)
ROM BASE	Underlying firmware version in <b>ROM</b> (revision number)

Possible lines in the boot screen and their meanings: continued

Entry	Description
FWVER=x.y.z	Firmware of product category and version where SPG: Firmware of Standard Precision GNSS product HPG: Firmware of High Precision GNSS product ADR: Firmware of ADR product UDR: Firmware of UDR product TIM: Firmware of Time Sync product FTS: Firmware of Time & Frequency Sync product LAP: Firmware of Lane Accurate product
PROTVER=30.00	Supported protocol version
GPS;GLO;GAL;BDS	Supported major GNSS.
SBAS;IMES;QZSS	Supported augmentation systems.
ANTSUPERV=AC SD PDoS SR	Configuration of the Antenna supervisor where AC: Active Antenna Control enabled SD: Short Circuit Detection enabled OD: Open Circuit Detection enabled PDoS: Short Circuit Power Down Logic enabled SR: Automatic Recovery from Short state
PF=FFF00	Product configuration.



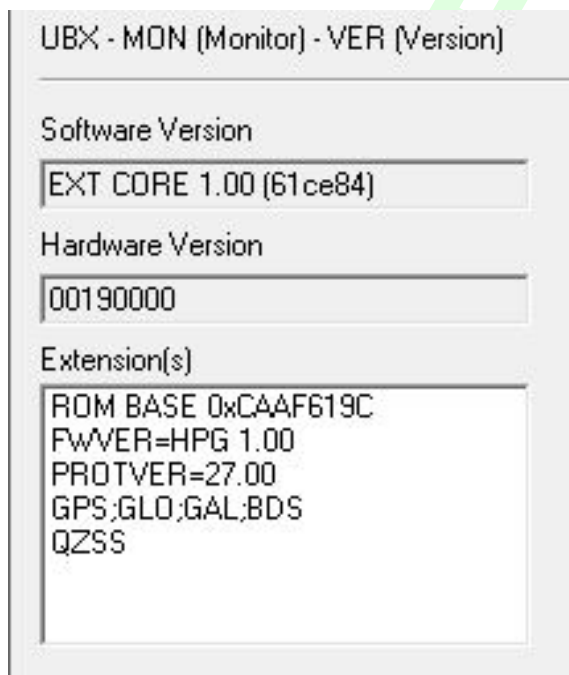
The line containing the FWVER indicates which version of the firmware is currently running and is called **firmware version** in the rest of the document.



The numbers in parentheses (revision numbers) should only be used to identify a known firmware version and are not guaranteed to increase over time.

## 2.1.2 Decoding the output of UBX-MON-VER (for Protocol Version 24 and above)

Note: F9P example shown for illustrative purposes



### Possible fields in UBX-MON-VER and their meanings:

Entry	Description
Software Version EXT CORE 1.00 (61ce84)	Currently running firmware version. If ROM CORE, then the u-blox receiver runs from <b>ROM</b> . If EXT CORE, then the u-blox receiver runs a firmware downloaded from <b>Flash</b> .
Hardware Version	The hardware version of the u-blox receiver.
Extension(s)	Extended information about the u-blox receiver firmware. See table below for the entries.



Not every entry is output by every u-blox receiver in the UBX-MON-VER extensions. This depends on the product, the firmware location and the firmware version.

### Possible entries in UBX-MON-VER Extension(s):

Entry	Description
FWVER=x.y.z	Firmware of product category and version where SPG: Firmware of Standard Precision GNSS product HPG: Firmware of High Precision GNSS product ADR: Firmware of ADR product UDR: Firmware of UDR product TIM: Firmware of Time Sync product FTS: Firmware of Time & Frequency Sync product LAP: Firmware of Lane Accurate product
PROTVER=30.00	Supported protocol version.
MOD=ZED-F9K	Module identification. Set in production.
GPS;GLO;GAL;BDS	Supported major GNSS.
SBAS;IMES;QZSS	Supported augmentation systems.

## 2.2 How to Determine the Supported Protocol Version of the u-blox Receiver

Each u-blox receiver reports its supported protocol version in the following ways:

- On start-up in the [boot screen](#)
- In the [UBX-MON-VER message](#)

with the line containing PROTVER (example: PROTVER=30.00).

Additionally, the firmware string, together with the firmware version, can be used to look up the corresponding protocol version. The tables below give an overview of the released firmware and their corresponding protocol versions.

### 2.2.1 u-blox 9 Firmware and Supported Protocol Versions

#### Firmware for High Precision GNSS Products

Firmware version	Firmware string	Protocol Version
LAP 1.00 (TBD)	EXT CORE 1.00 (TBD)	30.00

## 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 (except UART2). The receiver will change its current configuration immediately after receiving a configuration message. The receiver will always use 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 chapter Forcing a Receiver Reset in the [Integration Manual](#)).

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

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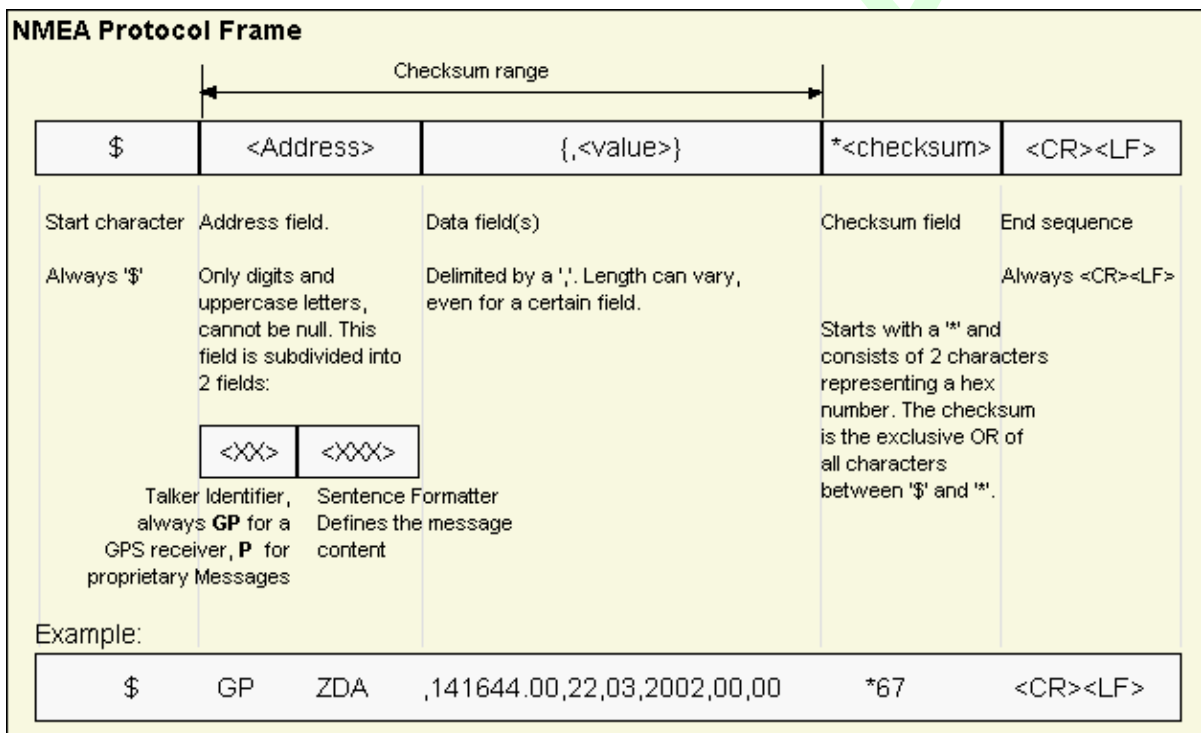
# Interface Description

## 4 NMEA Protocol

### 4.1 Protocol Overview

#### 4.1.1 Message Format

NMEA messages sent by the GNSS receiver are based on NMEA 0183 Version 4.10. The following picture shows the structure of a NMEA protocol message.



For further information on the NMEA Standard, refer to NMEA 0183 Standard For Interfacing Marine Electronic Devices, Version 4.10, June, 2012. See <http://www.nmea.org/> for ordering instructions.

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.

#### 4.1.2 Talker ID

One of the ways the NMEA standard differentiates between 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 device model and system configuration. The table below shows the Talker ID that will be used for various GNSS configurations.

## NMEA Talker IDs

Configured GNSS	Talker ID
GPS, SBAS, QZSS	GP
GLONASS	GL
Galileo	GA
BeiDou	GB
Any combination of GNSS	GN

### 4.1.3 Protocol Configuration

The [NMEA protocol](#) on u-blox receivers can be configured to the needs of customer applications using configuration items [CFG-NMEA-\\*](#).

There are four NMEA standards supported. The default NMEA version is 4.10. Alternatively versions 4.00, 2.3, and 2.1 can be enabled (for details on how this affects the output refer to section [Position Fix Flags in NMEA Mode](#)).

NMEA defines satellite numbering systems for some, but not all GNSS (this is partly dependent on the NMEA version). Satellite numbers for unsupported GNSS can be configured using configuration items [CFG-NMEA-\\*](#). Unknown satellite numbers are always reported as a null NMEA field (i.e. an empty string)

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.

### NMEA filtering flags

Parameter	Description
Position filtering	Enable 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	Enable positions from invalid fixes to be reported (with the "V" status flag to indicate that the data is not valid).
Time filtering	Enable the receiver's best knowledge of time to be output, even though it might be wrong.
Date filtering	Enable the receiver's best knowledge of date to be output, even though it might be wrong.
GPS-only filtering	Restrict output to GPS satellites only.
Track filtering	Permit course over ground (COG) to be reported even when it would otherwise be frozen.

### NMEA flags

Parameter	Description
Compatibility Mode	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.

NMEA flags continued

Parameter	Description
Consideration Mode	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.
Limit82 Mode	Enabling this mode will limit the NMEA sentence length to a maximum of 82 characters.
High Precision Mode	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.

### Extended configuration

Option	Description
GNSS to filter	Filters satellites based on their GNSS
Satellite numbering	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.
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 configuration items <a href="#">CFG-SIGNAL-*</a> ). This field enables the main Talker ID to be overridden.
GSV Talker ID	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	By default the Talker ID for BeiDou is 'GB'. This field enables the BeiDou Talker ID to be overridden.

### Extra fields in NMEA 4.10 and above

Message	Extra fields
<a href="#">GBS</a>	systemId, signalId
<a href="#">GNS</a>	navStatus
<a href="#">GRS</a>	systemId, signalId
<a href="#">GSA</a>	systemId
<a href="#">GSV</a>	signalId
<a href="#">RMC</a>	navStatus

#### 4.1.4 Satellite Numbering

The NMEA protocol (V4.10) 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 can be checked or set using configuration items [CFG-NMEA-\\*](#).

In order to support QZSS within current receivers and prepare for support of other systems (e.g. Galileo) in future receivers, an "extended" SV numbering scheme can be enabled (using



configuration items [CFG-NMEA-\\*](#)). 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 are reported using numbers in the range 193 to 197.

See [Satellite Numbering](#) for a complete list of satellite numbers.



GLONASS satellites can be tracked before they have been identified. In NMEA output, such unknown satellite numbers are always reported as a null field (i.e. an empty string).

#### 4.1.5 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. In other words: If the GPS Receiver reports a Latitude of 4717.112671 North and Longitude of 00833.914843 East, this is

Latitude 47 Degrees, 17.112671 Minutes

Longitude 8 Degrees, 33.914843 Minutes

or

Latitude 47 Degrees, 17 Minutes, 6.76026 Seconds

Longitude 8 Degrees, 33 Minutes, 54.89058 Seconds

or

Latitude 47.28521118 Degrees

Longitude 8.56524738 Degrees

#### 4.1.6 Position Fix Flags

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

##### Flags in NMEA 4.10 and above

NMEA Message Field	GLL, RMC status	GGA quality	GLL, VTG posMode	RMC, GNS posMode
No position fix (at power-up, after losing satellite lock)	V	0	N	N
GNSS fix, but user limits exceeded	V	0	N	N
Dead reckoning fix, but user limits exceeded	V	6	E	E
Dead reckoning fix	A	6	E	E
RTK float	A	5	D	F
RTK fixed	A	4	D	R
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
	See below (1)	See below (2)	See below (3)	See below (3)

(1) Possible values for status: V = Data invalid, A = Data valid

(2) 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

(3) 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

#### Flags in NMEA 2.3 and above

NMEA Message	GLL, RMC	GGA	GSA	GLL, VTG, RMC, GNS posMode
Field	status	quality	navMode	
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
	See below (1)	See below (2)	See below (3)	See below (4)

(1) Possible values for status: V = Data invalid, A = Data valid

(2) 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

(3) Possible values for navMode: 1 = No fix, 2 = 2D fix, 3 = 3D fix

(4) 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

#### Flags in NMEA 2.1 and below

The flags in NMEA 2.1 and below are the same as NMEA 2.3 and above 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.

#### 4.1.7 Multi-GNSS Considerations

Many applications which 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:

##### NMEA output for Multi-GNSS

Change	Description
Main Talker ID	The main Talker ID will be 'GN' (e.g. instead of 'GP' for a GPS receiver)
GSV Talker IDs	The GSV message reports the signal strength of the visible satellites. However, the Talker ID it uses is specific to the GNSS it is reporting information for, so for a multi-GNSS receiver it will not be the same as the main Talker ID. (e.g. other messages will be using the 'GN' Talker ID but the GSV message will use GNSS-specific Talker IDs)
Multiple GSA and GRS Messages	Multiple GSA and GRS messages are output for each fix, one for each GNSS. This may confuse applications which assume they are output only once per position fix (as is the case for a single GNSS receiver).

#### 4.1.8 Output of Invalid/Unknown Data

By default the receiver will not output invalid data. In such cases, it will output empty fields.

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 time valid) is reported as follows:

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

If Time is unknown (e.g. during a cold-start):

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

Note:



An exception from the above default are dead reckoning fixes, which are also output when invalid (user limits exceeded).



Differing from the NMEA standard, u-blox reports valid dead reckoning fixes with user limits met (not exceeded) as valid (A) instead of invalid (V).



Output of invalid data marked with the 'Invalid/Valid' Flags can be enabled using the configuration items [CFG-NMEA-\\*](#).

#### 4.1.9 Messages Overview

When configuring NMEA messages using the configuration items [CFG-NMEA-\\*](#), the Class/Ids shown in the table shall be used.

Page	Mnemonic	Cls/ID	Description
<b>NMEA Standard Messages</b>		<b>Standard Messages</b>	
11	<b>DTM</b>	0xF0 0x0A	Datum Reference
12	<b>GAQ</b>	0xF0 0x45	Poll a standard message (if the current Talker ID is GA)
12	<b>GBQ</b>	0xF0 0x44	Poll a standard message (if the current Talker ID is GB)
13	<b>GBS</b>	0xF0 0x09	GNSS Satellite Fault Detection
14	<b>GGA</b>	0xF0 0x00	Global positioning system fix data
15	<b>GLL</b>	0xF0 0x01	Latitude and longitude, with time of position fix and status
16	<b>GLQ</b>	0xF0 0x43	Poll a standard message (if the current Talker ID is GL)
16	<b>GNQ</b>	0xF0 0x42	Poll a standard message (if the current Talker ID is GN)
17	<b>GNS</b>	0xF0 0x0D	GNSS fix data
18	<b>GPQ</b>	0xF0 0x40	Poll a standard message (if the current Talker ID is GP)
19	<b>GRS</b>	0xF0 0x06	GNSS Range Residuals
20	<b>GSA</b>	0xF0 0x02	GNSS DOP and Active Satellites
21	<b>GST</b>	0xF0 0x07	GNSS Pseudo Range Error Statistics
22	<b>GSV</b>	0xF0 0x03	GNSS Satellites in View
23	<b>RMC</b>	0xF0 0x04	Recommended Minimum data
24	<b>THS</b>	0xF0 0x0E	True Heading and Status
25	<b>TXT</b>	0xF0 0x41	Text Transmission
26	<b>VLW</b>	0xF0 0x0F	Dual ground/water distance
26	<b>VTG</b>	0xF0 0x05	Course over ground and Ground speed
27	<b>ZDA</b>	0xF0 0x08	Time and Date

## 4.2 Standard Messages

Standard Messages: i.e. Messages as defined in the NMEA Standard.

### 4.2.1 DTM

#### 4.2.1.1 Datum Reference

Message	<b>DTM</b>		
Description	<b>Datum Reference</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	This message gives the difference between the current datum and the reference datum. The current datum defaults to WGS84. The reference datum cannot be changed and is always set to WGS84.		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x0A	11	

Message Structure:

```
$xxDTM,datum,subDatum,lat,NS,lon,EW,alt,refDatum*cs<CR><LF>
```

Example:

```
$GPDTM,W84,,0.0,N,0.0,E,0.0,W84*6F
```

```
$GPDTM,999,,0.08,N,0.07,E,-47.7,W84*1C
```

Field No.	Name	Unit	Format	Example	Description
0	xxDTM	-	string	\$GPDTM	DTM Message ID (xx = current Talker ID)
1	datum	-	string	W84	Local datum code: W84 = WGS84, 999 = user defined
2	subDatum	-	string	-	A null field
3	lat	min	numeric	0.08	Offset in Latitude
4	NS	-	character	S	North/South indicator
5	lon	min	numeric	0.07	Offset in Longitude
6	EW	-	character	E	East/West indicator
7	alt	m	numeric	-2.8	Offset in altitude
8	refDatum	-	string	W84	Reference datum code (always W84 = WGS 84)
9	cs	-	hexadecimal	*67	Checksum
10	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.2 GAQ

### 4.2.2.1 Poll a standard message (if the current Talker ID is GA)

Message	<b>GAQ</b>		
Description	<b>Poll a standard message (if the current Talker ID is GA)</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Poll Request		
Comment	Polls a standard NMEA message if the current Talker ID is GA		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x45	4	

Message Structure:

```
$xxGAQ,msgId*cs<CR><LF>
```

Example:

```
$EIGAQ,RMC*2B
```

Field No.	Name	Unit	Format	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	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.3 GBQ

### 4.2.3.1 Poll a standard message (if the current Talker ID is GB)

Message	<b>GBQ</b>		
Description	<b>Poll a standard message (if the current Talker ID is GB)</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Poll Request		
Comment	Polls a standard NMEA message if the current Talker ID is GB		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x44	4	

Message Structure:

```
$xxGBQ,msgId*cs<CR><LF>
```

Example:

```
$EIGBQ,RMC*28
```

Field No.	Name	Unit	Format	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	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.4 GBS

### 4.2.4.1 GNSS Satellite Fault Detection

Message	<b>GBS</b>		
Description	<b>GNSS Satellite Fault Detection</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	<p>This message outputs the results of the Receiver Autonomous Integrity Monitoring Algorithm (RAIM).</p> <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 which 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 can not be determined by the receiver autonomously).</li> <li>The fields <b>prob</b>, <b>bias</b> and <b>stddev</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>		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x09	13	

#### Message Structure:

```
$xxGBS,time,errLat,errLon,errAlt,svid,prob,bias,stddev,systemId,signalId*cs<CR><LF>
```

#### Example:

```
$GPGBS,235503.00,1.6,1.4,3.2,,,,,*40
```

```
$GPGBS,235458.00,1.4,1.3,3.1,03,-21.4,3.8,1,0*5B
```

Field No.	Name	Unit	Format	Example	Description
0	xxGBS	-	string	\$GPGBS	GBS Message ID (xx = current Talker ID)
1	time	-	hhmmss.ss	235503.00	UTC time to which this RAIM sentence belongs, see <a href="#">note on UTC representation</a>
2	errLat	m	numeric	1.6	Expected error in latitude
3	errLon	m	numeric	1.4	Expected error in longitude
4	errAlt	m	numeric	3.2	Expected error in altitude
5	svid	-	numeric	03	Satellite ID of most likely failed satellite
6	prob	-	numeric	-	Probability of missed detection, not supported (empty)
7	bias	m	numeric	-21.4	Estimate on most likely failed satellite (a priori residual)
8	stddev	m	numeric	3.8	Standard deviation of estimated bias
9	systemId	-	numeric	1	NMEA defined GNSS System ID <b>NMEA v4.10 and above only</b>
10	signalId	-	numeric	0	NMEA defined GNSS Signal ID (0 = All signals, see <a href="#">Signal Identifiers table</a> for other values) <b>NMEA v4.10 and above only</b>

GBS continued

Field No.	Name	Unit	Format	Example	Description
11	cs	-	hexadecimal	*5B	Checksum
12	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.5 GGA

### 4.2.5.1 Global positioning system fix data

Message	<b>GGA</b>		
Description	<b>Global positioning system fix data</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	<p><b>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.</b></p> <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>		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x00	17	

Message Structure:

```
$xxGGA,time,lat,NS,long,EW,quality,numSV,HDOP,alt,M,sep,M,diffAge,diffStation*cs<CR><LF>
```

Example:

```
$GPGGA,092725.00,4717.11399,N,00833.91590,E,1,08,1.01,499.6,M,48.0,M,,*5B
```

Field No.	Name	Unit	Format	Example	Description
0	xxGGA	-	string	\$GPGGA	GGA Message ID (xx = current Talker ID)
1	time	-	hhmmss.ss	092725.00	UTC time, see <a href="#">note on UTC representation</a>
2	lat	-	ddmm. mmmm	4717.11399	Latitude (degrees & minutes), see <a href="#">format description</a>
3	NS	-	character	N	North/South indicator
4	long	-	dddmm. mmmm	00833.91590	Longitude (degrees & minutes), see <a href="#">format description</a>
5	EW	-	character	E	East/West indicator
6	quality	-	digit	1	Quality indicator for position fix: 0 = No Fix / Invalid 1 = Standard GPS (2D/3D) 2 = Differential GPS 4 = RTK fixed solution 5 = RTK float solution 6 = Estimated (DR) Fix See also <a href="#">position fix flags description</a> .
7	numSV	-	numeric	08	Number of satellites used (range: 0-12)

GGA continued

Field No.	Name	Unit	Format	Example	Description
8	HDOP	-	numeric	1.01	Horizontal Dilution of Precision
9	alt	m	numeric	499.6	Altitude above mean sea level
10	uAlt	-	character	M	Altitude units: meters (fixed field)
11	sep	m	numeric	48.0	Geoid separation: difference between ellipsoid and mean sea level
12	uSep	-	character	M	Separation units: meters (fixed field)
13	diffAge	s	numeric	-	Age of differential corrections (blank when DGPS is not used)
14	diffStation	-	numeric	-	ID of station providing differential corrections (blank when DGPS is not used)
15	cs	-	hexadecimal	*5B	Checksum
16	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.6 GLL

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

Message	<b>GLL</b>		
Description	<b>Latitude and longitude, with time of position fix and status</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	<b>The output of this message is dependent on the currently selected datum (default: WGS84)</b> -		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x01	10	

Message Structure:

```
$xxGLL,lat,NS,long,EW,time,status,posMode*cs<CR><LF>
```

Example:

```
$GPGLL,4717.11364,N,00833.91565,E,092321.00,A,A*60
```

Field No.	Name	Unit	Format	Example	Description
0	xxGLL	-	string	\$GPGLL	GLL Message ID (xx = current Talker ID)
1	lat	-	ddmm. mmmmmm	4717.11364	Latitude (degrees & minutes), see <a href="#">format description</a>
2	NS	-	character	N	North/South indicator
3	long	-	dddmm. mmmmmm	00833.91565	Longitude (degrees & minutes), see <a href="#">format description</a>
4	EW	-	character	E	East/West indicator
5	time	-	hhmmss.ss	092321.00	UTC time, see <a href="#">note on UTC representation</a>
6	status	-	character	A	V = Data invalid or receiver warning, A = Data valid. See <a href="#">position fix flags description</a> .

GLL continued

Field No.	Name	Unit	Format	Example	Description
7	posMode	-	character	A	Positioning mode, see <a href="#">position fix flags description</a> . NMEA v2.3 and above only
8	cs	-	hexadecimal	*60	Checksum
9	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.7 GLQ

### 4.2.7.1 Poll a standard message (if the current Talker ID is GL)

Message	<b>GLQ</b>				
Description	<b>Poll a standard message (if the current Talker ID is GL)</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Poll Request				
Comment	Polls a standard NMEA message if the current Talker ID is GL				
Message Info	ID for CFG-MSG	Number of fields			
	0xF0 0x43	4			

Message Structure:

```
$xxGLQ,msgId*cs<CR><LF>
```

Example:

```
$EIGLQ,RMC*3A
```

Field No.	Name	Unit	Format	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	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.8 GNQ

### 4.2.8.1 Poll a standard message (if the current Talker ID is GN)

Message	<b>GNQ</b>				
Description	<b>Poll a standard message (if the current Talker ID is GN)</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Poll Request				
Comment	Polls a standard NMEA message if the current Talker ID is GN				
Message Info	ID for CFG-MSG	Number of fields			
	0xF0 0x42	4			

Message Structure:

```
$xxGNQ,msgId*cs<CR><LF>
```

Example:



\$EIGNQ,RMC*3A					
Field No.	Name	Unit	Format	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	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.9 GNS

### 4.2.9.1 GNSS fix data

Message	<b>GNS</b>		
Description	<b>GNSS fix data</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	<b>The output of this message is dependent on the currently selected datum (default: WGS84)</b> 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.).		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x0D	16	

#### Message Structure:

```
$xxGNS,time,lat,NS,long,EW,posMode,numSV,HDOP,alt,altRef,diffAge,diffStation,navStatus*cs<CR><LF>
```

#### Example:

```
$GPGNS,091547.00,5114.50897,N,00012.28663,W,AA,10,0.83,111.1,45.6,,V*71
```

Field No.	Name	Unit	Format	Example	Description
0	xxGNS	-	string	\$GPGNS	GNS Message ID (xx = current Talker ID)
1	time	-	hhmmss.ss	091547.00	UTC time, see <a href="#">note on UTC representation</a>
2	lat	-	ddmm.mmmmm	5114.50897	Latitude (degrees & minutes), see <a href="#">format description</a>
3	NS	-	character	N	North/South indicator
4	long	-	dddmm.mmmmm	00012.28663	Longitude (degrees & minutes), see <a href="#">format description</a>
5	EW	-	character	E	East/West indicator
6	posMode	-	character	AA	Positioning mode, see <a href="#">position fix flags description</a> . First character for GPS, second character for GLONASS
7	numSV	-	numeric	10	Number of satellites used (range: 0-99)
8	HDOP	-	numeric	0.83	Horizontal Dilution of Precision
9	alt	m	numeric	111.1	Altitude above mean sea level
10	sep	m	numeric	45.6	Geoid separation: difference between ellipsoid and mean sea level

GNS continued

Field No.	Name	Unit	Format	Example	Description
11	diffAge	s	numeric	-	Age of differential corrections (blank when DGPS is not used)
12	diffStation	-	numeric	-	ID of station providing differential corrections (blank when DGPS is not used)
13	navStatus	-	character	V	Navigational status indicator (V = Equipment is not providing navigational status information) <b>NMEA v4.10 and above only</b>
14	cs	-	hexadecimal	*71	Checksum
15	<CR><LF>	-	character	-	Carriage return and line feed

#### 4.2.10 GPQ

##### 4.2.10.1 Poll a standard message (if the current Talker ID is GP)

Message	<b>GPQ</b>		
Description	<b>Poll a standard message (if the current Talker ID is GP)</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Poll Request		
Comment	Polls a standard NMEA message if the current Talker ID is GP		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x40	4	

Message Structure:

```
$xxGPQ,msgId*cs<CR><LF>
```

Example:

```
$EIGPQ,RMC*3A
```

Field No.	Name	Unit	Format	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	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.11 GRS

### 4.2.11.1 GNSS Range Residuals

Message	<b>GRS</b>		
Description	<b>GNSS Range Residuals</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	<b>This messages relates to associated <a href="#">GGA</a> and <a href="#">GSA</a> messages.</b> 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>		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x06	19	

#### Message Structure:

```
$xxGRS,time,mode{,residual},systemId,signalId*cs<CR><LF>
```

#### Example:

```
$GPGRS,082632.00,1,0.54,0.83,1.00,1.02,-2.12,2.64,-0.71,-1.18,0.25,,,1,0*70
```

Field No.	Name	Unit	Format	Example	Description
0	xxGRS	-	string	\$GPGRS	GRS Message ID (xx = current Talker ID)
1	time	-	hhmmss.ss	082632.00	UTC time of associated position fix, see <a href="#">note on UTC representation</a>
2	mode	-	digit	1	Mode (u-blox receivers will always output Mode 1 residuals): 0 = Residuals were used to calculate the position given in the matching <a href="#">GGA</a> sentence. 1 = Residuals were recomputed after the <a href="#">GGA</a> position was computed.
Start of repeated block (12 times)					
3 + 1*N	residual	m	numeric	0.54	Range residuals for SVs used in navigation. The SV order matches the order from the <a href="#">GSA</a> sentence.
End of repeated block					
15	systemId	-	numeric	1	NMEA defined GNSS System ID <b>NMEA v4.10 and above only</b>
16	signalId	-	numeric	0	NMEA defined GNSS Signal ID (0 = All signals, see <a href="#">Signal Identifiers table</a> for other values) <b>NMEA v4.10 and above only</b>
17	cs	-	hexadecimal	*70	Checksum
18	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.12 GSA

### 4.2.12.1 GNSS DOP and Active Satellites

Message	<b>GSA</b>		
Description	<b>GNSS DOP and Active Satellites</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	<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 'sv') 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>		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x02	21	

#### Message Structure:

```
$xxGSA,opMode,navMode{,sv},PDOP,HDOP,VDOP,systemId*cs<CR><LF>
```

#### Example:

```
$GPGSA,A,3,23,29,07,08,09,18,26,28,,,,,1.94,1.18,1.54,1*0D
```

Field No.	Name	Unit	Format	Example	Description
0	xxGSA	-	string	\$GPGSA	GSA Message ID (xx = current Talker ID)
1	opMode	-	character	A	Operation mode: M = Manually set to operate in 2D or 3D mode A = Automatically switching between 2D or 3D mode
2	navMode	-	digit	3	Navigation mode (see also <a href="#">position fix flags description</a> ): 1 = Fix not available 2 = 2D Fix 3 = 3D Fix
Start of repeated block (12 times)					
3 + 1*N	sv	-	numeric	29	Satellite number
End of repeated block					
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	-	numeric	1	NMEA defined GNSS System ID <b>NMEA v4.10 and above only</b>
19	cs	-	hexadecimal	*0D	Checksum

GSA continued

Field No.	Name	Unit	Format	Example	Description
20	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.13 GST

### 4.2.13.1 GNSS Pseudo Range Error Statistics

Message	<b>GST</b>				
Description	<b>GNSS Pseudo Range Error Statistics</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Output				
Comment	This message reports statistical information on the quality of the position solution.				
Message Info	ID for CFG-MSG	Number of fields			
	0xF0 0x07	11			

#### Message Structure:

```
$xxGST,time,rangeRms,stdMajor,stdMinor,orient,stdLat,stdLong,stdAlt*cs<CR><LF>
```

#### Example:

```
$GPGST,082356.00,1.8,,,,,1.7,1.3,2.2*7E
```

Field No.	Name	Unit	Format	Example	Description
0	xxGST	-	string	\$GPGST	GST Message ID (xx = current Talker ID)
1	time	-	hhmmss.ss	082356.00	UTC time of associated position fix, see <a href="#">note on UTC representation</a>
2	rangeRms	m	numeric	1.8	RMS value of the standard deviation of the ranges
3	stdMajor	m	numeric	-	Standard deviation of semi-major axis (only supported in ADR 4.10 and above)
4	stdMinor	m	numeric	-	Standard deviation of semi-minor axis (only supported in ADR 4.10 and above)
5	orient	deg	numeric	-	Orientation of semi-major axis (only supported in ADR 4.10 and above)
6	stdLat	m	numeric	1.7	Standard deviation of latitude error
7	stdLong	m	numeric	1.3	Standard deviation of longitude error
8	stdAlt	m	numeric	2.2	Standard deviation of altitude error
9	cs	-	hexadecimal	*7E	Checksum
10	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.14 GSV

### 4.2.14.1 GNSS Satellites in View

Message	<b>GSV</b>		
Description	<b>GNSS Satellites in View</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	The number of satellites in view, together with each SV ID, elevation azimuth, and signal strength (C/No) value. Only four satellite details are transmitted in one message. <b>In a multi-GNSS system sets of GSV messages will be output multiple times, one set for each GNSS.</b>		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x03	8..16	

#### Message Structure:

```
$xxGSV,numMsg,msgNum,numSV,{,sv,elv,az,cno},signalId*cs<CR><LF>
```

#### Example:

```
$GPGSV,3,1,10,23,38,230,44,29,71,156,47,07,29,116,41,08,09,081,36,0*7F
```

```
$GPGSV,3,2,10,10,07,189,,05,05,220,,09,34,274,42,18,25,309,44,0*72
```

```
$GPGSV,3,3,10,26,82,187,47,28,43,056,46,0*77
```

Field No.	Name	Unit	Format	Example	Description
0	xxGSV	-	string	\$GPGSV	GSV Message ID (xx = GSV Talker ID)
1	numMsg	-	digit	3	Number of messages, total number of GSV messages being output
2	msgNum	-	digit	1	Number of this message
3	numSV	-	numeric	10	Number of satellites in view
Start of repeated block (1..4 times)					
4 + 4*N	sv	-	numeric	23	Satellite ID
5 + 4*N	elv	deg	numeric	38	Elevation (range 0-90)
6 + 4*N	az	deg	numeric	230	Azimuth, (range 0-359)
7 + 4*N	cno	dB Hz	numeric	44	Signal strength (C/N0, range 0-99), blank when not tracking
End of repeated block					
5.. 16	signalId	-	numeric	0	NMEA defined GNSS Signal ID (0 = All signals, see <a href="#">Signal Identifiers table</a> for other values) <b>NMEA v4.10 and above only</b>
6.. 16	cs	-	hexadecimal	*7F	Checksum
7.. 16	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.15 RMC

### 4.2.15.1 Recommended Minimum data

Message	<b>RMC</b>		
Description	<b>Recommended Minimum data</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	<b>The output of this message is dependent on the currently selected datum (default: WGS84)</b> The recommended minimum sentence defined by NMEA for GNSS system data.		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x04	16	

#### Message Structure:

```
$xxRMC,time,status,lat,NS,long,EW,spd,cog,date,mv,mvEW,posMode,navStatus*cs<CR><LF>
```

#### Example:

```
$GPRMC,083559.00,A,4717.11437,N,00833.91522,E,0.004,77.52,091202,,,A,V*57
```

Field No.	Name	Unit	Format	Example	Description
0	xxRMC	-	string	\$GPRMC	RMC Message ID (xx = current Talker ID)
1	time	-	hhmmss.ss	083559.00	UTC time, see <a href="#">note on UTC representation</a>
2	status	-	character	A	Status, V = Navigation receiver warning, A = Data valid, see <a href="#">position fix flags description</a>
3	lat	-	ddmm. mmmm	4717.11437	Latitude (degrees & minutes), see <a href="#">format description</a>
4	NS	-	character	N	North/South indicator
5	long	-	dddmm. mmmm	00833.91522	Longitude (degrees & minutes), see <a href="#">format description</a>
6	EW	-	character	E	East/West indicator
7	spd	knots	numeric	0.004	Speed over ground
8	cog	degrees	numeric	77.52	Course over ground
9	date	-	ddmmyy	091202	Date in day, month, year format, see <a href="#">note on UTC representation</a>
10	mv	degrees	numeric	-	Magnetic variation value. Only supported in ADR 4.10 and above.
11	mvEW	-	character	-	Magnetic variation E/W indicator. Only supported in ADR 4.10 and above.
12	posMode	-	character	A	Mode Indicator, see <a href="#">position fix flags description</a> <b>NMEA v2.3 and above only</b>

RMC continued

Field No.	Name	Unit	Format	Example	Description
13	navStatus	-	character	V	Navigational status indicator (V = Equipment is not providing navigational status information) <b>NMEA v4.10 and above only</b>
14	cs	-	hexadecimal	*57	Checksum
15	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.16 THS

### 4.2.16.1 True Heading and Status

Message	<b>THS</b>		
Description	<b>True Heading and Status</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)		
Type	Output		
Comment	Actual vehicle heading in degrees produced by any device or system producing true heading. This sentence includes a Mode indicator field providing critical safety related information about the heading data, and replaces the HDT sentence.		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x0E	5	

Message Structure:

```
$xxTHS,headt,mi*cs<CR><LF>
```

Example:

```
$GPTHs,77.52,E*32
```

Field No.	Name	Unit	Format	Example	Description
0	xxTHS	-	string	\$GPTHs	THS Message ID (xx = current Talker ID)
1	headt	degrees	numeric	77.52	Heading of vehicle (true)
2	mi	-	character	E	Mode indicator: A = autonomous, E = Estimated (dead reckoning), M = Manual input, S = Simulator, V = Data not valid
3	cs	-	hexadecimal	*32	Checksum
4	<CR><LF>	-	character	-	Carriage return and line feed



## 4.2.17 TXT

### 4.2.17.1 Text Transmission

Message	<b>TXT</b>		
Description	<b>Text Transmission</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	This message outputs various information on the receiver, such as power-up screen, software version etc. This message can be configured using UBX configuration interface <a href="#">CFG-INFMSG</a> .		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x41	7	

#### Message Structure:

```
$xxTXT,numMsg,msgNum,msgType,text*cs<CR><LF>
```

#### Example:

```
$GPTXT,01,01,02,u-blox ag - www.u-blox.com*50
```

```
$GPTXT,01,01,02,ANTARIS ATR0620 HW 00000040*67
```

Field No.	Name	Unit	Format	Example	Description
0	xxTXT	-	string	\$GPTXT	TXT Message ID (xx = current Talker ID)
1	numMsg	-	numeric	01	Total number of messages in this transmission, 01..99
2	msgNum	-	numeric	01	Message number in this transmission, range 01..xx
3	msgType	-	numeric	02	Text identifier, u-blox receivers specify the type of the message with this number. 00: Error 01: Warning 02: Notice 07: User
4	text	-	string	www.u-blox.com	Any ASCII text
5	cs	-	hexadecimal	*67	Checksum
6	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.18 VLW

### 4.2.18.1 Dual ground/water distance

Message	<b>VLW</b>		
Description	<b>Dual ground/water distance</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	The distance traveled, relative to the water and over the ground. This message relates to the <a href="#">Odometer</a> functionality.		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x0F	11	

#### Message Structure:

```
$xxVLW,twd,twdUnit,wd,wdUnit,tgd,tgdUnit,gd,gdUnit*cs<CR><LF>
```

#### Example:

```
$GPVLW,,N,,N,15.8,N,1.2,N*06
```

Field No.	Name	Unit	Format	Example	Description
0	xxVLW	-	string	\$GPVLW	VLW Message ID (xx = current Talker ID)
1	twd	nm	numeric	-	Total cumulative water distance, not output
2	twdUnit	-	character	N	Fixed field: nautical miles
3	wd	nm	numeric	-	Water distance since reset, not output
4	wdUnit	-	character	N	Fixed field: nautical miles
5	tgd	nm	numeric	15.8	Total cumulative ground distance
6	tgdUnit	-	character	N	Fixed field: nautical miles
7	gd	nm	numeric	1.2	Ground distance since reset
8	gdUnit	-	character	N	Fixed field: nautical miles
9	cs	-	hexadecimal	*06	Checksum
10	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.19 VTG

### 4.2.19.1 Course over ground and Ground speed

Message	<b>VTG</b>		
Description	<b>Course over ground and Ground speed</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	Velocity is given as Course over Ground (COG) and Speed over Ground (SOG).		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x05	12	

#### Message Structure:

```
$xxVTG,cogt,T,cogm,M,knots,N,kph,K,posMode*cs<CR><LF>
```

#### Example:

```
$GPVTG,77.52,T,,M,0.004,N,0.008,K,A*06
```

VTG continued

Field No.	Name	Unit	Format	Example	Description
0	xxVTG	-	string	\$GPVTG	VTG Message ID (xx = current Talker ID)
1	cogt	degrees	numeric	77.52	Course over ground (true)
2	T	-	character	T	Fixed field: true
3	cogm	degrees	numeric	-	Course over ground (magnetic). Only supported in ADR 4.10 and above.
4	M	-	character	M	Fixed field: magnetic
5	knots	knots	numeric	0.004	Speed over ground
6	N	-	character	N	Fixed field: knots
7	kph	km/h	numeric	0.008	Speed over ground
8	K	-	character	K	Fixed field: kilometers per hour
9	posMode	-	character	A	Mode Indicator, see <a href="#">position fix flags description</a> <b>NMEA v2.3 and above only</b>
10	cs	-	hexadecimal	*06	Checksum
11	<CR><LF>	-	character	-	Carriage return and line feed

## 4.2.20 ZDA

### 4.2.20.1 Time and Date

Message	<b>ZDA</b>		
Description	<b>Time and Date</b>		
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>		
Type	Output		
Comment	-		
Message Info	ID for CFG-MSG	Number of fields	
	0xF0 0x08	9	

#### Message Structure:

```
$xxZDA,hhmmss.ss,day,month,year,ltzh,ltzn*cs<CR><LF>
```

#### Example:

```
$GPZDA,082710.00,16,09,2002,00,00*64
```

Field No.	Name	Unit	Format	Example	Description
0	xxZDA	-	string	\$GPZDA	ZDA Message ID (xx = current Talker ID)
1	time	-	hhmmss.ss	082710.00	UTC Time, see <a href="#">note on UTC representation</a>
2	day	day	dd	16	UTC day (range: 1-31)

ZDA continued

Field No.	Name	Unit	Format	Example	Description
3	month	month	mm	09	UTC month (range: 1-12)
4	year	year	yyyy	2002	UTC year
5	ltzh	-	xx	00	Local time zone hours (fixed to 00)
6	ltzn	-	zz	00	Local time zone minutes (fixed to 00)
7	cs	-	hexadecimal	*64	Checksum
8	<CR><LF>	-	character	-	Carriage return and line feed

## 5 UBX Protocol

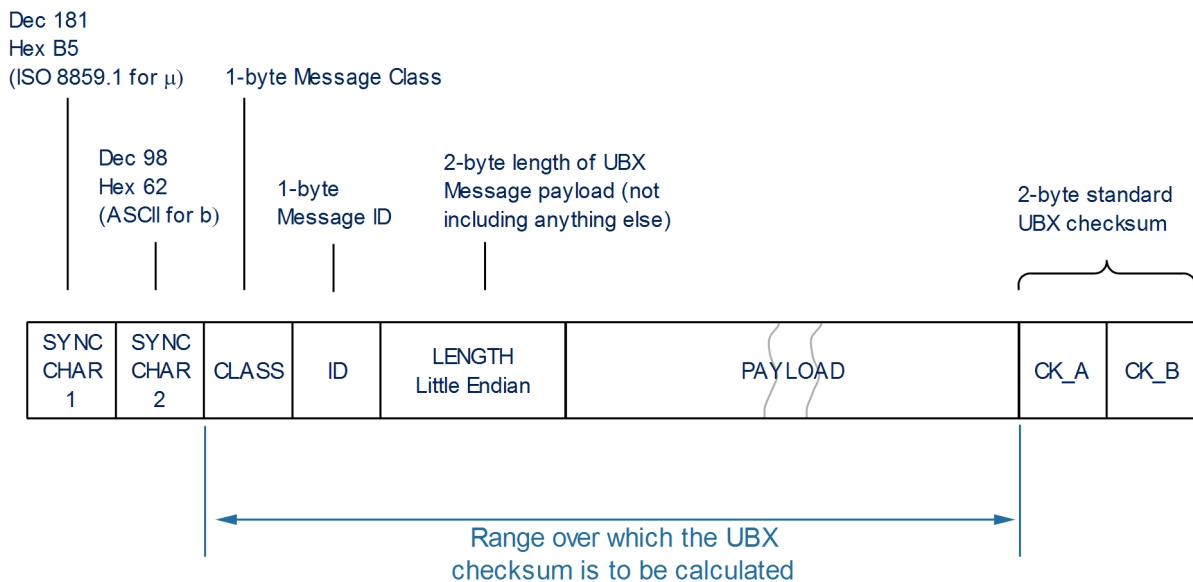
### 5.1 UBX Protocol Key Features

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 2-stage message identifier (Class and Message ID)

### 5.2 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 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 CRC fields. The number format of the length field is a Little-Endian unsigned 16-bit integer.
- The **Payload** field contains a variable number of bytes.
- The two 1-byte **CK\_A** and **CK\_B** fields hold a 16-bit checksum whose calculation is defined below. This concludes the Frame.

### 5.3 UBX Payload Definition Rules

### 5.3.1 Structure Packing

Values are placed in an order that structure packing is not a problem. This means that 2-byte values shall start on offsets which are a multiple of 2; 4-byte values shall start at a multiple of 4; and so on.

### 5.3.2 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 input message, reserved elements can either be explicitly set to zero or left with whatever value they were output with.

### 5.3.3 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 [Satellite Numbering](#) 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.

### 5.3.4 Message Naming

Referring to messages is done by adding the class name and a dash in front of the message name. For example, the version information message is referred to as UBX-MON-VER. Referring to message fields or their values is done by adding a dot and the name, e.g. UBX-MON-VER.swVersion.

### 5.3.5 Number Formats

All multi-byte values are ordered in Little Endian format, unless otherwise indicated.

All floating point values are transmitted in IEEE754 single or double precision.

#### Variable Type Definitions

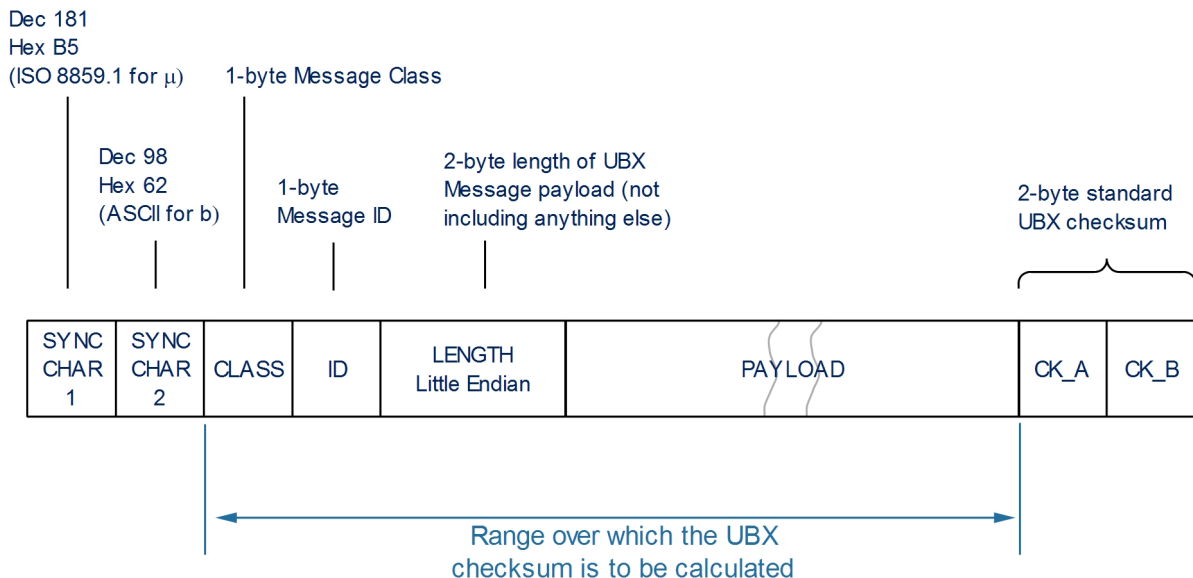
Short	Type	Size (Bytes)	Comment	Min/Max	Resolution
U1	Unsigned Char	1		0..255	1
RU1_3	Unsigned Char	1	binary floating point with 3 bit exponent, eeeb bbbb, (Value & 0x1F) << (Value >> 5)	0..(31*2^7) non-continuous	~ 2^(Value >> 5)
I1	Signed Char	1	2's complement	-128 .. 127	1
X1	Bitfield	1		n/a	n/a
U2	Unsigned Short	2		0 .. 65535	1
I2	Signed Short	2	2's complement	-32768 .. 32767	1
X2	Bitfield	2		n/a	n/a
U4	Unsigned Long	4		0 .. 4'294'967'295	1
I4	Signed Long	4	2's complement	-2'147'483'648 .. 2'147'483'647	1

Variable Type Definitions continued

Short	Type	Size (Bytes)	Comment	Min/Max	Resolution
X4	Bitfield	4		n/a	n/a
R4	IEEE 754 Single Precision	4		$-1 \cdot 2^{+127} \dots 2^{+127}$	$\sim \text{Value} \cdot 2^{-24}$
R8	IEEE 754 Double Precision	8		$-1 \cdot 2^{+1023} \dots 2^{+1023}$	$\sim \text{Value} \cdot 2^{-53}$
CH	ASCII / ISO 8859.1 Encoding	1			

## 5.4 UBX Checksum

The checksum is calculated over the Message, starting and including the CLASS field, up until, but excluding, the Checksum Field:



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] contains the data over which the checksum is to be calculated.
- The two CK\_ 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 0xFF after both operations in the loop.

```

CK_A = 0, CK_B = 0
For (I=0; I<N; I++)
{
    CK_A = CK_A + Buffer[I]
    CK_B = CK_B + CK_A
}

```

- After the loop, the two U1 values contain the checksum, transmitted after the Message, which conclude the Frame.

## 5.5 UBX Message Flow

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

### 5.5.1 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 (e.g. LOG) also use the same acknowledgement mechanism.

### 5.5.2 Polling Mechanism

All messages that are output by the receiver in a periodic manner (i.e. messages in classes MON, NAV and RXM) and Get/Set type messages, such as the messages in the CFG class, can also be polled.

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.

## 5.6 UBX Class IDs

A class is a grouping of messages which are related to each other. The following table lists all the current message classes.

Name	Class	Description
<a href="#">NAV</a>	<a href="#">0x01</a>	Navigation Results Messages: Position, Speed, Time, Acceleration, Heading, DOP, SVs used
<a href="#">RXM</a>	<a href="#">0x02</a>	Receiver Manager Messages: Satellite Status, RTC Status
<a href="#">INF</a>	<a href="#">0x04</a>	Information Messages: Printf-Style Messages, with IDs such as Error, Warning, Notice
<a href="#">ACK</a>	<a href="#">0x05</a>	Ack/Nak Messages: Acknowledge or Reject messages to UBX-CFG input messages
<a href="#">CFG</a>	<a href="#">0x06</a>	Configuration Input Messages: Configure the receiver.
<a href="#">UPD</a>	<a href="#">0x09</a>	Firmware Update Messages: Memory/Flash erase/write, Reboot, Flash identification, etc.
<a href="#">MON</a>	<a href="#">0x0A</a>	Monitoring Messages: Communication Status, CPU Load, Stack Usage, Task Status
<a href="#">TIM</a>	<a href="#">0x0D</a>	Timing Messages: Time Pulse Output, Time Mark Results
<a href="#">ESF</a>	<a href="#">0x10</a>	External Sensor Fusion Messages: External Sensor Measurements and Status Information
<a href="#">MGA</a>	<a href="#">0x13</a>	Multiple GNSS Assistance Messages: Assistance data for various GNSS
<a href="#">LOG</a>	<a href="#">0x21</a>	Logging Messages: Log creation, deletion, info and retrieval
<a href="#">SEC</a>	<a href="#">0x27</a>	Security Feature Messages
<a href="#">HNR</a>	<a href="#">0x28</a>	High Rate Navigation Results Messages: High rate time, position, speed, heading

**All remaining class IDs are reserved.**



## 5.7 UBX Messages Overview

Page	Mnemonic	Cls/ID	Length	Type	Description
<b>UBX Class ACK</b>			<b>Ack/Nak Messages</b>		
38	<b>ACK-ACK</b>	0x05 0x01	2	Output	Message Acknowledged
38	<b>ACK-NAK</b>	0x05 0x00	2	Output	Message Not-Acknowledged
<b>UBX Class CFG</b>			<b>Configuration Input Messages</b>		
39	<b>CFG-OTP</b>	0x06 0x41	0	Poll Request	Poll OTP content
39	<b>CFG-OTP</b>	0x06 0x41	128	Get	OTP content
40	<b>CFG-OTP</b>	0x06 0x41	0 + 1*N	Set	Writes OTP content
40	<b>CFG-PIO</b>	0x06 0x2c	19	Set	Set PIO pins
41	<b>CFG-PT2</b>	0x06 0x59	12 + 4*N	Set	Production test configuration
42	<b>CFG-RST</b>	0x06 0x04	4	Command	Reset Receiver / Clear Backup Data...
44	<b>CFG-SPT</b>	0x06 0x64	12	Get/Set	Configure and start a sensor...
44	<b>CFG-USBTEST</b>	0x06 0x58	2	Set	USB Testing
45	<b>CFG-VALDEL</b>	0x06 0x8C	4 + 4*N	Set	Deletes values corresponding to...
46	<b>CFG-VALDEL</b>	0x06 0x8C	4 + 4*N	Set	Deletes values corresponding to...
48	<b>CFG-VALGET</b>	0x06 0x8B	4 + 4*N	Poll Request	Get Configuration Items
49	<b>CFG-VALGET</b>	0x06 0x8B	4 + 1*N	Polled	Configuration Items
49	<b>CFG-VALSET</b>	0x06 0x8A	4 + 1*N	Set	Sets values corresponding to provided...
51	<b>CFG-VALSET</b>	0x06 0x8A	4 + 1*N	Set	Sets values corresponding to provided...
<b>UBX Class ESF</b>			<b>External Sensor Fusion Messages</b>		
53	<b>ESF-ALG</b>	0x10 0x14	16	Periodic/Polled	IMU alignment information
54	<b>ESF-INS</b>	0x10 0x15	36	Periodic/Polled	Vehicle dynamics information
55	<b>ESF-MEAS</b>	0x10 0x02	(8 + 4*numM...	Input/Output	External Sensor Fusion Measurements
57	<b>ESF-RAW</b>	0x10 0x03	4 + 8*N	Output	Raw sensor measurements
58	<b>ESF-RESETALG</b>	0x10 0x13	0	Command	Reset automatic IMU-mount alignment
58	<b>ESF-STATUS</b>	0x10 0x10	16 + 4*numS...	Periodic/Polled	External Sensor Fusion (ESF) status...
<b>UBX Class HNR</b>			<b>High Rate Navigation Results Messages</b>		
62	<b>HNR-INS</b>	0x28 0x02	36	Periodic/Polled	Vehicle dynamics information
63	<b>HNR-PVT</b>	0x28 0x00	72	Periodic/Polled	High Rate Output of PVT Solution
<b>UBX Class INF</b>			<b>Information Messages</b>		
66	<b>INF-DEBUG</b>	0x04 0x04	0 + 1*N	Output	ASCII output with debug contents
66	<b>INF-ERROR</b>	0x04 0x00	0 + 1*N	Output	ASCII output with error contents
67	<b>INF-NOTICE</b>	0x04 0x02	0 + 1*N	Output	ASCII output with informational contents
67	<b>INF-TEST</b>	0x04 0x03	0 + 1*N	Output	ASCII output with test contents
68	<b>INF-WARNING</b>	0x04 0x01	0 + 1*N	Output	ASCII output with warning contents
<b>UBX Class LOG</b>			<b>Logging Messages</b>		
69	<b>LOG-CREATE</b>	0x21 0x07	8	Command	Create Log File
70	<b>LOG-ERASE</b>	0x21 0x03	0	Command	Erase Logged Data

## UBX Messages Overview continued

Page	Mnemonic	Cls/ID	Length	Type	Description
70	<b>LOG-FINDTIME</b>	0x21 0x0E	12	Input	Find index of a log entry based on a...
71	<b>LOG-FINDTIME</b>	0x21 0x0E	8	Output	Response to FINDTIME request
72	<b>LOG-INFO</b>	0x21 0x08	0	Poll Request	Poll for log information
72	<b>LOG-INFO</b>	0x21 0x08	48	Output	Log information
74	<b>LOG-RETRIEVEPO...</b>	0x21 0x0f	32	Output	Odometer log entry
74	<b>LOG-RETRIEVEPOS</b>	0x21 0x0b	40	Output	Position fix log entry
75	<b>LOG-RETRIEVEST...</b>	0x21 0x0d	16 + 1*byteCo..	Output	Byte string log entry
76	<b>LOG-RETRIEVE</b>	0x21 0x09	12	Command	Request log data
77	<b>LOG-STRING</b>	0x21 0x04	0 + 1*N	Command	Store arbitrary string in on-board flash
<b>UBX Class MGA</b>				<b>Multiple GNSS Assistance Messages</b>	
78	<b>MGA-ACK-DATA0</b>	0x13 0x60	8	Output	Multiple GNSS Acknowledge message
79	<b>MGA-BDS-EPH</b>	0x13 0x03	88	Input	BDS Ephemeris Assistance
80	<b>MGA-BDS-ALM</b>	0x13 0x03	40	Input	BDS Almanac Assistance
81	<b>MGA-BDS-HEALTH</b>	0x13 0x03	68	Input	BDS Health Assistance
82	<b>MGA-BDS-UTC</b>	0x13 0x03	20	Input	BDS UTC Assistance
82	<b>MGA-BDS-IONO</b>	0x13 0x03	16	Input	BDS Ionospheric Assistance
83	<b>MGA-DBD</b>	0x13 0x80	0	Poll Request	Poll the Navigation Database
83	<b>MGA-DBD</b>	0x13 0x80	12 + 1*N	Input/Output	Navigation Database Dump Entry
84	<b>MGA-GAL-EPH</b>	0x13 0x02	76	Input	Galileo Ephemeris Assistance
86	<b>MGA-GAL-ALM</b>	0x13 0x02	32	Input	Galileo Almanac Assistance
87	<b>MGA-GAL-TIMEO...</b>	0x13 0x02	12	Input	Galileo GPS time offset assistance
87	<b>MGA-GAL-UTC</b>	0x13 0x02	20	Input	Galileo UTC Assistance
88	<b>MGA-GLO-EPH</b>	0x13 0x06	48	Input	GLONASS Ephemeris Assistance
89	<b>MGA-GLO-ALM</b>	0x13 0x06	36	Input	GLONASS Almanac Assistance
90	<b>MGA-GLO-TIMEO...</b>	0x13 0x06	20	Input	GLONASS Auxiliary Time Offset...
91	<b>MGA-GPS-EPH</b>	0x13 0x00	68	Input	GPS Ephemeris Assistance
92	<b>MGA-GPS-ALM</b>	0x13 0x00	36	Input	GPS Almanac Assistance
93	<b>MGA-GPS-HEALTH</b>	0x13 0x00	40	Input	GPS Health Assistance
94	<b>MGA-GPS-UTC</b>	0x13 0x00	20	Input	GPS UTC Assistance
94	<b>MGA-GPS-IONO</b>	0x13 0x00	16	Input	GPS Ionosphere Assistance
95	<b>MGA-INI-POS_XYZ</b>	0x13 0x40	20	Input	Initial Position Assistance
96	<b>MGA-INI-POS_LLH</b>	0x13 0x40	20	Input	Initial Position Assistance
97	<b>MGA-INI-TIME_UTC</b>	0x13 0x40	24	Input	Initial Time Assistance
98	<b>MGA-INI-TIME_GN...</b>	0x13 0x40	24	Input	Initial Time Assistance
99	<b>MGA-INI-CLKD</b>	0x13 0x40	12	Input	Initial Clock Drift Assistance
100	<b>MGA-INI-FREQ</b>	0x13 0x40	12	Input	Initial Frequency Assistance
101	<b>MGA-INI-EOP</b>	0x13 0x40	72	Input	Earth Orientation Parameters Assistance
101	<b>MGA-QZSS-EPH</b>	0x13 0x05	68	Input	QZSS Ephemeris Assistance

## UBX Messages Overview continued

Page	Mnemonic	Cls/ID	Length	Type	Description
103	<b>MGA-QZSS-ALM</b>	0x13 0x05	36	Input	QZSS Almanac Assistance
104	<b>MGA-QZSS-HEAL...</b>	0x13 0x05	12	Input	QZSS Health Assistance
<b>UBX Class MON</b>				<b>Monitoring Messages</b>	
105	<b>MON-COMMS</b>	0x0A 0x36	8 + 40*nPorts	Periodic/Polled	Comm port information
106	<b>MON-GNSS</b>	0x0A 0x28	8	Polled	Information message major GNSS...
108	<b>MON-HW2</b>	0x0A 0x0B	28	Periodic/Polled	Extended Hardware Status
109	<b>MON-HW3</b>	0x0A 0x37	22 + 6*nPins	Periodic/Polled	HW I/O pin information
111	<b>MON-HW</b>	0x0A 0x09	60	Periodic/Polled	Hardware Status
112	<b>MON-IO</b>	0x0A 0x02	0 + 20*N	Periodic/Polled	I/O Subsystem Status
113	<b>MON-MSGPP</b>	0x0A 0x06	120	Periodic/Polled	Message Parse and Process Status
113	<b>MON-PATCH</b>	0x0A 0x27	4 + 16*nEntries	Polled	Output information about installed...
114	<b>MON-PIO</b>	0x0A 0x24	19	Polled	Production testing message for PIO pins
115	<b>MON-PT2</b>	0x0A 0x2B	24 + 28*num...	Periodic/Polled	Multi-GNSS Production Test Monitor...
117	<b>MON-RF</b>	0x0A 0x38	4 + 24*nBlocks	Periodic/Polled	RF information
118	<b>MON-RXBUF</b>	0x0A 0x07	24	Periodic/Polled	Receiver Buffer Status
119	<b>MON-RXR</b>	0x0A 0x21	1	Output	Receiver Status Information
120	<b>MON-SPT</b>	0x0A 0x2F	4 + 12*numR...	Polled	Sensor Production Test Message
123	<b>MON-TEMP</b>	0x0A 0x0E	0	Poll Request	Poll Temperature value [C] and...
123	<b>MON-TEMP</b>	0x0A 0x0E	12	Periodic/Polled	Temperature value [C] and...
124	<b>MON-TXBUF</b>	0x0A 0x08	28	Periodic/Polled	Transmitter Buffer Status
125	<b>MON-VER</b>	0x0A 0x04	40 + 30*N	Polled	Receiver/Software Version
<b>UBX Class NAV</b>				<b>Navigation Results Messages</b>	
126	<b>NAV-ATT</b>	0x01 0x05	32	Periodic/Polled	Attitude Solution
127	<b>NAV-CLOCK</b>	0x01 0x22	20	Periodic/Polled	Clock Solution
127	<b>NAV-COV</b>	0x01 0x36	64	Periodic/Polled	Covariance matrices
128	<b>NAV-DGPS</b>	0x01 0x31	16 + 12*numCh	Periodic/Polled	DGPS Data Used for NAV
129	<b>NAV-DOP</b>	0x01 0x04	18	Periodic/Polled	Dilution of precision
130	<b>NAV-EELL</b>	0x01 0x3d	16	Periodic/Polled	Position Error Ellipse Parameters
131	<b>NAV-EOE</b>	0x01 0x61	4	Periodic	End Of Epoch
131	<b>NAV-HPPOSECEF</b>	0x01 0x13	28	Periodic/Polled	High Precision Position Solution in ECEF
132	<b>NAV-HPPOSLLH</b>	0x01 0x14	36	Periodic/Polled	High Precision Geodetic Position Solution
133	<b>NAV-ODO</b>	0x01 0x09	20	Periodic/Polled	Odometer Solution
134	<b>NAV-ORB</b>	0x01 0x34	8 + 6*numSv	Periodic/Polled	GNSS Orbit Database Info
137	<b>NAV-POSECEF</b>	0x01 0x01	20	Periodic/Polled	Position Solution in ECEF
137	<b>NAV-POSLLH</b>	0x01 0x02	28	Periodic/Polled	Geodetic Position Solution
138	<b>NAV-PVT</b>	0x01 0x07	92	Periodic/Polled	Navigation Position Velocity Time...
141	<b>NAV-RESETODO</b>	0x01 0x10	0	Command	Reset odometer
141	<b>NAV-SAT</b>	0x01 0x35	8 + 12*numSvs	Periodic/Polled	Satellite Information

## UBX Messages Overview continued

Page	Mnemonic	Cls/ID	Length	Type	Description
143	<b>NAV-SIG</b>	0x01 0x43	8 + 16*numSi...	Periodic/Polled	Signal Information
145	<b>NAV-STATUS</b>	0x01 0x03	16	Periodic/Polled	Receiver Navigation Status
147	<b>NAV-TIMEBDS</b>	0x01 0x24	20	Periodic/Polled	BDS Time Solution
148	<b>NAV-TIMEGAL</b>	0x01 0x25	20	Periodic/Polled	Galileo Time Solution
149	<b>NAV-TIMEGLO</b>	0x01 0x23	20	Periodic/Polled	GLO Time Solution
150	<b>NAV-TIMEGPS</b>	0x01 0x20	16	Periodic/Polled	GPS Time Solution
151	<b>NAV-TIMELS</b>	0x01 0x26	24	Periodic/Polled	Leap second event information
153	<b>NAV-TIMEUTC</b>	0x01 0x21	20	Periodic/Polled	UTC Time Solution
155	<b>NAV-VELECEF</b>	0x01 0x11	20	Periodic/Polled	Velocity Solution in ECEF
155	<b>NAV-VELNED</b>	0x01 0x12	36	Periodic/Polled	Velocity Solution in NED
<b>UBX Class RXM</b>			<b>Receiver Manager Messages</b>		
157	<b>RXM-MEASX</b>	0x02 0x14	44 + 24*num...	Periodic/Polled	Satellite Measurements for RRLP
159	<b>RXM-PMREQ</b>	0x02 0x41	8	Command	Requests a Power Management task
159	<b>RXM-PMREQ</b>	0x02 0x41	16	Command	Requests a Power Management task
161	<b>RXM-RAWX</b>	0x02 0x15	16 + 32*num...	Periodic/Polled	Multi-GNSS Raw Measurement Data
164	<b>RXM-RLM</b>	0x02 0x59	16	Output	Galileo SAR Short-RLM report
165	<b>RXM-RLM</b>	0x02 0x59	28	Output	Galileo SAR Long-RLM report
165	<b>RXM-RTC5</b>	0x02 0x23	28	Periodic/Polled	Real Time Clock Status
166	<b>RXM-RTCM</b>	0x02 0x32	8	Output	RTCM input status
167	<b>RXM-SFRBX</b>	0x02 0x13	8 + 4*numW...	Output	Broadcast Navigation Data Subframe
<b>UBX Class SEC</b>			<b>Security Feature Messages</b>		
168	<b>SEC-ECSIGN</b>	0x27 0x04	108	Output	Signature for output message
168	<b>SEC-UNIQID</b>	0x27 0x03	9	Output	Unique Chip ID
<b>UBX Class TIM</b>			<b>Timing Messages</b>		
169	<b>TIM-TM2</b>	0x0D 0x03	28	Periodic/Polled	Time mark data
170	<b>TIM-TP</b>	0x0D 0x01	16	Periodic/Polled	Time Pulse Timedata
172	<b>TIM-VRFY</b>	0x0D 0x06	20	Periodic/Polled	Sourced Time Verification
<b>UBX Class UPD</b>			<b>Firmware Update Messages</b>		
173	<b>UPD-CERASE</b>	0x09 0x16	0	Command	Chip erase the connected SQL flash
173	<b>UPD-CERASE</b>	0x09 0x16	1	Output	Chip erase the connected SQL flash
174	<b>UPD-CRC</b>	0x09 0x0D	5	Output	Result of CRC check.
174	<b>UPD-ERASE</b>	0x09 0x0B	4	Command	Erase flash sector
175	<b>UPD-ERASE</b>	0x09 0x0B	5	Output	Erase flash sector
175	<b>UPD-FLDET</b>	0x09 0x08	4	Poll Request	Get the Flash manufacturer and device...
175	<b>UPD-FLDET</b>	0x09 0x08	8	Get	Get the Flash manufacturer and device...
176	<b>UPD-FLWRI</b>	0x09 0x0C	8 + 1*size	Command	Write flash data (area must be erased...
177	<b>UPD-FLWRI</b>	0x09 0x0C	5	Output	Write flash data success indication
177	<b>UPD-IDEN</b>	0x09 0x06	0	Poll Request	Identify flash loader version

## UBX Messages Overview continued

Page	Mnemonic	Cls/ID	Length	Type	Description
177	<b>UPD-IDEN</b>	0x09 0x06	1	Get	Identify flash loader version
178	<b>UPD-POS</b>	0x09 0x15	2	Command	Enable PLL during safeboot
178	<b>UPD-QSIZE</b>	0x09 0x09	0	Poll Request	Get number of pending commands in...
179	<b>UPD-QSIZE</b>	0x09 0x09	1	Get	Number of pending commands in queue
179	<b>UPD-QSIZE</b>	0x09 0x09	2	Get	Number of pending commands in queue
179	<b>UPD-RBOOT</b>	0x09 0x0E	0	Command	Performs a watchdog reset
180	<b>UPD-ROM</b>	0x09 0x25	12	Polled	Message is holding ROM CRC
180	<b>UPD-SAFE</b>	0x09 0x07	0	Command	Boot in safe environment from ROM or...
181	<b>UPD-SAFE</b>	0x09 0x07	1	Command	Start flash loader task
181	<b>UPD-SETQ</b>	0x09 0x0F	1	Set	Set maximum of pending commands in...
182	<b>UPD-SETQ</b>	0x09 0x0F	2	Set	Set maximum of pending commands in...
182	<b>UPD-SOS</b>	0x09 0x14	0	Poll Request	Poll Backup File Restore Status
182	<b>UPD-SOS</b>	0x09 0x14	4	Command	Create Backup File in Flash
183	<b>UPD-SOS</b>	0x09 0x14	4	Command	Clear Backup in Flash
183	<b>UPD-SOS</b>	0x09 0x14	8	Output	Backup File Creation Acknowledge
184	<b>UPD-SOS</b>	0x09 0x14	8	Output	System Restored from Backup

## 5.8 UBX-ACK (0x05)

Ack/Nak Messages: i.e. Acknowledge or Reject messages to UBX-CFG input messages. Messages in the UBX-ACK class output the processing results to UBX-CFG and some other messages.

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

#### 5.8.1.1 Message Acknowledged

Message	<b>UBX-ACK-ACK</b>					
Description	<b>Message Acknowledged</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	Output upon processing of an input message. ACK Message 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 Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	clsID	-	Class ID of the Acknowledged Message	
1	U1	-	msgID	-	Message ID of the Acknowledged Message	

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

#### 5.8.2.1 Message Not-Acknowledged

Message	<b>UBX-ACK-NAK</b>					
Description	<b>Message Not-Acknowledged</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	Output upon processing of an input message. NAK Message 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 Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	clsID	-	Class ID of the Not-Acknowledged Message	
1	U1	-	msgID	-	Message ID of the Not-Acknowledged Message	

## 5.9 UBX-CFG (0x06)

Configuration Input Messages: i.e. Configure the receiver..

Messages in the CFG class can be used to configure the receiver and poll current configuration values. Any messages in the CFG class sent to the receiver are either acknowledged (with message [UBX-ACK-ACK](#)) if processed successfully or rejected (with message [UBX-ACK-NAK](#)) if processing unsuccessfully.

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

#### 5.9.1.1 Poll OTP content

Message	<b>UBX-CFG-OTP</b>					
Description	<b>Poll OTP content</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Poll Request					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x06	0x41	0	see below	CK_A CK_B
No payload						

#### 5.9.1.2 OTP content

Message	<b>UBX-CFG-OTP</b>					
Description	<b>OTP content</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Get					
Comment	The content of the OTP, returned as a result of a POLL message. See section <a href="#">eFuse</a> for a detailed description of the OTP content.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x06	0x41	128	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1[128]	-	otpContent	-	The content of the OTP	

### 5.9.1.3 Writes OTP content

Message	<b>UBX-CFG-OTP</b>				
Description	<b>Writes OTP content</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Set				
Comment	Writes content to the OTP. An ACK will be returned when the content was successfully written. A NAK when there was a problem.				
Message Structure	Header	Class	ID	Length (Bytes)	Payload
	0xB5 0x62	0x06	0x41	0 + 1*N	see below
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
Start of repeated block (N times)					
N*1	U1	-	payload	-	Payload. Use u-center to compose the message.
End of repeated block					

## 5.9.2 UBX-CFG-PIO (0x06 0x2c)

### 5.9.2.1 Set PIO pins

Message	<b>UBX-CFG-PIO</b>				
Description	<b>Set PIO pins</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Set				
Comment	PIO setup for production testing. Request 1 (SET-PIN) will change to a PIO test state and set a desired pin state for PIO pins (except those specified as 'unaltered'). Clearly, PIO settings could disturb system operation or, possibly, even cause damage. Request 0 (EXIT_TEST) will end test state and restore the PIO state back as it was before the most recent change into test state. An EXIT-TEST message only contains the request, while the other requests contain a value per pin. For a SET-PIN message, this determines the PIO state that will be set.				
Message Structure	Header	Class	ID	Length (Bytes)	Payload
	0xB5 0x62	0x06	0x2c	19	see below
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1	-	version	-	Message version (1 for this version)
1	U1	-	request	-	Possible requests: 0: EXIT-TEST. No test, back to normal operation 1: SET-PIN. Set pin state (unaltered, float, high, low, pull-up)



UBX-CFG-PIO continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
Start of repeated block (17 times)					
2 + 1*N	U1	-	requiredPinState	-	One value per PIO pin: 0: Pin state unaltered 4: Pin driven high 5: Pin driven low
End of repeated block					

### 5.9.3 UBX-CFG-PT2 (0x06 0x59)

#### 5.9.3.1 Production test configuration

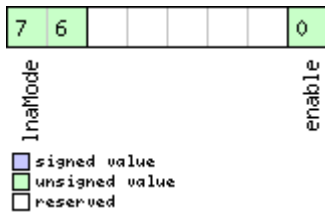
Message	UBX-CFG-PT2					
Description	Production test configuration					
Firmware	Supported on: <ul style="list-style-type: none"><li>u-blox 9 with protocol version 30</li></ul>					
Type	Set					
Comment	Activate and set config for Production test mode. This allows setting a variable number of SV signal descriptors (no more than the number of RF channels of the receiver). Activating also enables output message UBX-MON-PT2.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x06	0x59	12 + 4*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0 for this version)	
1	X1	-	activate	-	production testmode (see graphic below)	
2	U1	-	extInt	-	input pin for the optional frequency aiding 0x00=EXTINT0 0x01=EXTINT1 0xFF=no frequency aiding	
3	U1	-	reAcqCno	dBHz	C/N0 threshold to force re-acquisition (=0 means inactive)	
4	U4	-	refFreq	Hz	Reference frequency	
8	U4	-	refFreqAcc	ppb	Reference frequency accuracy	
Start of repeated block (N times)						
12 + 4*N	U1	-	gnssId	-	GNSS identifier (see Satellite Numbering)	
13 + 4*N	U1	-	svId	-	Satellite identifier (see Satellite Numbering)	
14 + 4*N	U1	-	sigId	-	Signal identifier. 0 is the only value currently supported.	
15 + 4*N	U1	-	accsId	-	Access identifier, used to select frequency channel in range (0-13) for GLONASS (0 = -7, 1 = -6, ..., 12 = +5, 13 = +6). Ignored for all other GNSS.	

UBX-CFG-PT2 continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
End of repeated block					

## Bitfield activate

This graphic explains the bits of activate



Name	Description
enable	1=activate testmode, 0=deactivate testmode
lnaMode	Internal LNA Mode 0x00=Use default internal LNA settings 0x01=Switch internal LNA off 0x02=Switch internal LNA on

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

### 5.9.4.1 Reset Receiver / Clear Backup Data Structures

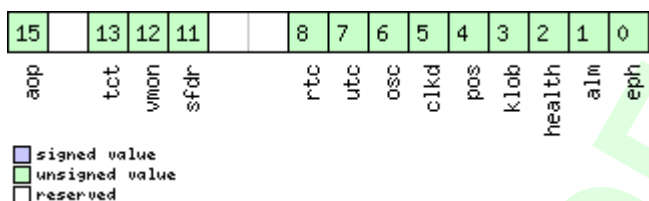
Message	<b>UBX-CFG-RST</b>					
Description	<b>Reset Receiver / Clear Backup Data Structures</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	Don't expect this message to be acknowledged by the receiver. • Newer FW version won't acknowledge this message at all. • Older FW version will acknowledge this message but the acknowledge may not be sent completely before the receiver is reset.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x06	0x04	4	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	X2	-	navBbrMask	-	BBR Sections to clear. The following Special Sets apply: 0x0000 Hot start 0x0001 Warm start 0xFFFF Cold start (see <a href="#">graphic below</a> )	

## UBX-CFG-RST continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
2	U1	-	resetMode	-	Reset Type 0x00 - Hardware reset (Watchdog) immediately 0x01 - Controlled Software reset 0x02 - Controlled Software reset (GNSS only) 0x04 - Hardware reset (Watchdog) after shutdown 0x08 - Controlled GNSS stop 0x09 - Controlled GNSS start
3	U1	-	reserved1	-	Reserved

### Bitfield navBbrMask

This graphic explains the bits of navBbrMask



Name	Description
eph	Ephemeris
alm	Almanac
health	Health
klob	Klobuchar parameters
pos	Position
clkd	Clock Drift
osc	Oscillator Parameter
utc	UTC Correction + GPS Leap Seconds Parameters
rtc	RTC
sfdr	SFDR Parameters (only available on the ADR product variant)
vmon	SFDR Vehicle Monitoring Parameter (only available on the ADR product variant)
tct	TCT Parameters (only available on the ADR product variant)
aop	Autonomous Orbit Parameters

### 5.9.5 UBX-CFG-SPT (0x06 0x64)

#### 5.9.5.1 Configure and start a sensor production test

Message	<b>UBX-CFG-SPT</b>					
Description	<b>Configure and start a sensor production test</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)					
Type	Get/Set					
Comment	The production test uses the built-in self-test capabilities of an attached sensor. This message is only supported if a sensor is directly connected to the u-blox receiver.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x06	0x64	12	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0 for this version)	
1	U1	-	reserved1	-	<a href="#">Reserved</a>	
2	U2	-	sensorId	-	ID of the sensor to be tested; see <a href="#">UBX-MON-SPT</a> for defined IDs	
4	U1[8]	-	reserved2	-	<a href="#">Reserved</a>	

### 5.9.6 UBX-CFG-USBTEST (0x06 0x58)

#### 5.9.6.1 USB Testing

Message	<b>UBX-CFG-USBTEST</b>					
Description	<b>USB Testing</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Set					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x06	0x58	2	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0 for this version)	
1	U1	-	usbPinState	-	Define the USB test state and output 0: Test mode disabled, normal pin usage 1: Set tristate: DP=Z DM=Z 2: Output DP=1 DM=0 3: Output DP=0 DM=1 4: Output DP=0 DM=0	

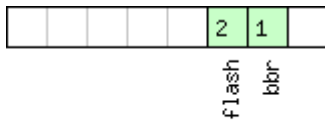
## 5.9.7 UBX-CFG-VALDEL (0x06 0x8C)

### 5.9.7.1 Deletes values corresponding to provided keys

Message	UBX-CFG-VALDEL					
Description	Deletes values corresponding to provided keys					
Firmware	Supported on: <ul style="list-style-type: none"><li>u-blox 9 with protocol version 30</li></ul>					
Type	Set					
Comment	<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 won't 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 UBX-CFG-VALDEL that supports transactions.</li><li>This message does not check if the resulting configuration is valid.</li><li>See Receiver Configuration 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 layers 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, then 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></ul>					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x06	0x8C	4 + 4*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version, set to 0	
1	X1	-	layers	-	The layers where the configuration should be deleted from (see graphic below)	
2	U1[2]	-	reserved1	-	Reserved	
Start of repeated block (N times)						
4 + 4*N	U4	-	keys	-	Configuration Item IDs of the Configuration Items to be deleted	
End of repeated block						

## Bitfield layers

This graphic explains the bits of layers



☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
bbr	Delete configuration from the BBR layer
flash	Delete configuration from the Flash layer

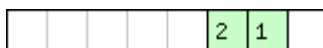
### 5.9.7.2 Deletes values corresponding to provided keys within a transaction

Message	<b>UBX-CFG-VALDEL</b>				
Description	<b>Deletes values corresponding to provided keys within a transaction</b>				
Firmware	Supported on: <ul style="list-style-type: none"> <li>u-blox 9 with protocol version 30</li> </ul>				
Type	Set				
Comment	<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 won't 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> <li>See <a href="#">Receiver Configuration</a> for details.</li> <li>See version 0 of <a href="#">UBX-CFG-VALDEL</a> for simplified version of this message.</li> </ul> <p>This message returns a UBX-ACK-NAK, cancels any started transaction, and no configuration is applied:</p> <ul style="list-style-type: none"> <li>if any key within a transaction is unknown to the receiver FW</li> <li>if an invalid transaction state transition is requested</li> <li>if the layers bitfield changes within a transaction</li> <li>if the layers bitfield does not specify a layer to delete a value from</li> </ul> <p>Notes:</p> <ul style="list-style-type: none"> <li>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.</li> <li>This message can be sent with no keys to delete for the purposes of managing the transaction state transition.</li> <li>If a key is sent multiple times within the same message or within the same transaction, then 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> </ul>				
	Header	Class	ID	Length (Bytes)	Payload
					Checksum

Message Structure	0xB5 0x62	0x06	0x8C	4 + 4*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version, set to 1	
1	X1	-	layers	-	The layers where the configuration should be deleted from (see <a href="#">graphic below</a> )	
2	X1	-	transaction	-	Transaction action to be applied: (see <a href="#">graphic below</a> )	
3	U1	-	reserved1	-	Reserved	
Start of repeated block (N times)						
4 + 4*N	U4	-	keys	-	Configuration Item IDs of the Configuration Items to be deleted	
End of repeated block						

## Bitfield layers

This graphic explains the bits of layers



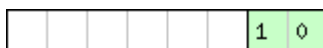
flash  
bbr

■ signed value  
■ unsigned value  
■ reserved

Name	Description
bbr	Delete configuration from the BBR layer
flash	Delete configuration from the Flash layer

## Bitfield transaction

This graphic explains the bits of transaction



action

■ signed value  
■ unsigned value  
■ reserved

Name	Description
action	<p>Transaction action to be applied:</p> <p>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.</p> <p>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.</p> <p>2: Deletion transaction ongoing: In the next UBX-CFG-VALDEL, it can be either 0, 1, 2 or 3.</p> <p>3: Apply and end a deletion transaction: In the next UBX-CFG-VALDEL, it can be either 0 or 1.</p>

## 5.9.8 UBX-CFG-VALGET (0x06 0x8B)

### 5.9.8.1 Get Configuration Items

Message	<b>UBX-CFG-VALGET</b>				
Description	<b>Get Configuration Items</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Poll Request				
Comment	<p>This message is used to read configuration items from the receiver. It returns the configuration data for the specified items and layer.</p> <p>A UBX-CFG-NAK message is returned in case one or more items are unknown to the receiver or when the number of requested items is greater than 64.</p> <p>Otherwise a UBX-CFG-ACK message is returned.</p> <p>The configuration items are identified by their configuration key IDs.</p> <p>See <a href="#">Receiver Configuration</a> for details.</p>				
Message Structure	Header	Class	ID	Length (Bytes)	Payload
	0xB5 0x62	0x06	0x8B	4 + 4*N	see below
Checksum					
CK_A CK_B					
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1	-	version	-	message version, set to 0
1	U1	-	layer	-	<p>The layers from which the configuration items should be retrieved:</p> <p>0 - RAM layer</p> <p>1 - BBR layer</p> <p>2 - Flash layer</p> <p>3 - Image layer</p> <p>4 - OTP layer</p> <p>5 - Pin layer</p> <p>6 - ROM layer</p> <p>7 - Default layer</p>
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>
Start of repeated block (N times)					
4 + 4*N	U4	-	keys	-	configuration key ID selected for retrieval
End of repeated block					



### 5.9.8.2 Configuration Items

Message	<b>UBX-CFG-VALGET</b>				
Description	<b>Configuration Items</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Polled				
Comment	This message is output by the receiver to return requested configuration data (key and value pairs). See <a href="#">Receiver Configuration</a> for details.				
Message Structure	Header	Class	ID	Length (Bytes)	Payload
	0xB5 0x62	0x06	0x8B	4 + 1*N	see below
Checksum					
CK_A CK_B					
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1	-	version	-	message version, set to 1
1	U1	-	layer	-	The layers from which the configuration items originate: 0 - RAM layer 1 - BBR 2 - Flash 3 - Image layer 4 - OTP layer 5 - Pin layer 6 - ROM layer 7 - Default
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>
Start of repeated block (N times)					
4 + 1*N	U1	-	cfgData	-	<a href="#">configuration data</a> (key and value pairs)
End of repeated block					

### 5.9.9 UBX-CFG-VALSET (0x06 0x8A)

#### 5.9.9.1 Sets values corresponding to provided key-value pairs

Message	<b>UBX-CFG-VALSET</b>				
Description	<b>Sets values corresponding to provided key-value pairs</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Set				
Comment	<b>Overview:</b> <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 parameters 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 <a href="#">UBX-CFG-VALSET</a> that supports</li> </ul>				

transactions.

- See [Receiver Configuration](#) for details.

This message returns a UBX-ACK-NAK and no configuration is applied:

- if any key is unknown to the receiver FW
- if the layers bitfield does not specify a layer to save a value to
- 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.

Notes:

- If a key is sent multiple times within the same message, then the value eventually being applied is the last sent.

Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x06	0x8A	4 + 1*N	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1	-	version	-	Message version, set to 0
1	X1	-	layers	-	The layers where the configuration should be applied (see <a href="#">graphic below</a> )
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>

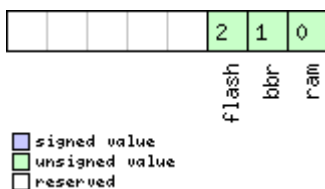
Start of repeated block (N times)

4 + 1*N	U1	-	cfgData	-	<a href="#">configuration data</a> (key and value pairs)
---------	----	---	---------	---	--

End of repeated block

## Bitfield layers

This graphic explains the bits of layers



Name	Description
ram	Update <a href="#">configuration</a> in the RAM layer
bbr	Update <a href="#">configuration</a> in the BBR layer
flash	Update <a href="#">configuration</a> in the Flash layer

### 5.9.9.2 Sets values corresponding to provided key-value pairs within a transaction

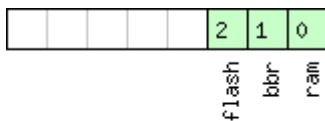
Message	<b>UBX-CFG-VALSET</b>					
Description	<b>Sets values corresponding to provided key-value pairs within a transaction</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li>u-blox 9 with protocol version 30</li> </ul>					
Type	Set					
Comment	<p>Overview:</p> <ul style="list-style-type: 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 parameters 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 with the result being managed within a transaction. Within a transaction there is no limit on the number key-value pairs; a transaction is effectively limited to the number of known keys.</li> <li>See <a href="#">Receiver Configuration</a> for details.</li> <li>See version 0 of <a href="#">UBX-CFG-VALSET</a> for simplified version of this message.</li> </ul> <p>This message returns a UBX-ACK-NAK, cancels any started transaction, and no configuration is applied:</p> <ul style="list-style-type: none"> <li>if any key within a transaction is unknown to the receiver FW</li> <li>if an invalid transaction state transition is requested</li> <li>if the layers bitfield changes within a transaction</li> <li>if the layers bitfield does not specify a layer to save a value to</li> </ul> <p>This message returns a UBX-ACK-NAK, and no configuration is applied:</p> <ul style="list-style-type: none"> <li>if the requested configuration is not valid. While in a transaction context, only the last message that requests to apply the transaction returns a NAK. The validity of a configuration is checked only if the message requests to apply the configuration to the RAM configuration layer. This also applies to a transaction-less request.</li> </ul> <p>Notes:</p> <ul style="list-style-type: none"> <li>Any request for another UBX-CFG-message type (including UBX-CFG-VALDEL and UBX-CFG-VALGET) will cancel any started transaction, and no configuration is applied.</li> <li>This message can be sent with no key/values to set for the purposes of managing the transaction state transition.</li> <li>If a key is sent multiple times within the same message or within the same transaction, then the value eventually being applied is the last sent.</li> </ul>					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x06	0x8A	4 + 1*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version, set to 1	
1	X1	-	layers	-	The layers where the configuration should be applied (see <a href="#">graphic below</a> )	
2	U1	-	transaction	-	Transaction action to be applied (see <a href="#">graphic below</a> )	

UBX-CFG-VALSET continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
3	U1	-	reserved1	-	Reserved
Start of repeated block (N times)					
4 + 1*N	U1	-	cfgData	-	configuration data (key and value pairs)
End of repeated block					

## Bitfield layers

This graphic explains the bits of layers

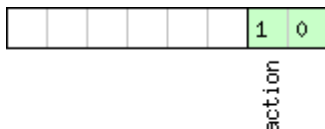


☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
ram	Update configuration in the RAM layer
bbr	Update configuration in the BBR layer
flash	Update configuration in the Flash layer

## Bitfield transaction

This graphic explains the bits of transaction



☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
action	<p>Transaction action to be applied:</p> <p>0: Transactionless UBX-CFG-VALSET: In the next UBX-CFG-VALSET, it can be either 0 or 1. If a transaction has not yet been started, the incoming configuration is applied (if valid). If a transaction has already been started, cancels any started transaction and the incoming configuration is applied (if valid).</p> <p>1: (Re)Start set transaction: In the next UBX-CFG-VALSET, 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-VALSET messages.</p> <p>2: Set transaction ongoing: In the next UBX-CFG-VALSET, it can be either 0, 1, 2 or 3.</p> <p>3: Apply and end a set transaction: In the next UBX-CFG-VALSET, it can be either 0 or 1.</p>

## 5.10 UBX-ESF (0x10)

External Sensor Fusion Messages: i.e. External Sensor Measurements and Status Information. Messages in the ESF class are used to output external sensor fusion information from the receiver.

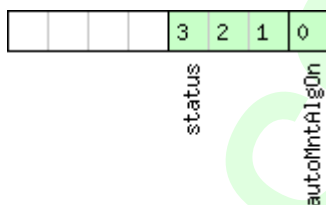
### 5.10.1 UBX-ESF-ALG (0x10 0x14)

#### 5.10.1.1 IMU alignment information

Message	<b>UBX-ESF-ALG</b>					
Description	<b>IMU alignment information</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)					
Type	Periodic/Polled					
Comment	This message outputs the IMU alignment angles which define the rotation from the installation-frame to the IMU-frame. In addition, it indicates the automatic IMU-mount alignment status.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x10	0x14	16	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	U1	-	version	-	Message version (1 for this version)	
5	U1	-	flags	-	Flags (see <a href="#">graphic below</a> )	
6	U1	-	error	-	Flags (see <a href="#">graphic below</a> )	
7	U1	-	reserved1	-	<a href="#">Reserved</a>	
8	U4	1e-2	yaw	deg	IMU-mount yaw angle [0, 360]	
12	I2	1e-2	pitch	deg	IMU-mount pitch angle [-90, 90]	
14	I2	1e-2	roll	deg	IMU-mount roll angle [-180, 180]	

### Bitfield flags

This graphic explains the bits of flags

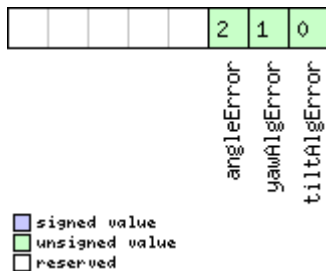


☒ signed value  
☒ unsigned value  
☐ reserved

Name	Description
autoMntAlgOn	Automatic IMU-mount alignment on/off bit (0: automatic alignment is not running, 1: automatic alignment is running)
status	Status of the IMU-mount alignment (0: user-defined/fixed angles are used, 1: IMU-mount roll/pitch angles alignment is ongoing, 2: IMU-mount roll/pitch/yaw angles alignment is ongoing, 3: coarse IMU-mount alignment are used, 4: fine IMU-mount alignment are used)

## Bitfield error

This graphic explains the bits of error



Name	Description
tiltAlgError	IMU-mount tilt (roll and/or pitch) alignment error (0: no error, 1: error)
yawAlgError	IMU-mount yaw alignment error (0: no error, 1: error)
angleError	IMU-mount misalignment Euler angle singularity error (0: no error, 1: error). If this error bit is set, the IMU-mount roll and IMU-mount yaw angles cannot uniquely be defined due to the singularity issue happening with installations mounted with a +/- 90 degrees misalignment around pitch axis. This is also known as the 'gimbal-lock' problem affecting rotations described by Euler angles.

## 5.10.2 UBX-ESF-INS (0x10 0x15)

### 5.10.2.1 Vehicle dynamics information

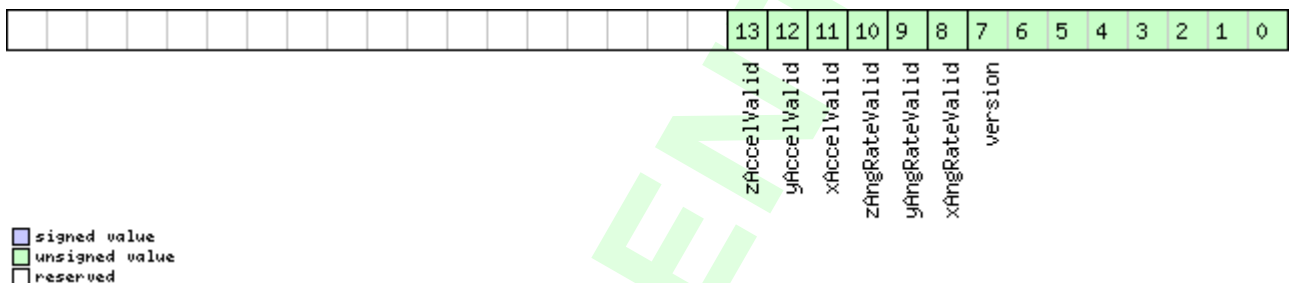
Message	<b>UBX-ESF-INS</b>					
Description	<b>Vehicle dynamics information</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)					
Type	Periodic/Polled					
Comment	This message outputs information about the vehicle dynamics. The output dynamics information (angular rates and accelerations) are expressed with respect to the vehicle-frame.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x10	0x15	36	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	bitfield0	-	Bitfield (see <a href="#">graphic below</a> )	
4	U1[4]	-	reserved1	-	<a href="#">Reserved</a>	
8	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
12	I4	1e-3	xAngRate	deg/s	Compensated x-axis angular rate.	

UBX-ESF-INS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
16	I4	1e-3	yAngRate	deg/s	Compensated y-axis angular rate.
20	I4	1e-3	zAngRate	deg/s	Compensated z-axis angular rate.
24	I4	-	xAccel	mg	Compensated x-axis acceleration (gravity-free).
28	I4	-	yAccel	mg	Compensated y-axis acceleration (gravity-free).
32	I4	-	zAccel	mg	Compensated z-axis acceleration (gravity-free).

## Bitfield bitfield0

This graphic explains the bits of bitfield0



Name	Description
version	Message version (1 for this version).
xAngRateValid	Compensated x-axis angular rate data validity flag (0: not valid, 1: valid).
yAngRateValid	Compensated y-axis angular rate data validity flag (0: not valid, 1: valid).
zAngRateValid	Compensated z-axis angular rate data validity flag (0: not valid, 1: valid).
xAccelValid	Compensated x-axis acceleration data validity flag (0: not valid, 1: valid).
yAccelValid	Compensated y-axis acceleration data validity flag (0: not valid, 1: valid).
zAccelValid	Compensated z-axis acceleration data validity flag (0: not valid, 1: valid).

### 5.10.3 UBX-ESF-MEAS (0x10 0x02)

#### 5.10.3.1 External Sensor Fusion Measurements

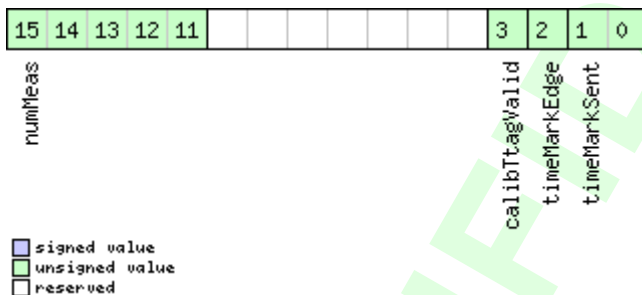
Message	<b>UBX-ESF-MEAS</b>					
Description	<b>External Sensor Fusion Measurements</b>					
Firmware	Supported on: • <b>u-blox 9 with protocol version 30 (only with ADR products)</b>					
Type	Input/Output					
Comment	Contains sensor measurements with timestamp. Optionally, can include timestamp that the message was received at the receiver. Multiple measurements can be included in a single message. (1 measurement per sensor type).					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x10	0x02	(8 + 4*numMeas) or (12 + 4*numMeas)	see below	CK_A CK_B
Payload Contents:						

UBX-ESF-MEAS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4	-	timeTag	-	Time tag of measurement generated by external sensor
4	X2	-	flags	-	Flags. Set all unused bits to zero. (see <a href="#">graphic below</a> )
6	U2	-	id	-	Identification number of data provider
Start of repeated block (numMeas times)					
8 + 4*N	X4	-	data	-	data (see <a href="#">graphic below</a> )
End of repeated block					
Start of optional block					
8 + 4*numMeas	U4	-	calibTtag	ms	Receiver local time calibrated. This field <b>must not</b> be supplied when calibTtagValid is set to 0.
End of optional block					

## Bitfield flags

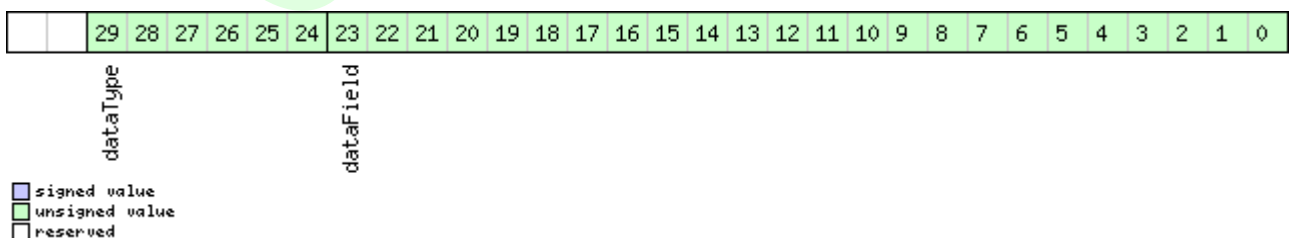
This graphic explains the bits of flags



Name	Description
timeMarkSent	Time mark signal was supplied just prior to sending this message: 0 = none, 1 = on Ext0, 2 = on Ext1
timeMarkEdge	Trigger on rising (0) or falling (1) edge of time mark signal
calibTtagValid	Calibration time tag available. Always set to zero.
numMeas	Number of measurements contained in this message (optional, can be obtained from message size)

## Bitfield data

This graphic explains the bits of data





Name	Description
dataField	Data
dataType	Type of data (0 = no data; 1..63 = data type)

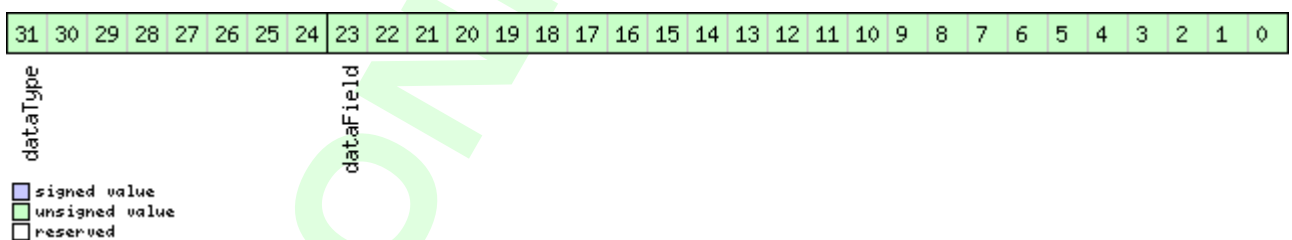
#### 5.10.4 UBX-ESF-RAW (0x10 0x03)

##### 5.10.4.1 Raw sensor measurements

Message	UBX-ESF-RAW					
Description	Raw sensor measurements					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)</li></ul>					
Type	Output					
Comment	Contains all sensor measurements from the last measurement interval. Use UBX-ESF-MEAS if measurements are needed in real-time.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x10	0x03	4 + 8*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1[4]	-	reserved1	-	Reserved	
Start of repeated block (N times)						
4 + 8*N	X4	-	data	-	data Same as in <a href="#">UBX-ESF-MEAS</a> (see <a href="#">graphic below</a> )	
8 + 8*N	U4	-	sTtag	-	sensor time tag	
End of repeated block						

### Bitfield data

This graphic explains the bits of data



Name	Description
dataField	data
dataType	type of data (0 = no data; 1..255 = data type)

### 5.10.5 UBX-ESF-RESETALG (0x10 0x13)

#### 5.10.5.1 Reset automatic IMU-mount alignment

Message	<b>UBX-ESF-RESETALG</b>					
Description	<b>Reset automatic IMU-mount alignment</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)					
Type	Command					
Comment	Resets the IMU alignment solution estimated by the automatic IMU-mount alignment engine. This message is ignored if automatic IMU-mount alignment is disabled. Sensors will need to be recalibrated. <a href="#">UBX-ACK-ACK</a> or <a href="#">UBX-ACK-NAK</a> are returned to indicate success or failure.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x10	0x13	0	see below	CK_A CK_B
No payload						

### 5.10.6 UBX-ESF-STATUS (0x10 0x10)

#### 5.10.6.1 External Sensor Fusion (ESF) status information

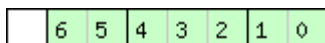
Message	<b>UBX-ESF-STATUS</b>					
Description	<b>External Sensor Fusion (ESF) status information</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)					
Type	Periodic/Polled					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x10	0x10	16 + 4*numSens	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	U1	-	version	-	Message version (2 for this version)	
5	X1	-	initStatus1	-	Initialization status bitfield, part 1 (see <a href="#">graphic below</a> )	
6	X1	-	initStatus2	-	Initialization status bitfield, part 2 (see <a href="#">graphic below</a> )	
7	U1[5]	-	reserved1	-	<a href="#">Reserved</a>	

## UBX-ESF-STATUS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
12	U1	-	fusionMode	-	<p>Fusion mode:</p> <p>0: Initialization mode: receiver is initializing some unknown values required for doing sensor fusion</p> <p>1: Fusion mode: GNSS and sensor data are used for navigation solution computation</p> <p>2: Suspended fusion mode: sensor fusion is temporarily disabled due to e.g. invalid sensor data or detected ferry</p> <p>3: Disabled fusion mode: sensor fusion is permanently disabled until receiver reset due e.g. to sensor error</p> <p>See the ADR section in <a href="#">Integration manual</a> for more details.</p>
13	U1[2]	-	reserved2	-	<a href="#">Reserved</a>
15	U1	-	numSens	-	Number of sensors
Start of repeated block (numSens times)					
16 + 4*N	X1	-	sensStatus1	-	Sensor status, part 1 (see <a href="#">graphic below</a> )
17 + 4*N	X1	-	sensStatus2	-	Sensor status, part 2 (see <a href="#">graphic below</a> )
18 + 4*N	U1	-	freq	Hz	Observation frequency
19 + 4*N	X1	-	faults	-	Sensor faults (see <a href="#">graphic below</a> )
End of repeated block					

## Bitfield initStatus1

This graphic explains the bits of initStatus1



insInitStatus

mntAlgStatus

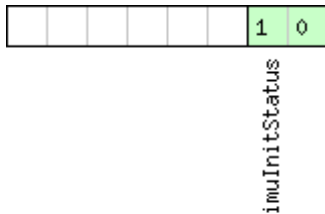
wtInitStatus

- signed value
- unsigned value
- reserved

Name	Description
wtInitStatus	Wheel-tick factor initialization status (0: off, 1: initializing, 2: initialized).
mntAlgStatus	Automatic IMU-mount alignment status (0: off, 1: initializing, 2: initialized).
insInitStatus	INS initialization status (0: off, 1: initializing, 2: initialized).

## Bitfield initStatus2

This graphic explains the bits of initStatus2

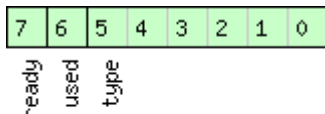


☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
imuInitStatus	IMU initialization status (0: off, 1: initializing, 2: initialized).

## Bitfield sensStatus1

This graphic explains the bits of sensStatus1

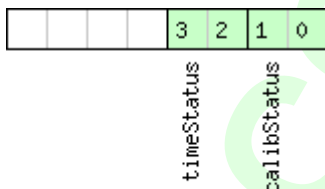


☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
type	Sensor data type. Data types are defined in the <a href="#">Sensor Data Types</a> section.
used	If set, sensor data is <b>used</b> for the current sensor fusion solution.
ready	If set, sensor is set up (configuration is available or not required) but not used for computing the current sensor fusion <b>solution</b> .

## Bitfield sensStatus2

This graphic explains the bits of sensStatus2

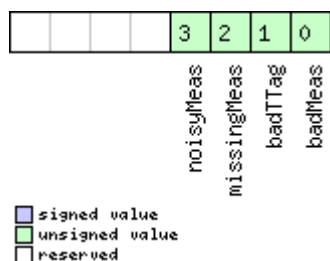


☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
calibStatus	00: Sensor is not calibrated 01: Sensor is calibrating 10/11: Sensor is calibrated Good dead reckoning performance is only possible when all used sensors are calibrated. Depending on the quality of the GNSS signals and the sensor data, the sensors may take a longer time to get calibrated.
timeStatus	00: No data 01: Reception of the first byte used to tag the measurement 10: Event input used to tag the measurement 11: Time tag provided with the data

## Bitfield faults

This graphic explains the bits of faults



Name	Description
badMeas	Bad measurements detected
badTTag	Bad measurement time-tags detected
missingMeas	Missing or time-misaligned measurements detected
noisyMeas	High measurement noise-level detected

## 5.11 UBX-HNR (0x28)

High Rate Navigation Results Messages: i.e. High rate time, position, speed, heading.

Messages in the HNR class are used to output high rate navigation data for position, altitude, velocity and their accuracies.

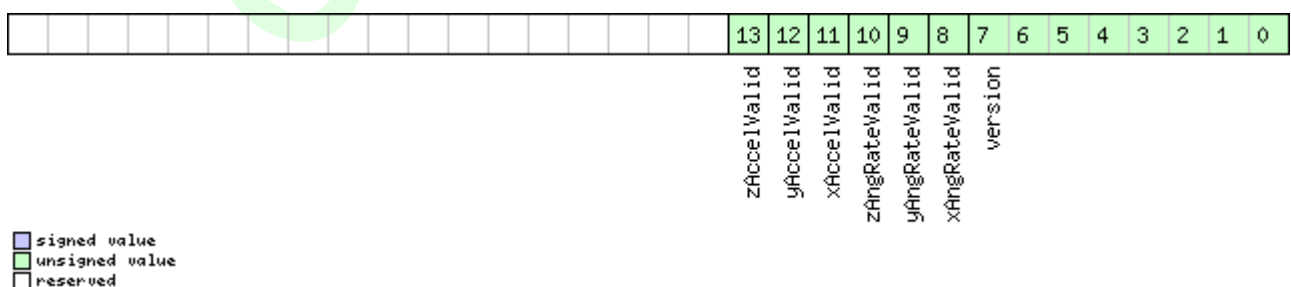
### 5.11.1 UBX-HNR-INS (0x28 0x02)

#### 5.11.1.1 Vehicle dynamics information

Message	<b>UBX-HNR-INS</b>					
Description	<b>Vehicle dynamics information</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li>• <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)</li> </ul>					
Type	Periodic/Polled					
Comment	This message outputs high rate information about vehicle dynamics computed by the Inertial Navigation System (INS) during ESF-based navigation. Similar to <a href="#">UBX-ESF-INS</a> , but at the higher navigation rate, using sensor data to propagate the vehicle dynamics between GNSS epochs.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x28	0x02	36	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	X4	-	bitfield0	-	Bitfield (see <a href="#">graphic below</a> )	
4	U1[4]	-	reserved1	-	<a href="#">Reserved</a>	
8	U4	-	iTOW	ms	GPS time of week of the HNR epoch. See the section HNR in <a href="#">Integration manual</a> for details.	
12	I4	1e-3	xAngRate	deg/s	Compensated x-axis angular rate.	
16	I4	1e-3	yAngRate	deg/s	Compensated y-axis angular rate.	
20	I4	1e-3	zAngRate	deg/s	Compensated z-axis angular rate.	
24	I4	-	xAccel	mg	Compensated x-axis acceleration (with gravity).	
28	I4	-	yAccel	mg	Compensated y-axis acceleration (with gravity).	
32	I4	-	zAccel	mg	Compensated z-axis acceleration (with gravity).	

## Bitfield bitfield0

This graphic explains the bits of `bitfield0`



Name	Description
version	Message version (0 for this version).
xAngRateValid	Compensated x-axis angular rate data validity flag (0: not valid, 1: valid).
yAngRateValid	Compensated y-axis angular rate data validity flag (0: not valid, 1: valid).
zAngRateValid	Compensated z-axis angular rate data validity flag (0: not valid, 1: valid).
xAccelValid	Compensated x-axis acceleration data validity flag (0: not valid, 1: valid).
yAccelValid	Compensated y-axis acceleration data validity flag (0: not valid, 1: valid).
zAccelValid	Compensated z-axis acceleration data validity flag (0: not valid, 1: valid).

### 5.11.2 UBX-HNR-PVT (0x28 0x00)

#### 5.11.2.1 High Rate Output of PVT Solution

Message	<b>UBX-HNR-PVT</b>					
Description	<b>High Rate Output of PVT Solution</b>					
Firmware	Supported on: • <b>u-blox 9 with protocol version 30 (only with ADR products)</b>					
Type	Periodic/Polled					
Comment	Similar to <a href="#">UBX-NAV-PVT</a> , but at the higher navigation rate, using sensor data to propagate the vehicle position between GNSS epochs.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x28	0x00	72	see below	CK_A CK_B

Payload Contents:

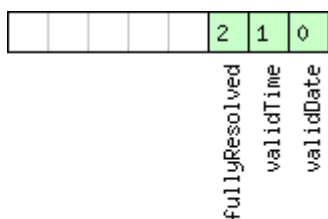
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.
4	U2	-	year	y	Year (UTC)
6	U1	-	month	month	Month, range 1..12 (UTC)
7	U1	-	day	d	Day of month, range 1..31 (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 (see <a href="#">graphic below</a> )
12	I4	-	nano	ns	Fraction of second, range -1e9 .. 1e9 (UTC)
16	U1	-	gpsFix	-	GPSfix Type, range 0..5 0x00 = No Fix 0x01 = Dead Reckoning only 0x02 = 2D-Fix 0x03 = 3D-Fix 0x04 = GPS + dead reckoning combined 0x05 = Time only fix 0x06..0xff: reserved
17	X1	-	flags	-	Fix Status Flags (see <a href="#">graphic below</a> )
18	U1[2]	-	reserved1	-	<a href="#">Reserved</a>
20	I4	1e-7	lon	deg	Longitude
24	I4	1e-7	lat	deg	Latitude

UBX-HNR-PVT continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
28	I4	-	height	mm	Height above Ellipsoid
32	I4	-	hMSL	mm	Height above mean sea level
36	I4	-	gSpeed	mm/s	Ground Speed (2-D)
40	I4	-	speed	mm/s	Speed (3-D)
44	I4	1e-5	headMot	deg	Heading of motion (2-D)
48	I4	1e-5	headVeh	deg	Heading of vehicle (2-D)
52	U4	-	hAcc	mm	Horizontal accuracy
56	U4	-	vAcc	mm	Vertical accuracy
60	U4	-	sAcc	mm/s	Speed accuracy
64	U4	1e-5	headAcc	deg	Heading accuracy
68	U1[4]	-	reserved2	-	Reserved

## Bitfield valid

This graphic explains the bits of valid

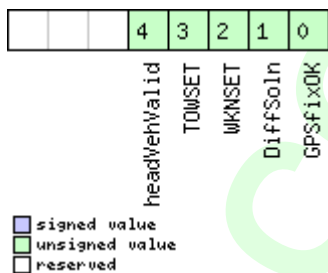


- signed value
- unsigned value
- reserved

Name	Description
validDate	1 = Valid UTC Date (see <a href="#">Integration manual</a> Time Validity section for details)
validTime	1 = Valid UTC Time of Day (see <a href="#">Integration manual</a> Time Validity section for details)
fullyResolved	1 = UTC Time of Day has been fully resolved (no seconds uncertainty)

## Bitfield flags

This graphic explains the bits of flags



- signed value
- unsigned value
- reserved



Name	Description
GPSfixOK	>1 = Fix within limits (e.g. DOP & accuracy)
DiffSoln	1 = DGPS used
WKNSET	1 = Valid GPS week number
TOWSET	1 = Valid GPS time of week (iTOW & fTOW)
headVehValid	Heading of vehicle is valid

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## 5.12 UBX-INF (0x04)

Information Messages: i.e. Printf-Style Messages, with IDs such as Error, Warning, Notice. Messages in the INF class are used to output strings in a printf style from the firmware or application code. All INF messages have an associated type to indicate the kind of message.

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

#### 5.12.1.1 ASCII output with debug contents

Message	UBX-INF-DEBUG					
Description	ASCII output with debug contents					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a></li></ul>					
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 + 1*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
Start of repeated block (N times)						
N*1	CH	-	str	-	ASCII Character	
End of repeated block						

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

#### 5.12.2.1 ASCII output with error contents

Message	UBX-INF-ERROR					
Description	ASCII output with error contents					
Firmware	Supported on: <ul style="list-style-type: none"><li>u-blox 9 with protocol version 30</li></ul>					
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 + 1*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
Start of repeated block (N times)						
N*1	CH	-	str	-	ASCII Character	
End of repeated block						

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

#### 5.12.3.1 ASCII output with informational contents

Message	UBX-INF-NOTICE					
Description	ASCII output with informational contents					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a></li></ul>					
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 + 1*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
Start of repeated block (N times)						
N*1	CH	-	str	-	ASCII Character	
End of repeated block						

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

#### 5.12.4.1 ASCII output with test contents

Message	UBX-INF-TEST					
Description	ASCII output with test contents					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a></li></ul>					
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 + 1*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
Start of repeated block (N times)						
N*1	CH	-	str	-	ASCII Character	
End of repeated block						

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

#### 5.12.5.1 ASCII output with warning contents

Message	UBX-INF-WARNING					
Description	ASCII output with warning contents					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a></li></ul>					
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 + 1*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
Start of repeated block (N times)						
N*1	CH	-	str	-	ASCII Character	
End of repeated block						

## 5.13 UBX-LOG (0x21)

Logging Messages: i.e. Log creation, deletion, info and retrieval.

Messages in the LOG class are used to configure and report status information of the logging and batching features.

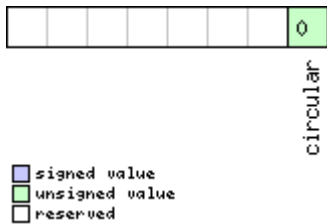
### 5.13.1 UBX-LOG-CREATE (0x21 0x07)

#### 5.13.1.1 Create Log File

Message	<b>UBX-LOG-CREATE</b>					
Description	<b>Create Log File</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li>u-blox 9 with protocol version 30</li> </ul>					
Type	Command					
Comment	<p>This message is used to create an initial logging file and activate the logging subsystem.</p> <p>UBX-ACK-ACK or UBX-ACK-NAK are returned to indicate success or failure.</p> <p>This message does not handle activation of recording or filtering of log entries (see CFG-LOGFILTER: Data Logger Configuration).</p>					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x21	0x07	8	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	The version of this message. Set to 0	
1	X1	-	logCfg	-	Config flags (see <a href="#">graphic below</a> )	
2	U1	-	reserved1	-	<b>Reserved</b>	
3	U1	-	logSize	-	<p>Indicates the size of the log:</p> <p>0 (maximum safe size): Ensures that logging will not be interrupted and enough space will be left available for all other uses of the filestore</p> <p>1 (minimum size):</p> <p>2 (user defined): See 'userDefinedSize' below</p>	
4	U4	-	userDefinedSize	bytes	<p>Sets the maximum amount of space in the filestore that can be used by the logging task.</p> <p>This field is only applicable if logSize is set to user defined.</p>	

## Bitfield logCfg

This graphic explains the bits of logCfg



Name	Description
circular	Log is circular (new entries overwrite old ones in a full log) if this bit set

### 5.13.2 UBX-LOG-ERASE (0x21 0x03)

#### 5.13.2.1 Erase Logged Data

Message	<b>UBX-LOG-ERASE</b>					
Description	<b>Erase Logged Data</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	This message deactivates the logging system and erases all logged data. <a href="#">UBX-ACK-ACK</a> or <a href="#">UBX-ACK-NAK</a> are returned to indicate success or failure.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x21	0x03	0	see below	CK_A CK_B
No payload						

### 5.13.3 UBX-LOG-FINDTIME (0x21 0x0E)

#### 5.13.3.1 Find index of a log entry based on a given time

Message	<b>UBX-LOG-FINDTIME</b>					
Description	<b>Find index of a log entry based on a given time</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	<p>This message can be used for a time-based search of a log. It can find the index of the first log entry with time equal to the given time, otherwise the index of the most recent entry with time less than the given time. This index can then be used with the <a href="#">UBX-LOG-RETRIEVE</a> message to provide time-based retrieval of log entries.</p> <p>Searching a log is effective for a given time later than the base date (January 1st, 2004). Searching a log for a given time earlier than the base date will result in an 'entry not found' response.</p> <p>Searching a log for a given time greater than the last recorded entry's time will return the index of the last recorded entry.</p>					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x21	0x0E	12	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	

## UBX-LOG-FINDTIME continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1	-	version	-	Message version (=0 for this version)
1	U1	-	type	-	Message type, 0 for request
2	U1[2]	-	reserved1	-	Reserved
4	U2	-	year	-	Year (1-65635) of UTC time
6	U1	-	month	-	Month (1-12) of UTC time
7	U1	-	day	-	Day (1-31) of UTC time
8	U1	-	hour	-	Hour (0-23) of UTC time
9	U1	-	minute	-	Minute (0-59) of UTC time
10	U1	-	second	-	Second (0-60) of UTC time
11	U1	-	reserved2	-	Reserved

### 5.13.3.2 Response to FINDTIME request

Message	<b>UBX-LOG-FINDTIME</b>					
Description	<b>Response to FINDTIME request</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x21	0x0E	8	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (=1 for this version)	
1	U1	-	type	-	Message type, 1 for response	
2	U1[2]	-	reserved1	-	Reserved	
4	U4	-	entryNumber	-	Index of the first log entry with time = given time, otherwise index of the most recent entry with time < given time. If 0xFFFFFFFF, no log entry found with time <= given time. The indexing of log entries is zero based.	

### 5.13.4 UBX-LOG-INFO (0x21 0x08)

#### 5.13.4.1 Poll for log information

Message	<b>UBX-LOG-INFO</b>					
Description	<b>Poll for log information</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Poll Request					
Comment	Upon sending of this message, the receiver returns UBX-LOG-INFO as defined below.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x21	0x08	0	see below	CK_A CK_B
No payload						

#### 5.13.4.2 Log information

Message	<b>UBX-LOG-INFO</b>					
Description	<b>Log information</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	This message is used to report information about the logging subsystem. Note: <ul style="list-style-type: none"> <li>The reported maximum log size will be smaller than that originally specified in LOG-CREATE due to logging and filestore implementation overheads.</li> <li>Log entries are compressed in a variable length fashion, so it may be difficult to predict log space usage with any precision.</li> <li>There may be times when the receiver does not have an accurate time (e.g. if the week number is not yet known), in which case some entries will not have a timestamp. This may result in the oldest/newest entry time values not taking account of these entries.</li> </ul>					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x21	0x08	48	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	The version of this message. Set to 1	
1	U1[3]	-	reserved1	-	<a href="#">Reserved</a>	
4	U4	-	filestoreCapacity	bytes	The capacity of the filestore	
8	U1[8]	-	reserved2	-	<a href="#">Reserved</a>	
16	U4	-	currentMaxLogSize	bytes	The maximum size the current log is allowed to grow to	
20	U4	-	currentLogSize	bytes	Approximate amount of space in log currently occupied	

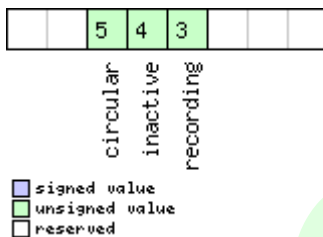


## UBX-LOG-INFO continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
24	U4	-	entryCount	-	Number of entries in the log. Note: for circular logs this value will decrease when a group of entries is deleted to make space for new ones.
28	U2	-	oldestYear	-	Oldest entry UTC year (1-65635) or zero if there are no entries with known time
30	U1	-	oldestMonth	-	Oldest month (1-12)
31	U1	-	oldestDay	-	Oldest day (1-31)
32	U1	-	oldestHour	-	Oldest hour (0-23)
33	U1	-	oldestMinute	-	Oldest minute (0-59)
34	U1	-	oldestSecond	-	Oldest second (0-60)
35	U1	-	reserved3	-	Reserved
36	U2	-	newestYear	-	Newest year (1-65635) or zero if there are no entries with known time
38	U1	-	newestMonth	-	Newest month (1-12)
39	U1	-	newestDay	-	Newest day (1-31)
40	U1	-	newestHour	-	Newest hour (0-23)
41	U1	-	newestMinute	-	Newest minute (0-59)
42	U1	-	newestSecond	-	Newest second (0-60)
43	U1	-	reserved4	-	Reserved
44	X1	-	status	-	Log status flags (see <a href="#">graphic below</a> )
45	U1[3]	-	reserved5	-	Reserved

## Bitfield status

This graphic explains the bits of status



Name	Description
recording	Log entry <b>recording</b> is currently turned on
inactive	Logging system not active - no log present
circular	The current log is circular

### 5.13.5 UBX-LOG-RETRIEVEPOSEXTRA (0x21 0x0f)

#### 5.13.5.1 Odometer log entry

Message	<b>UBX-LOG-RETRIEVEPOSEXTRA</b>					
Description	<b>Odometer log entry</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	This message is used to report an odometer log entry					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x21	0x0f	32	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	entryIndex	-	The index of this log entry	
4	U1	-	version	-	The version of this message. Set to 0	
5	U1	-	reserved1	-	<a href="#">Reserved</a>	
6	U2	-	year	-	Year (1-65635) of UTC time. Will be zero if time not known	
8	U1	-	month	-	Month (1-12) of UTC time	
9	U1	-	day	-	Day (1-31) of UTC time	
10	U1	-	hour	-	Hour (0-23) of UTC time	
11	U1	-	minute	-	Minute (0-59) of UTC time	
12	U1	-	second	-	Second (0-60) of UTC time	
13	U1[3]	-	reserved2	-	<a href="#">Reserved</a>	
16	U4	-	distance	-	Odometer distance traveled since the last time the odometer was reset by a <a href="#">UBX-NAV-RESETODO</a>	
20	U1[12]	-	reserved3	-	<a href="#">Reserved</a>	

### 5.13.6 UBX-LOG-RETRIEVEPOS (0x21 0x0b)

#### 5.13.6.1 Position fix log entry

Message	<b>UBX-LOG-RETRIEVEPOS</b>					
Description	<b>Position fix log entry</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	This message is used to report a position fix log entry					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x21	0x0b	40	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	entryIndex	-	The index of this log entry	
4	I4	1e-7	lon	deg	Longitude	
8	I4	1e-7	lat	deg	Latitude	

## UBX-LOG-RETRIEVEPOS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
12	I4	-	hMSL	mm	Height above mean sea level
16	U4	-	hAcc	mm	Horizontal accuracy estimate
20	U4	-	gSpeed	mm/s	Ground speed (2-D)
24	U4	1e-5	heading	deg	Heading
28	U1	-	version	-	The version of this message. Set to 0
29	U1	-	fixType	-	Fix type: 0x01: Dead Reckoning only 0x02: 2D-Fix 0x03: 3D-Fix 0x04: GNSS + Dead Reckoning combined
30	U2	-	year	-	Year (1-65635) of UTC time
32	U1	-	month	-	Month (1-12) of UTC time
33	U1	-	day	-	Day (1-31) of UTC time
34	U1	-	hour	-	Hour (0-23) of UTC time
35	U1	-	minute	-	Minute (0-59) of UTC time
36	U1	-	second	-	Second (0-60) of UTC time
37	U1	-	reserved1	-	Reserved
38	U1	-	numSV	-	Number of satellites used in the position fix
39	U1	-	reserved2	-	Reserved

### 5.13.7 UBX-LOG-RETRIEVESTRING (0x21 0x0d)

#### 5.13.7.1 Byte string log entry

Message	<b>UBX-LOG-RETRIEVESTRING</b>					
Description	<b>Byte string log entry</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	This message is used to report a byte string log entry					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x21	0x0d	16 + 1*byteCount	see below	CK_A CK_B

## Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4	-	entryIndex	-	The index of this log entry
4	U1	-	version	-	The version of this message. Set to 0
5	U1	-	reserved1	-	Reserved
6	U2	-	year	-	Year (1-65635) of UTC time. Will be zero if time not known
8	U1	-	month	-	Month (1-12) of UTC time
9	U1	-	day	-	Day (1-31) of UTC time
10	U1	-	hour	-	Hour (0-23) of UTC time
11	U1	-	minute	-	Minute (0-59) of UTC time

## UBX-LOG-RETRIEVESTRING continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
12	U1	-	second	-	Second (0-60) of UTC time
13	U1	-	reserved2	-	Reserved
14	U2	-	byteCount	-	Size of string in bytes
Start of repeated block (byteCount times)					
16 + 1*N	U1	-	bytes	-	The bytes of the string
End of repeated block					

### 5.13.8 UBX-LOG-RETRIEVE (0x21 0x09)

#### 5.13.8.1 Request log data

Message	<b>UBX-LOG-RETRIEVE</b>				
Description	<b>Request log data</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Command				
Comment	This message is used to request logged data (log recording must first be disabled, (see <a href="#">CFG-LOGFILTER: Data Logger Configuration</a> )). Log entries are returned in chronological order, using the messages <a href="#">UBX-LOG-RETRIEVEPOS</a> and <a href="#">UBX-LOG-RETRIEVESTRING</a> . The maximum number of entries that can be returned in response to a single UBX-LOG-RETRIEVE message is 256. If more entries than this are required the message will need to be sent multiple times with different startNumbers. The retrieve will be stopped if any UBX-LOG message is received.				
Message Structure	Header	Class	ID	Length (Bytes)	Payload
	0xB5 0x62	0x21	0x09	12	see below
Checksum					
CK_A CK_B					
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4	-	startNumber	-	Index of first log entry to be transferred. If it is larger than the index of the last available log entry, then the first log entry to be transferred is the last available log entry. The indexing of log entries is zero based.
4	U4	-	entryCount	-	Number of log entries to transfer in total including the first entry to be transferred. If it is larger than the log entries available starting from the first entry to be transferred, then only the available log entries are transferred followed by a <a href="#">UBX-ACK-NAK</a> . The maximum is 256.
8	U1	-	version	-	The version of this message. Set to 0.
9	U1[3]	-	reserved1	-	Reserved

### 5.13.9 UBX-LOG-STRING (0x21 0x04)

#### 5.13.9.1 Store arbitrary string in on-board flash

Message	UBX-LOG-STRING					
Description	Store arbitrary string in on-board flash					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a></li></ul>					
Type	Command					
Comment	This message can be used to store an arbitrary byte string in the on-board flash memory. The maximum length that can be stored is 256 bytes.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x21	0x04	0 + 1*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
Start of repeated block (N times)						
N*1	U1	-	bytes	-	The string of bytes to be logged (maximum 256)	
End of repeated block						

## 5.14 UBX-MGA (0x13)

Multiple GNSS Assistance Messages: i.e. Assistance data for various GNSS.

Messages in the MGA class are used for GNSS aiding information from and to the receiver.

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

#### 5.14.1.1 UBX-MGA-ACK-DATA0

Message	<b>UBX-MGA-ACK-DATA0</b>					
Description	<b>Multiple GNSS Acknowledge message</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	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 the section Flow control in <a href="#">Integration Manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x60	8	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Type of acknowledgment: 0: The message was not used by the receiver (see infoCode field for an indication of why) 1: The message was accepted for use by the receiver (the infoCode field will be 0)	
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: 0: The receiver accepted the data 1: The receiver doesn't know the time so can't use the data (To resolve this a <a href="#">UBX-MGA-INITIMEUTC</a> message should be supplied first) 2: The message version is not supported by the receiver 3: The message size does not match the message version 4: The message data could not be stored to the database 5: The receiver is not ready to use the message data 6: The message type is unknown	
3	U1	-	msgId	-	UBX message ID of the ack'ed message	

UBX-MGA-ACK continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
4	U1[4]	-	msgPayloadStart	-	The first 4 bytes of the ack'ed message's payload

## 5.14.2 UBX-MGA-BDS (0x13 0x03)

### 5.14.2.1 UBX-MGA-BDS-EPH

Message	<b>UBX-MGA-BDS-EPH</b>					
Description	<b>BDS Ephemeris Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of BeiDou ephemeris assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x03	88	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x01 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1	-	svId	-	BDS satellite identifier (see <a href="#">Satellite Numbering</a> )	
3	U1	-	reserved1	-	<a href="#">Reserved</a>	
4	U1	-	SatH1	-	Autonomous satellite Health flag	
5	U1	-	IODC	-	Issue of Data, Clock	
6	I2	2 <sup>-66</sup>	a2	s/s <sup>2</sup>	Time polynomial coefficient 2	
8	I4	2 <sup>-50</sup>	a1	s/s	Time polynomial coefficient 1	
12	I4	2 <sup>-33</sup>	a0	s	Time polynomial coefficient 0	
16	U4	2 <sup>3</sup>	toc	s	Clock data reference time	
20	I2	0.1	TGD1	ns	Equipment Group Delay Differential	
22	U1	-	URAI	-	User Range Accuracy Index	
23	U1	-	IODE	-	Issue of Data, Ephemeris	
24	U4	2 <sup>3</sup>	toe	s	Ephemeris reference time	
28	U4	2 <sup>-19</sup>	sqrta	m <sup>0.5</sup>	Square root of semi-major axis	
32	U4	2 <sup>-33</sup>	e	-	Eccentricity	
36	I4	2 <sup>-31</sup>	omega	semi-circles	Argument of perigee	
40	I2	2 <sup>-43</sup>	Deltan	semi-circles /s	Mean motion difference from computed value	
42	I2	2 <sup>-43</sup>	IDOT	semi-circles /s	Rate of inclination angle	

UBX-MGA-BDS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
44	I4	2 <sup>-31</sup>	M0	semi-circles	Mean anomaly at reference time
48	I4	2 <sup>-31</sup>	Omega0	semi-circles	Longitude of ascending node of orbital of plane computed according to reference time
52	I4	2 <sup>-43</sup>	OmegaDot	semi-circles /s	Rate of right ascension
56	I4	2 <sup>-31</sup>	i0	semi-circles	Inclination angle at reference time
60	I4	2 <sup>-31</sup>	Cuc	semi-circles	Amplitude of cosine harmonic correction term to the argument of latitude
64	I4	2 <sup>-31</sup>	Cus	semi-circles	Amplitude of sine harmonic correction term to the argument of latitude
68	I4	2 <sup>-6</sup>	Crc	m	Amplitude of cosine harmonic correction term to the orbit radius
72	I4	2 <sup>-6</sup>	Crs	m	Amplitude of sine harmonic correction term to the orbit radius
76	I4	2 <sup>-31</sup>	Cic	semi-circles	Amplitude of cosine harmonic correction term to the angle of inclination
80	I4	2 <sup>-31</sup>	Cis	semi-circles	Amplitude of sine harmonic correction term to the angle of inclination
84	U1[4]	-	reserved2	-	Reserved

#### 5.14.2.2 UBX-MGA-BDS-ALM

Message	<b>UBX-MGA-BDS-ALM</b>					
Description	<b>BDS Almanac Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of BeiDou almanac assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x03	40	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x02 for this version)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1	-	svId	-	BeiDou satellite identifier (see <a href="#">Satellite Numbering</a> )	
3	U1	-	reserved1	-	Reserved	
4	U1	-	wna	week	Almanac Week Number	



## UBX-MGA-BDS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
5	U1	2 <sup>12</sup>	toa	s	Almanac reference time
6	I2	2 <sup>-19</sup>	deltaI	semi-circles	Almanac correction of orbit reference inclination at reference time
8	U4	2 <sup>-11</sup>	sqrtA	m <sup>0.5</sup>	Almanac square root of semi-major axis
12	U4	2 <sup>-21</sup>	e	-	Almanac eccentricity
16	I4	2 <sup>-23</sup>	omega	semi-circles	Almanac argument of perigee
20	I4	2 <sup>-23</sup>	M0	semi-circles	Almanac mean anomaly at reference time
24	I4	2 <sup>-23</sup>	Omega0	semi-circles	Almanac longitude of ascending node of orbit plane at computed according to reference time
28	I4	2 <sup>-38</sup>	omegaDot	semi-circles /s	Almanac rate of right ascension
32	I2	2 <sup>-20</sup>	a0	s	Almanac satellite clock bias
34	I2	2 <sup>-38</sup>	a1	s/s	Almanac satellite clock rate
36	U1[4]	-	reserved2	-	Reserved

### 5.14.2.3 UBX-MGA-BDS-HEALTH

Message	<b>UBX-MGA-BDS-HEALTH</b>					
Description	<b>BDS Health Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of BeiDou health assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x03	68	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x04 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	Reserved	
4	U2[30]	-	healthCode	-	Each two-byte value represents a BDS SV (1-30). The 9 LSBs of each byte contain the 9 bit health code from subframe 5 pages 7,8 of the D1 message, and from subframe 5 pages 35,36 of the D1 message.	
64	U1[4]	-	reserved2	-	Reserved	

#### 5.14.2.4 UBX-MGA-BDS-UTC

Message	<b>UBX-MGA-BDS-UTC</b>					
Description	<b>BDS UTC Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of BeiDou UTC assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x03	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x05 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
4	I4	2 <sup>-30</sup>	a0UTC	s	BDT clock bias relative to UTC	
8	I4	2 <sup>-50</sup>	a1UTC	s/s	BDT clock rate relative to UTC	
12	I1	-	dtLS	s	Delta time due to leap seconds before the new leap second effective	
13	U1[1]	-	reserved2	-	<a href="#">Reserved</a>	
14	U1	-	wnRec	week	BeiDou week number of reception of this UTC parameter set (8 bit truncated)	
15	U1	-	wnLSF	week	Week number of the new leap second	
16	U1	-	dN	day	Day number of the new leap second	
17	I1	-	dtLSF	s	Delta time due to leap seconds after the new leap second effective	
18	U1[2]	-	reserved3	-	<a href="#">Reserved</a>	

#### 5.14.2.5 UBX-MGA-BDS-IONO

Message	<b>UBX-MGA-BDS-IONO</b>					
Description	<b>BDS Ionospheric Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of BeiDou ionospheric assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x03	16	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x06 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	

## UBX-MGA-BDS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
4	I1	2 <sup>-30</sup>	alpha0	s	Ionospheric parameter alpha0
5	I1	2 <sup>-27</sup>	alpha1	s/pi	Ionospheric parameter alpha1
6	I1	2 <sup>-24</sup>	alpha2	s/pi <sup>2</sup>	Ionospheric parameter alpha2
7	I1	2 <sup>-24</sup>	alpha3	s/pi <sup>3</sup>	Ionospheric parameter alpha3
8	I1	2 <sup>-11</sup>	beta0	s	Ionospheric parameter beta0
9	I1	2 <sup>-14</sup>	beta1	s/pi	Ionospheric parameter beta1
10	I1	2 <sup>-16</sup>	beta2	s/pi <sup>2</sup>	Ionospheric parameter beta2
11	I1	2 <sup>-16</sup>	beta3	s/pi <sup>3</sup>	Ionospheric parameter beta3
12	U1[4]	-	reserved2	-	Reserved

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

#### 5.14.3.1 Poll the Navigation Database

Message	<b>UBX-MGA-DBD</b>					
Description	<b>Poll the Navigation Database</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Poll Request					
Comment	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.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x80	0	see below	CK_A CK_B
No payload						

#### 5.14.3.2 Navigation Database Dump Entry

Message	<b>UBX-MGA-DBD</b>					
Description	<b>Navigation Database Dump Entry</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input/Output					
Comment	<b>UBX-MGA-DBD messages are only intended to be sent back to the same receiver that generated them.</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 the section AssistNow online in <a href="#">Integration manual</a> for details. The maximum payload size for firmware 2.01 onwards is 164 bytes (which makes the maximum message size 172 bytes).					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x80	12 + 1*N	see below	CK_A CK_B

Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1[12]	-	reserved1	-	<a href="#">Reserved</a>
Start of repeated block (N times)					
12 + 1*N	U1	-	data	-	fw specific data
End of repeated block					

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

##### 5.14.4.1 UBX-MGA-GAL-EPH

Message	<b>UBX-MGA-GAL-EPH</b>					
Description	<b>Galileo Ephemeris Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of Galileo ephemeris assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x02	76	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
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	-	reserved1	-	<a href="#">Reserved</a>	
4	U2	-	iodNav	-	Ephemeris and clock correction Issue of Data	
6	I2	2 <sup>-43</sup>	deltaN	semi-circles /s	Mean motion difference from computed value	
8	I4	2 <sup>-31</sup>	m0	semi-circles	Mean anomaly at reference time	
12	U4	2 <sup>-33</sup>	e	-	Eccentricity	
16	U4	2 <sup>-19</sup>	sqrtA	m <sup>0.5</sup>	Square root of the semi-major axis	
20	I4	2 <sup>-31</sup>	omega0	semi-circles	Longitude of ascending node of orbital plane at weekly epoch	
24	I4	2 <sup>-31</sup>	i0	semi-circles	Inclination angle at reference time	
28	I4	2 <sup>-31</sup>	omega	semi-circles	Argument of perigee	
32	I4	2 <sup>-43</sup>	omegaDot	semi-circles /s	Rate of change of right ascension	

UBX-MGA-GAL continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
36	I2	2 <sup>-43</sup>	iDot	semi-circles /s	Rate of change of inclination angle
38	I2	2 <sup>-29</sup>	cuc	radians	Amplitude of the cosine harmonic correction term to the argument of latitude
40	I2	2 <sup>-29</sup>	cus	radians	Amplitude of the sine harmonic correction term to the argument of latitude
42	I2	2 <sup>-5</sup>	crc	radians	Amplitude of the cosine harmonic correction term to the orbit radius
44	I2	2 <sup>-5</sup>	crs	radians	Amplitude of the sine harmonic correction term to the orbit radius
46	I2	2 <sup>-29</sup>	cic	radians	Amplitude of the cosine harmonic correction term to the angle of inclination
48	I2	2 <sup>-29</sup>	cis	radians	Amplitude of the sine harmonic correction term to the angle of inclination
50	U2	60	toe	s	Ephemeris reference time
52	I4	2 <sup>-34</sup>	af0	s	SV clock bias correction coefficient
56	I4	2 <sup>-46</sup>	af1	s/s	SV clock drift correction coefficient
60	I1	2 <sup>-59</sup>	af2	s/s square d	SV clock drift rate correction coefficient
61	U1	-	sisIndexE1E5b	-	Signal-In-Space Accuracy index for dual frequency E1-E5b
62	U2	60	toc	s	Clock correction data reference Time of Week
64	I2	-	bgdE1E5b	-	E1-E5b Broadcast Group Delay
66	U1[2]	-	reserved2	-	Reserved
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]	-	reserved3	-	Reserved

#### 5.14.4.2 UBX-MGA-GAL-ALM

Message	<b>UBX-MGA-GAL-ALM</b>					
Description	<b>Galileo Almanac Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of Galileo almanac assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x02	32	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	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	-	reserved1	-	<a href="#">Reserved</a>	
4	U1	-	ioda	-	Almanac Issue of Data	
5	U1	-	almWNa	week	Almanac reference week number	
6	U2	600	toa	s	Almanac reference time	
8	I2	2 <sup>-9</sup>	deltaSqrtA	m <sup>0.5</sup>	Difference with respect to the square root of the nominal semi-major axis (29 600 km)	
10	U2	2 <sup>-16</sup>	e	-	Eccentricity	
12	I2	2 <sup>-14</sup>	deltaI	semi-circles	Inclination at reference time relative to i0 = 56 degree	
14	I2	2 <sup>-15</sup>	omega0	semi-circles	Longitude of ascending node of orbital plane at weekly epoch	
16	I2	2 <sup>-33</sup>	omegaDot	semi-circles /s	Rate of change of right ascension	
18	I2	2 <sup>-15</sup>	omega	semi-circles	Argument of perigee	
20	I2	2 <sup>-15</sup>	m0	semi-circles	Satellite mean anomaly at reference time	
22	I2	2 <sup>-19</sup>	af0	s	Satellite clock correction bias 'truncated'	
24	I2	2 <sup>-38</sup>	af1	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]	-	reserved2	-	<a href="#">Reserved</a>	

#### 5.14.4.3 UBX-MGA-GAL-TIMEOFFSET

Message	<b>UBX-MGA-GAL-TIMEOFFSET</b>					
Description	<b>Galileo GPS time offset assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of Galileo time to GPS time offset. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x02	12	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x03 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
4	I2	2 <sup>-35</sup>	a0G	s	Constant term of the polynomial describing the offset	
6	I2	2 <sup>-51</sup>	a1G	s/s	Rate of change of the offset	
8	U1	3600	t0G	s	DReference time for GGTO data	
9	U1	-	wn0G	weeks	Week Number of GGTO reference	
10	U1[2]	-	reserved2	-	<a href="#">Reserved</a>	

#### 5.14.4.4 UBX-MGA-GAL-UTC

Message	<b>UBX-MGA-GAL-UTC</b>					
Description	<b>Galileo UTC Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of Galileo UTC assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x02	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x05 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
4	I4	2 <sup>-30</sup>	a0	s	First parameter of UTC polynomial	
8	I4	2 <sup>-50</sup>	a1	s/s	Second parameter of UTC polynomial	
12	I1	-	dtLS	s	Delta time due to current leap seconds	
13	U1	3600	tot	s	UTC parameters reference time of week (Galileo time)	

UBX-MGA-GAL continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
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]	-	reserved2	-	Reserved

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

#### 5.14.5.1 UBX-MGA-GLO-EPH

Message	<b>UBX-MGA-GLO-EPH</b>					
Description	<b>GLONASS Ephemeris Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of GLONASS ephemeris assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x06	48	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
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	-	reserved1	-	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	2 <sup>-11</sup>	x	km	X component of the SV position in PZ-90.02 coordinate System	
12	I4	2 <sup>-11</sup>	y	km	Y component of the SV position in PZ-90.02 coordinate System	
16	I4	2 <sup>-11</sup>	z	km	Z component of the SV position in PZ-90.02 coordinate System	



UBX-MGA-GLO continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
20	I4	2 <sup>-20</sup>	dx	km/s	X component of the SV velocity in PZ-90.02 coordinate System
24	I4	2 <sup>-20</sup>	dy	km/s	Y component of the SV velocity in PZ-90.02 coordinate System
28	I4	2 <sup>-20</sup>	dz	km/s	Z component of the SV velocity in PZ-90.02 coordinate System
32	I1	2 <sup>-30</sup>	ddx	km/s <sup>2</sup>	X component of the SV acceleration in PZ-90.02 coordinate System
33	I1	2 <sup>-30</sup>	ddy	km/s <sup>2</sup>	Y component of the SV acceleration in PZ-90.02 coordinate System
34	I1	2 <sup>-30</sup>	ddz	km/s <sup>2</sup>	Z component of the SV acceleration in PZ-90.02 coordinate System
35	U1	15	tb	minutes	Index of a time interval within current day according to UTC(SU)
36	I2	2 <sup>-40</sup>	gamma	-	Relative carrier frequency deviation
38	U1	-	E	days	Ephemeris data age indicator
39	I1	2 <sup>-30</sup>	deltaTau	s	Time difference between L2 and L1 band
40	I4	2 <sup>-30</sup>	tau	s	SV clock bias
44	U1[4]	-	reserved2	-	Reserved

#### 5.14.5.2 UBX-MGA-GLO-ALM

Message	<b>UBX-MGA-GLO-ALM</b>					
Description	<b>GLONASS Almanac Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of GLONASS almanac assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x06	36	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
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	-	reserved1	-	Reserved	
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)	

## UBX-MGA-GLO continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
7	U1	-	C	-	Unhealthy flag at instant of almanac upload (1 indicates operability of satellite)
8	I2	2 <sup>-18</sup>	tau	s	Coarse time correction to GLONASS time
10	U2	2 <sup>-20</sup>	epsilon	-	Eccentricity
12	I4	2 <sup>-20</sup>	lambda	semi-circles	Longitude of the first (within the N-day) ascending node of satellite orbit in PC-90. 02 coordinate system
16	I4	2 <sup>-20</sup>	deltaI	semi-circles	Correction to the mean value of inclination
20	U4	2 <sup>-5</sup>	tLambda	s	Time of the first ascending node passage
24	I4	2 <sup>-9</sup>	deltaT	s/orbital-period	Correction to the mean value of Draconian period
28	I1	2 <sup>-14</sup>	deltaDT	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]	-	reserved2	-	Reserved

### 5.14.5.3 UBX-MGA-GLO-TIMEOFFSET

Message	<b>UBX-MGA-GLO-TIMEOFFSET</b>					
Description	<b>GLONASS Auxiliary Time Offset Assistance</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li>u-blox 9 with protocol version 30</li> </ul>					
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 the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x06	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	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	2 <sup>-27</sup>	tauC	s	Time scale correction to UTC(SU) time	
8	I4	2 <sup>-31</sup>	tauGps	s	Correction to GPS time relative to GLONASS time	

UBX-MGA-GLO continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
12	I2	2 <sup>-10</sup>	B1	s	Coefficient to determine delta UT1
14	I2	2 <sup>-16</sup>	B2	s/msd	Rate of change of delta UT1
16	U1[4]	-	reserved1	-	<a href="#">Reserved</a>

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

### 5.14.6.1 UBX-MGA-GPS-EPH

Message	<b>UBX-MGA-GPS-EPH</b>					
Description	<b>GPS Ephemeris Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of GPS ephemeris assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x00	68	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description
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	-	reserved1	-	<a href="#">Reserved</a>
4	U1	-	fitInterval	-	Fit interval flag
5	U1	-	uraIndex	-	URA index
6	U1	-	svHealth	-	SV health
7	I1	2 <sup>-31</sup>	tgd	s	Group delay differential
8	U2	-	iodc	-	IODC
10	U2	2 <sup>-4</sup>	toc	s	Clock data reference time
12	U1	-	reserved2	-	<a href="#">Reserved</a>
13	I1	2 <sup>-55</sup>	af2	s/s square d	Time polynomial coefficient 2
14	I2	2 <sup>-43</sup>	af1	s/s	Time polynomial coefficient 1
16	I4	2 <sup>-31</sup>	af0	s	Time polynomial coefficient 0
20	I2	2 <sup>-5</sup>	crs	m	Crs
22	I2	2 <sup>-43</sup>	deltaN	semi-circles /s	Mean motion difference from computed value
24	I4	2 <sup>-31</sup>	m0	semi-circles	Mean anomaly at reference time
28	I2	2 <sup>-29</sup>	cuc	radians	Amplitude of cosine harmonic correction term to argument of latitude

## UBX-MGA-GPS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
30	I2	2 <sup>-29</sup>	cus	radians	Amplitude of sine harmonic correction term to argument of latitude
32	U4	2 <sup>-33</sup>	e	-	Eccentricity
36	U4	2 <sup>-19</sup>	sqrtA	m <sup>0.5</sup>	Square root of the semi-major axis
40	U2	2 <sup>4</sup>	toe	s	Reference time of ephemeris
42	I2	2 <sup>-29</sup>	cic	radians	Amplitude of cos harmonic correction term to angle of inclination
44	I4	2 <sup>-31</sup>	omega0	semi-circles	Longitude of ascending node of orbit plane at weekly epoch
48	I2	2 <sup>-29</sup>	cis	radians	Amplitude of sine harmonic correction term to angle of inclination
50	I2	2 <sup>-5</sup>	crc	m	Amplitude of cosine harmonic correction term to orbit radius
52	I4	2 <sup>-31</sup>	i0	semi-circles	Inclination angle at reference time
56	I4	2 <sup>-31</sup>	omega	semi-circles	Argument of perigee
60	I4	2 <sup>-43</sup>	omegaDot	semi-circles/s	Rate of right ascension
64	I2	2 <sup>-43</sup>	idot	semi-circles/s	Rate of inclination angle
66	U1[2]	-	reserved3	-	Reserved

### 5.14.6.2 UBX-MGA-GPS-ALM

Message	<b>UBX-MGA-GPS-ALM</b>					
Description	<b>GPS Almanac Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of GPS almanac assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x00	36	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	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	

## UBX-MGA-GPS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
4	U2	2 <sup>-21</sup>	e	-	Eccentricity
6	U1	-	almWNa	week	Reference week number of almanac (the 8 bit WNa field)
7	U1	2 <sup>-12</sup>	toa	s	Reference time of almanac
8	I2	2 <sup>-19</sup>	deltaI	semi-circles	Delta inclination angle at reference time
10	I2	2 <sup>-38</sup>	omegaDot	semi-circles /s	Rate of right ascension
12	U4	2 <sup>-11</sup>	sqrta	m <sup>0.5</sup>	Square root of the semi-major axis
16	I4	2 <sup>-23</sup>	omega0	semi-circles	Longitude of ascending node of orbit plane
20	I4	2 <sup>-23</sup>	omega	semi-circles	Argument of perigee
24	I4	2 <sup>-23</sup>	m0	semi-circles	Mean anomaly at reference time
28	I2	2 <sup>-20</sup>	af0	s	Time polynomial coefficient 0 (8 MSBs)
30	I2	2 <sup>-38</sup>	af1	s/s	Time polynomial coefficient 1
32	U1[4]	-	reserved1	-	Reserved

### 5.14.6.3 UBX-MGA-GPS-HEALTH

Message	<b>UBX-MGA-GPS-HEALTH</b>					
Description	<b>GPS Health Assistance</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li>u-blox 9 with protocol version 30</li> </ul>					
Type	Input					
Comment	This message allows the delivery of GPS health assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x00	40	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x04 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	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]	-	reserved2	-	Reserved	

#### 5.14.6.4 UBX-MGA-GPS-UTC

Message	<b>UBX-MGA-GPS-UTC</b>					
Description	<b>GPS UTC Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of GPS UTC assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x00	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x05 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
4	I4	2 <sup>-30</sup>	utcA0	s	First parameter of UTC polynomial	
8	I4	2 <sup>-50</sup>	utcA1	s/s	Second parameter of UTC polynomial	
12	I1	-	utcDtLS	s	Delta time due to current leap seconds	
13	U1	2 <sup>12</sup>	utcTot	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]	-	reserved2	-	<a href="#">Reserved</a>	

#### 5.14.6.5 UBX-MGA-GPS-IONO

Message	<b>UBX-MGA-GPS-IONO</b>					
Description	<b>GPS Ionosphere Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of GPS ionospheric assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x00	16	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x06 for this type)	

## UBX-MGA-GPS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
1	U1	-	version	-	Message version (0x00 for this version)
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>
4	I1	2 <sup>-30</sup>	ionoAlpha0	s	Ionospheric parameter alpha0 [s]
5	I1	2 <sup>-27</sup>	ionoAlpha1	s/semi-circle	Ionospheric parameter alpha1 [s/semi-circle]
6	I1	2 <sup>-24</sup>	ionoAlpha2	s/(semi-circle <sup>2</sup> )	Ionospheric parameter alpha2 [s/semi-circle <sup>2</sup> ]
7	I1	2 <sup>-24</sup>	ionoAlpha3	s/(semi-circle <sup>3</sup> )	Ionospheric parameter alpha3 [s/semi-circle <sup>3</sup> ]
8	I1	2 <sup>-11</sup>	ionoBeta0	s	Ionospheric parameter beta0 [s]
9	I1	2 <sup>-14</sup>	ionoBeta1	s/semi-circle	Ionospheric parameter beta1 [s/semi-circle]
10	I1	2 <sup>-16</sup>	ionoBeta2	s/(semi-circle <sup>2</sup> )	Ionospheric parameter beta2 [s/semi-circle <sup>2</sup> ]
11	I1	2 <sup>-16</sup>	ionoBeta3	s/(semi-circle <sup>3</sup> )	Ionospheric parameter beta3 [s/semi-circle <sup>3</sup> ]
12	U1[4]	-	reserved2	-	<a href="#">Reserved</a>

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

#### 5.14.7.1 UBX-MGA-INI-POS\_XYZ

Message	<b>UBX-MGA-INI-POS_XYZ</b>					
Description	<b>Initial Position Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	<b>Supplying position assistance that is inaccurate by more than the specified position accuracy, may lead to substantially degraded receiver performance.</b> 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 the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x40	20	see below	CK_A CK_B
Payload Contents:						

## UBX-MGA-INI continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1	-	type	-	Message type (0x00 for this type)
1	U1	-	version	-	Message version (0x00 for this version)
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>
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)

## 5.14.7.2 UBX-MGA-INI-POS\_LLH

Message	<b>UBX-MGA-INI-POS_LLH</b>					
Description	<b>Initial Position Assistance</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li><a href="#">u-blox 9 with protocol version 30</a></li> </ul>					
Type	Input					
Comment	<b>Supplying position assistance that is inaccurate by more than the specified position accuracy, may lead to substantially degraded receiver performance.</b> 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 the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x40	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x01 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
4	I4	1e-7	lat	deg	WGS84 Latitude	
8	I4	1e-7	lon	deg	WGS84 Longitude	
12	I4	-	alt	cm	WGS84 Altitude	
16	U4	-	posAcc	cm	Position accuracy (stddev)	

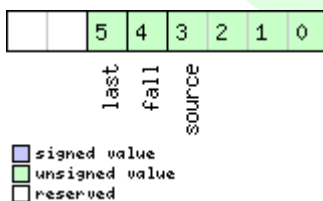


### 5.14.7.3 UBX-MGA-INI-TIME\_UTC

Message	<b>UBX-MGA-INI-TIME_UTC</b>					
Description	<b>Initial Time Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	<b>Supplying time assistance that is inaccurate by more than the specified time accuracy, may lead to substantially degraded receiver performance.</b> 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 the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x40	24	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
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 (see <a href="#">graphic below</a> )	
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	U1	-	reserved1	-	<a href="#">Reserved</a>	
12	U4	-	ns	ns	Nanoseconds, from 0 to 999,999,999	
16	U2	-	tAccS	s	Seconds part of time accuracy	
18	U1[2]	-	reserved2	-	<a href="#">Reserved</a>	
20	U4	-	tAccNs	ns	Nanoseconds part of time accuracy, from 0 to 999,999,999	

#### Bitfield ref

This graphic explains the bits of ref



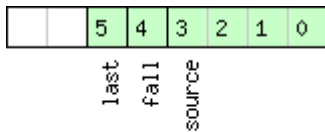
Name	Description
source	0: none, i.e. on receipt of message (will be inaccurate!) 1: relative to pulse sent to EXTINT0 2: relative to pulse sent to EXTINT1 3-15: reserved
fall	use falling edge of EXTINT pulse (default rising) - only if source is EXTINT
last	use last EXTINT pulse (default next pulse) - only if source is EXTINT

#### 5.14.7.4 UBX-MGA-INI-TIME\_GNSS

Message	<b>UBX-MGA-INI-TIME_GNSS</b>					
Description	<b>Initial Time Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	<b>Supplying time assistance that is inaccurate by more than the specified time accuracy, may lead to substantially degraded receiver performance.</b> 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 the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x40	24	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	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 (see <a href="#">graphic below</a> )	
3	U1	-	gnssId	-	Source of time information. Currently supported: 0: GPS time 2: Galileo time 3: BeiDou time 6: GLONASS time: week = 834 + ((N4-1)*1461 + Nt)/7, tow = (((N4-1)*1461 + Nt) % 7) * 86400 + tod	
4	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
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]	-	reserved2	-	<a href="#">Reserved</a>	
20	U4	-	tAccNs	ns	Nanoseconds part of time accuracy, from 0 to 999,999,999	

## Bitfield ref

This graphic explains the bits of ref



☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
source	0: none, i.e. on receipt of message (will be inaccurate!) 1: relative to pulse sent to EXTINT0 2: relative to pulse sent to EXTINT1 3-15: reserved
fall	use falling edge of EXTINT pulse (default rising) - only if source is EXTINT
last	use last EXTINT pulse (default next pulse) - only if source is EXTINT

### 5.14.7.5 UBX-MGA-INI-CLKD

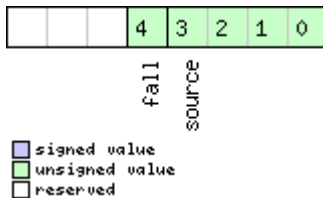
Message	<b>UBX-MGA-INI-CLKD</b>					
Description	<b>Initial Clock Drift Assistance</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li>u-blox 9 with protocol version 30</li> </ul>					
Type	Input					
Comment	<b>Supplying clock drift assistance that is inaccurate by more than the specified accuracy, may lead to substantially degraded receiver performance.</b> This message allows the delivery of clock drift assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x40	12	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x20 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
4	I4	-	clkD	ns/s	Clock drift	
8	U4	-	clkDAcc	ns/s	Clock drift accuracy	

### 5.14.7.6 UBX-MGA-INIT-FREQ

Message	<b>UBX-MGA-INIT-FREQ</b>					
Description	<b>Initial Frequency Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	<b>Supplying external frequency assistance that is inaccurate by more than the specified accuracy, may lead to substantially degraded receiver performance.</b> This message allows the delivery of external frequency assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x40	12	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x21 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1	-	reserved1	-	<a href="#">Reserved</a>	
3	X1	-	flags	-	Frequency reference (see <a href="#">graphic below</a> )	
4	I4	1e-2	freq	Hz	Frequency	
8	U4	-	freqAcc	ppb	Frequency accuracy	

### Bitfield flags

This graphic explains the bits of flags



Name	Description
source	0: frequency available on EXTINT0 1: frequency available on EXTINT1 2-15: reserved
fall	use falling edge of EXTINT pulse (default rising)

### 5.14.7.7 UBX-MGA-INI-EOP

Message	<b>UBX-MGA-INI-EOP</b>					
Description	<b>Earth Orientation Parameters Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of new Earth Orientation Parameters (EOP) to a receiver to improve AssistNow Autonomous operation.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x40	72	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x30 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
4	U2	-	d2kRef	d	reference time (days since 1.1.2000 12.00h UTC)	
6	U2	-	d2kMax	d	expiration time (days since 1.1.2000 12.00h UTC)	
8	I4	2 <sup>-30</sup>	xpP0	arcsec	x <sub>p</sub> t <sup>0</sup> polynomial term (offset)	
12	I4	2 <sup>-30</sup>	xpP1	arcsec /d	x <sub>p</sub> t <sup>1</sup> polynomial term (drift)	
16	I4	2 <sup>-30</sup>	ypP0	arcsec	y <sub>p</sub> t <sup>0</sup> polynomial term (offset)	
20	I4	2 <sup>-30</sup>	ypP1	arcsec /d	y <sub>p</sub> t <sup>1</sup> polynomial term (drift)	
24	I4	2 <sup>-25</sup>	dUT1	s	dUT1 t <sup>0</sup> polynomial term (offset)	
28	I4	2 <sup>-30</sup>	ddUT1	s/d	dUT1 t <sup>1</sup> polynomial term (drift)	
32	U1[40]	-	reserved2	-	<a href="#">Reserved</a>	

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

#### 5.14.8.1 UBX-MGA-QZSS-EPH

Message	<b>UBX-MGA-QZSS-EPH</b>					
Description	<b>QZSS Ephemeris Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of QZSS ephemeris assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x05	68	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x01 for this type)	

UBX-MGA-QZSS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
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	-	reserved1	-	<a href="#">Reserved</a>
4	U1	-	fitInterval	-	Fit interval flag
5	U1	-	uraIndex	-	URA index
6	U1	-	svHealth	-	SV health
7	I1	2 <sup>-31</sup>	tgd	s	Group delay differential
8	U2	-	iodc	-	IODC
10	U2	2 <sup>4</sup>	toc	s	Clock data reference time
12	U1	-	reserved2	-	<a href="#">Reserved</a>
13	I1	2 <sup>-55</sup>	af2	s/s squared	Time polynomial coefficient 2
14	I2	2 <sup>-43</sup>	af1	s/s	Time polynomial coefficient 1
16	I4	2 <sup>-31</sup>	af0	s	Time polynomial coefficient 0
20	I2	2 <sup>-5</sup>	crs	m	Crs
22	I2	2 <sup>-43</sup>	deltaN	semi-circles/s	Mean motion difference from computed value
24	I4	2 <sup>-31</sup>	m0	semi-circles	Mean anomaly at reference time
28	I2	2 <sup>-29</sup>	cuc	radians	Amp of cosine harmonic corr term to arg of lat
30	I2	2 <sup>-29</sup>	cus	radians	Amp of sine harmonic corr term to arg of lat
32	U4	2 <sup>-33</sup>	e	-	eccentricity
36	U4	2 <sup>-19</sup>	sqrtA	m <sup>0.5</sup>	Square root of the semi-major axis A
40	U2	2 <sup>4</sup>	toe	s	Reference time of ephemeris
42	I2	2 <sup>-29</sup>	cic	radians	Amp of cos harmonic corr term to angle of inclination
44	I4	2 <sup>-31</sup>	omega0	semi-circles	Long of asc node of orbit plane at weekly epoch
48	I2	2 <sup>-29</sup>	cis	radians	Amp of sine harmonic corr term to angle of inclination
50	I2	2 <sup>-5</sup>	crc	m	Amp of cosine harmonic corr term to orbit radius
52	I4	2 <sup>-31</sup>	i0	semi-circles	Inclination angle at reference time
56	I4	2 <sup>-31</sup>	omega	semi-circles	Argument of perigee
60	I4	2 <sup>-43</sup>	omegaDot	semi-circles/s	Rate of right ascension

UBX-MGA-QZSS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
64	I2	2 <sup>-43</sup>	idot	semi-circles/s	Rate of inclination angle
66	U1[2]	-	reserved3	-	Reserved

#### 5.14.8.2 UBX-MGA-QZSS-ALM

Message	<b>UBX-MGA-QZSS-ALM</b>					
Description	<b>QZSS Almanac Assistance</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Input					
Comment	This message allows the delivery of QZSS almanac assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x05	36	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	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	2 <sup>-21</sup>	e	-	Almanac eccentricity	
6	U1	-	almWNa	week	Reference week number of almanac (the 8 bit WNa field)	
7	U1	2 <sup>12</sup>	toa	s	Reference time of almanac	
8	I2	2 <sup>-19</sup>	deltaI	semi-circles	Delta inclination angle at reference time	
10	I2	2 <sup>-38</sup>	omegaDot	semi-circles/s	Almanac rate of right ascension	
12	U4	2 <sup>-11</sup>	sqrtA	m <sup>0.5</sup>	Almanac square root of the semi-major axis A	
16	I4	2 <sup>-23</sup>	omega0	semi-circles	Almanac long of asc node of orbit plane at weekly	
20	I4	2 <sup>-23</sup>	omega	semi-circles	Almanac argument of perigee	
24	I4	2 <sup>-23</sup>	m0	semi-circles	Almanac mean anomaly at reference time	
28	I2	2 <sup>-20</sup>	af0	s	Almanac time polynomial coefficient 0 (8 MSBs)	
30	I2	2 <sup>-38</sup>	af1	s/s	Almanac time polynomial coefficient 1	

UBX-MGA-QZSS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
32	U1[4]	-	reserved1	-	<a href="#">Reserved</a>

#### 5.14.8.3 UBX-MGA-QZSS-HEALTH

Message	<b>UBX-MGA-QZSS-HEALTH</b>					
Description	<b>QZSS Health Assistance</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li><a href="#">u-blox 9 with protocol version 30</a></li> </ul>					
Type	Input					
Comment	This message allows the delivery of QZSS health assistance to a receiver. See the section AssistNow online in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x13	0x05	12	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	type	-	Message type (0x04 for this type)	
1	U1	-	version	-	Message version (0x00 for this version)	
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
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]	-	reserved2	-	<a href="#">Reserved</a>	



## 5.15 UBX-MON (0x0A)

Monitoring Messages: i.e. Communication Status, CPU Load, Stack Usage, Task Status.

Messages in the MON class are used to report the receiver status, such as CPU load, stack usage, I/O subsystem statistics etc.

### 5.15.1 UBX-MON-COMMS (0x0A 0x36)

#### 5.15.1.1 Comm port information

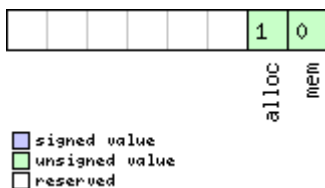
Message	UBX-MON-COMMS					
Description	Comm port information					
Firmware	Supported on: <ul style="list-style-type: none"><li>u-blox 9 with protocol version 30</li></ul>					
Type	Periodic/Polled					
Comment	Consolidated communications information for all ports. The size of the message is determined 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 + 40*nPorts	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0x00 for this version)	
1	U1	-	nPorts	-	Number of ports included	
2	X1	-	txErrors	-	tx error bitmask (see <a href="#">graphic below</a> )	
3	U1[1]	-	reserved1	-	<a href="#">Reserved</a>	
4	U1[4]	-	protIds		The identifiers of the protocols reported in the msgs array. 0: UBX, 1: NMEA, 2: RTCM2, 5: RTCM3, 256: No protocol reported.	
Start of repeated block (nPorts times)						
8 + 40*N	U2	-	portId	-	Unique identifier for the port. See section Communications ports in <a href="#">Integration manual</a> for details.	
10 + 40*N	U2	-	txPending	bytes	Number of bytes pending in transmitter buffer	
12 + 40*N	U4	-	txBytes	bytes	Number of bytes ever sent	
16 + 40*N	U1	-	txUsage	%	Maximum usage transmitter buffer during the last sysmon period	
17 + 40*N	U1	-	txPeakUsage	%	Maximum usage transmitter buffer	
18 + 40*N	U2	-	rxPending	bytes	Number of bytes in receiver buffer	
20 + 40*N	U4	-	rxBytes	bytes	Number of bytes ever received	
24 + 40*N	U1	-	rxUsage	%	Maximum usage receiver buffer during the last sysmon period	
25 + 40*N	U1	-	rxPeakUsage	%	Maximum usage receiver buffer	
26 + 40*N	U2	-	overrunErrs	-	Number of 100ms timeslots with overrun errors	

UBX-MON-COMMS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
28 + 40*N	U2[4]	-	msgs	msg	Number of successfully parsed messages for each protocol. The reported protocols are identified through the protIds field.
36 + 40*N	U1[8]	-	reserved2	-	<a href="#">Reserved</a>
44 + 40*N	U4	-	skipped	bytes	Number of skipped bytes
End of repeated block					

## Bitfield txErrors

This graphic explains the bits of txErrors



Name	Description
mem	Memory Allocation error
alloc	Allocation error (TX buffer full)

## 5.15.2 UBX-MON-GNSS (0x0A 0x28)

### 5.15.2.1 Information message major GNSS selection

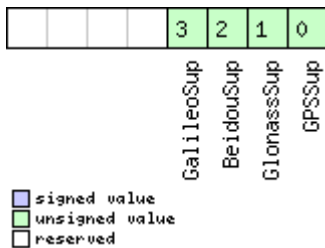
Message	<b>UBX-MON-GNSS</b>					
Description	<b>Information message major GNSS selection</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li><a href="#">u-blox 9 with protocol version 30</a></li> </ul>					
Type	Polled					
Comment	This message reports major GNSS selection. It does 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.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x28	8	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0x01 for this version)	
1	X1	-	supported	-	A bit mask showing the major GNSS that can be supported by this receiver (see <a href="#">graphic below</a> )	

## UBX-MON-GNSS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
2	X1	-	defaultGnss	-	A bit mask showing the default major GNSS selection. If the default major GNSS selection is currently configured in the efuse for this receiver, it takes precedence over the default major GNSS selection configured in the executing firmware of this receiver. (see <a href="#">graphic below</a> )
3	X1	-	enabled	-	A bit mask showing the current major GNSS selection enabled for this receiver (see <a href="#">graphic below</a> )
4	U1	-	simultaneous	-	Maximum number of concurrent major GNSS that can be supported by this receiver
5	U1[3]	-	reserved1	-	<a href="#">Reserved</a>

### Bitfield supported

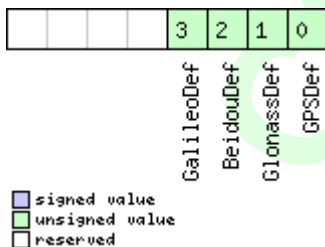
This graphic explains the bits of supported



Name	Description
GPSSup	GPS is supported
GlonassSup	GLONASS is supported
BeidouSup	BeiDou is supported
GalileoSup	Galileo is supported

### Bitfield defaultGnss

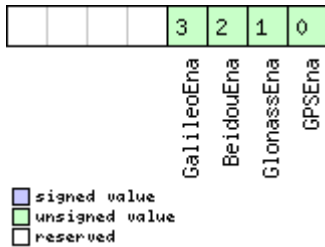
This graphic explains the bits of defaultGnss



Name	Description
GPSTDef	GPS is default-enabled
GlonassDef	GLONASS is default-enabled
BeidouDef	BeiDou is default-enabled
GalileoDef	Galileo is default-enabled

## Bitfield enabled

This graphic explains the bits of enabled



Name	Description
GPSEna	GPS is enabled
GlonassEna	GLONASS is enabled
BeidouEna	BeiDou is enabled
GalileoEna	Galileo is enabled

### 5.15.3 UBX-MON-HW2 (0x0A 0x0B)

#### 5.15.3.1 Extended Hardware Status

Message	<b>UBX-MON-HW2</b>					
Description	<b>Extended Hardware Status</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li>u-blox 9 with protocol version 30</li> </ul>					
Type	Periodic/Polled					
Comment	<b>This message is deprecated in this protocol version. Use <a href="#">UBX-MON-HW3</a> and <a href="#">UBX-MON-RF</a> instead.</b> Status of different aspects of the hardware such as Imbalance, Low-Level Configuration and POST Results. The first four parameters of this message represent the complex signal from the RF front end. The following rules of thumb apply: <ul style="list-style-type: none"> <li>The smaller the absolute value of the variable <code>ofsI</code> and <code>ofsQ</code>, the better.</li> <li>Ideally, the magnitude of the I-part (<code>magI</code>) and the Q-part (<code>magQ</code>) of the complex signal should be the same.</li> </ul>					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x0B	28	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	11	-	<code>ofsI</code>	-	Imbalance of I-part of complex signal, scaled (-128 = max. negative imbalance, 127 = max. positive imbalance)	

## UBX-MON-HW2 continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
1	U1	-	magI	-	Magnitude of I-part of complex signal, scaled (0 = no signal, 255 = max. magnitude)
2	I1	-	ofsQ	-	Imbalance of Q-part of complex signal, scaled (-128 = max. negative imbalance, 127 = max. positive imbalance)
3	U1	-	magQ	-	Magnitude of Q-part of complex signal, scaled (0 = no signal, 255 = max. magnitude)
4	U1	-	cfgSource	-	Source of low-level configuration (114 = ROM, 111 = OTP, 112 = config pins, 102 = flash image)
5	U1[3]	-	reserved1	-	Reserved
8	U4	-	lowLevCfg	-	Low-level configuration (obsolete in protocol versions greater than 15)
12	U1[8]	-	reserved2	-	Reserved
20	U4	-	postStatus	-	POST status word
24	U1[4]	-	reserved3	-	Reserved

### 5.15.4 UBX-MON-HW3 (0x0A 0x37)

#### 5.15.4.1 HW I/O pin information

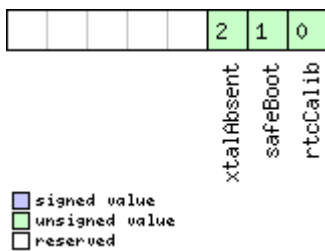
Message	UBX-MON-HW3					
Description	HW I/O pin information					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a></li></ul>					
Type	Periodic/Polled					
Comment	This message contains information specific to each HW I/O pin, for example whether the pin is <b>set</b> as Input or Output. For the antenna supervisor status and other RF status information, see the <a href="#">UBX-MON-RF</a> message.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x37	22 + 6*nPins	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	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 (see <a href="#">graphic below</a> )	
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]	-	reserved1	-	<a href="#">Reserved</a>	
Start of repeated block (nPins times)						

UBX-MON-HW3 continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
22 + 6*N	U2	-	pinId	-	Identifier for the pin, including both external and internal pins.
24 + 6*N	X2	-	pinMask	-	Pin mask (see <a href="#">graphic below</a> )
26 + 6*N	U1	-	VP	-	Virtual pin mapping
27 + 6*N	U1	-	reserved2	-	<a href="#">Reserved</a>
End of repeated block					

## Bitfield flags

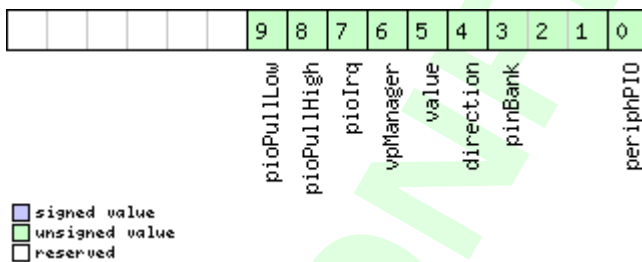
This graphic explains the bits of flags



Name	Description
rtcCalib	RTC is calibrated
safeBoot	safeBoot mode (0 = inactive, 1 = active)
xtalAbsent	RTC xtal has been determined to be absent

## Bitfield pinMask

This graphic explains the bits of pinMask



Name	Description
periphPIO	Pin is <b>set</b> to peripheral or PIO? 0=Peripheral 1=PIO
pinBank	Bank the pin belongs to, where 0=A 1=B 2=C 3=D 4=E 5=F 6=G 7=H
direction	Pin direction? 0=Input 1=Output
value	Pin value? 0=Low 1=High
vpManager	Used by Virtual Pin Manager? 0=No 1=Yes
pioIrq	Interrupt enabled? 0=No 1=Yes
pioPullHigh	Using Pull High Resistor? 0=No 1=Yes
pioPullLow	Using Pull Low Resistor 0=No 1=Yes

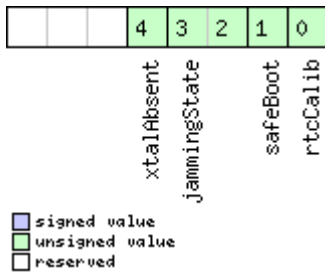
### 5.15.5 UBX-MON-HW (0x0A 0x09)

#### 5.15.5.1 Hardware Status

Message	<b>UBX-MON-HW</b>					
Description	<b>Hardware Status</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	<b>This message is deprecated in this protocol version. Use <a href="#">UBX-MON-HW3</a> and <a href="#">UBX-MON-RF</a> instead.</b> Status of different aspect of the hardware, such as Antenna, PIO/Peripheral Pins, Noise Level, Automatic Gain Control (AGC)					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x09	60	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	X4	-	pinSel	-	Mask of Pins Set as Peripheral/PIO	
4	X4	-	pinBank	-	Mask of Pins Set as Bank A/B	
8	X4	-	pinDir	-	Mask of Pins Set as Input/Output	
12	X4	-	pinVal	-	Mask of Pins Value Low/High	
16	U2	-	noisePerMS	-	Noise Level as measured by the GPS Core	
18	U2	-	agcCnt	-	AGC Monitor (counts SIGHI xor SIGLO, range 0 to 8191)	
20	U1	-	aStatus	-	Status of the Antenna Supervisor State Machine (0=INIT, 1=DONTKNOW, 2=OK, 3=SHORT, 4=OPEN)	
21	U1	-	aPower	-	Current PowerStatus of Antenna (0=OFF, 1=ON, 2=DONTKNOW)	
22	X1	-	flags	-	Flags (see <a href="#">graphic below</a> )	
23	U1	-	reserved1	-	<a href="#">Reserved</a>	
24	X4	-	usedMask	-	Mask of Pins that are used by the Virtual Pin Manager	
28	U1[17]	-	VP	-	Array of Pin Mappings for each of the 17 Physical Pins	
45	U1	-	jamInd	-	CW Jamming indicator, scaled (0 = no CW jamming, 255 = strong CW jamming)	
46	U1[2]	-	reserved2	-	<a href="#">Reserved</a>	
48	X4	-	pinIrq	-	Mask of Pins Value using the PIO Irq	
52	X4	-	pullH	-	Mask of Pins Value using the PIO Pull High Resistor	
56	X4	-	pullL	-	Mask of Pins Value using the PIO Pull Low Resistor	

## Bitfield flags

This graphic explains the bits of flags



Name	Description
rtcCalib	RTC is calibrated
safeBoot	safeBoot mode (0 = inactive, 1 = active)
jammingState	output from Jamming/Interference Monitor (0 = unknown or feature disabled, 1 = ok - no significant jamming, 2 = warning - interference visible but fix OK, 3 = critical - interference visible and no fix)
xtalAbsent	RTC xtal has been determined to be absent.

### 5.15.6 UBX-MON-IO (0x0A 0x02)

#### 5.15.6.1 I/O Subsystem Status

Message	<b>UBX-MON-IO</b>				
Description	<b>I/O Subsystem Status</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Periodic/Polled				
Comment	<b>This message is deprecated in this protocol version. Use <a href="#">UBX-MON-COMMS</a> instead.</b> 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.				
Message Structure	Header	Class	ID	Length (Bytes)	Payload
	0xB5 0x62	0x0A	0x02	0 + 20*N	see below
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
Start of repeated block (N times)					
N*20	U4	-	rxBytes	bytes	Number of bytes ever received
4 + 20*N	U4	-	txBytes	bytes	Number of bytes ever sent
8 + 20*N	U2	-	parityErrs	-	Number of 100ms timeslots with parity errors
10 + 20*N	U2	-	framingErrs	-	Number of 100ms timeslots with framing errors
12 + 20*N	U2	-	overrunErrs	-	Number of 100ms timeslots with overrun errors
14 + 20*N	U2	-	breakCond	-	Number of 100ms timeslots with break conditions
16 + 20*N	U1[4]	-	reserved1	-	<a href="#">Reserved</a>
End of repeated block					



### 5.15.7 UBX-MON-MSGPP (0x0A 0x06)

#### 5.15.7.1 Message Parse and Process Status

Message	<b>UBX-MON-MSGPP</b>					
Description	<b>Message Parse and Process Status</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	<b>This message is deprecated in this protocol version. Use <a href="#">UBX-MON-COMMS</a> instead.</b>					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x06	120	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
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	

### 5.15.8 UBX-MON-PATCH (0x0A 0x27)

#### 5.15.8.1 Output information about installed patches.

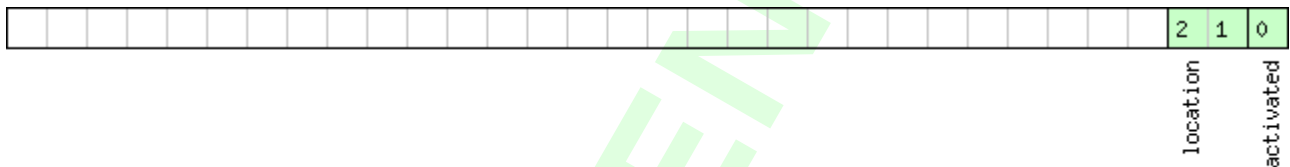
Message	UBX-MON-PATCH					
Description	Output information about installed patches.					
Firmware	Supported on: <ul style="list-style-type: none"><li>u-blox 9 with protocol version 30</li></ul>					
Type	Polled					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x27	4 + 16*nEntries	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U2	-	version	-	Type of the message. 0x1 for this one.	
2	U2	-	nEntries	-	The number of patches that is output.	
Start of repeated block (nEntries times)						

## UBX-MON-PATCH continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
4 + 16*N	X4	-	patchInfo	-	Additional information about the patch not stated in the patch header. (see <a href="#">graphic below</a> )
8 + 16*N	U4	-	comparatorNumber	-	The number of the comparator.
12 + 16*N	U4	-	patchAddress	-	The address that the targeted by the patch.
16 + 16*N	U4	-	patchData	-	The data that will be inserted at the patchAddress.
End of repeated block					

### Bitfield patchInfo

This graphic explains the bits of patchInfo



☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
activated	1: the patch is active. 0: otherwise.
location	Indicates where the patch is stored. 0: eFuse, 1: ROM, 2: BBR, 3: file system.

### 5.15.9 UBX-MON-PIO (0x0A 0x24)

#### 5.15.9.1 Production testing message for PIO pins

Message	<b>UBX-MON-PIO</b>					
Description	<b>Production testing message for PIO pins</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Polled					
Comment	This message is the response to a poll. It will report the PIO pin state. If the receiver has been set in PIO test mode by a <a href="#">UBX-CFG-PIO</a> message then this state may have been influenced by SET-PIN forms of the <a href="#">UBX-CFG-PIO</a> message.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x24	19	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (1 for this version)	

UBX-MON-PIO continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
1	U1	-	responseType	-	0: Not in test mode, simple read of pin state 1: Test mode, simple read of pin state, which may have been affected by a CFG-PIO SET-PIN request
Start of repeated block (17 times)					
2 + 1*N	U1	-	pinState	-	One value per PIO pin: 4: Pin driven high 5: Pin driven low
End of repeated block					

### 5.15.10 UBX-MON-PT2 (0x0A 0x2B)

#### 5.15.10.1 Multi-GNSS Production Test Monitor Message

Message	UBX-MON-PT2					
Description	Multi-GNSS Production Test Monitor Message					
Firmware	Supported on: <ul style="list-style-type: none"><li>u-blox 9 with protocol version 30</li></ul>					
Type	Periodic/Polled					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x2B	24 + 28*numRfChn + 36*numSvSigDesc	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (=0 for this version)	
1	U1	-	testMode	-	currently active test mode	
2	U1	-	numRfChn	-	number of RF channels reported in this message	
3	U1	-	numSvSigDesc	-	number of SV signal descriptors reported in this message	
4	U4	-	testRunTime	ms	test runtime since channel assignment	
8	I4	-	clkDriftAid	ppb	clock drift of receiver clock relative to extint source (with an offset of 1e9: 1000000000 means 'zero doppler')	
12	I4	-	clkDriftTrk	ppb	clock drift of receiver clock relative to tracked GNSS signals (without offset: 0 means 'zero doppler')	
16	U4	-	rtcFreq	Hz	RTC frequency	
20	U4	-	postStatus	-	Power On Self Test status mask	
Start of repeated block (numRfChn times)						
24 + 28*N	U1	-	rfPga	-	RF gain amplifier setting	

UBX-MON-PT2 continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
25 + 28*N	U1[27]	-	reserved1	-	<a href="#">Reserved</a>
End of repeated block					
Start of repeated block (numSvSigDesc times)					
24 + 28*numRfChn + 36*N	U1	-	gnssId	-	GNSS identifier (see <a href="#">Satellite Numbering</a> )
25 + 28*numRfChn + 36*N	U1	-	svId	-	GNSS identifier (see <a href="#">Satellite Numbering</a> )
26 + 28*numRfChn + 36*N	U1	-	sigId	-	Signal identifier. 0 is the only value currently supported.
27 + 28*numRfChn + 36*N	U1	-	accsId	-	Access identifier, used to indicate frequency channel in range (0-13) for GLONASS (0 = -7, 1 = -6, ..., 12 = +5, 13 = +6). The value should be ignored for all other GNSS.
28 + 28*numRfChn + 36*N	U2	2 <sup>-8</sup>	cnoMin	dBHz	minimum CNo across all channels tracking this SV signal
30 + 28*numRfChn + 36*N	U2	2 <sup>-8</sup>	cnoMax	dBHz	maximum CNo across all channels tracking this SV signal
32 + 28*numRfChn + 36*N	U1[14]	-	reserved2	-	<a href="#">Reserved</a>
46 + 28*numRfChn + 36*N	U1	2 <sup>-8</sup>	carrPhDevMax	cycles	carrier phase measurement deviation maximum across all associated channels (1 cycle = 360 deg)
47 + 28*numRfChn + 36*N	U1	-	reserved3	-	<a href="#">Reserved</a>
48 + 28*numRfChn + 36*N	U1	-	codeLockSuccess	%	percentage of channels codelocked
49 + 28*numRfChn + 36*N	U1	-	phaseLockSuccess	%	percentage of channels codelocked
50 + 28*numRfChn + 36*N	U2	-	minCodeLockTime	ms	minimum codelock time across all associated channels
52 + 28*numRfChn + 36*N	U2	-	maxCodeLockTime	ms	maximum codelock time across all associated channels

UBX-MON-PT2 continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
54 + 28*numRfChn + 36*N	U2	-	minPhaseLockTime	ms	minimum phaselock time across all associated channels
56 + 28*numRfChn + 36*N	U2	-	maxPhaseLockTime	ms	maximum phaselock time across all associated channels
58 + 28*numRfChn + 36*N	U1[2]	-	reserved4	-	Reserved
End of repeated block					

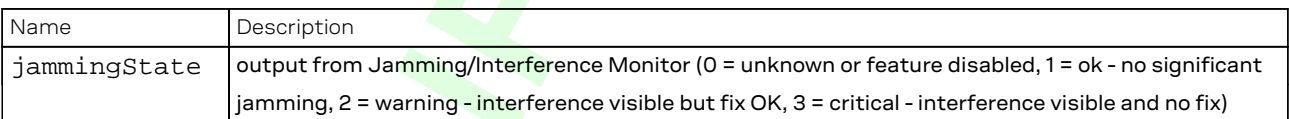
### 5.15.11 UBX-MON-RF (0x0A 0x38)

#### 5.15.11.1 RF information

Message	UBX-MON-RF					
Description	RF information					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a></li></ul>					
Type	Periodic/Polled					
Comment	Information for each RF block.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x38	4 + 24*nBlocks	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0x00 for this version)	
1	U1	-	nBlocks	-	The number of RF blocks included	
2	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
Start of repeated block (nBlocks times)						
4 + 24*N	U1	-	blockId	-	RF block id	
5 + 24*N	X1	-	flags	-	Flags (see <a href="#">graphic below</a> )	
6 + 24*N	U1	-	antStatus	-	Status of the antenna supervisor state machine (0x00=INIT,0x01=DONTKNOW,0x02=OK,0x03=SHORT,0x04=OPEN)	
7 + 24*N	U1	-	antPower	-	Current power status of antenna (0x00=OFF,0x01=ON,0x02=DONTKNOW)	
8 + 24*N	U4	-	postStatus	-	POST status word	
12 + 24*N	U1[4]	-	reserved2	-	<a href="#">Reserved</a>	
16 + 24*N	U2	-	noisePerMS	-	Noise level as measured by the GPS core	
18 + 24*N	U2	-	agcCnt	-	AGC Monitor (counts SIGHI xor SIGLO, range 0 to 8191)	
20 + 24*N	U1	-	jamInd	-	CW jamming indicator, scaled (0=no CW jamming, 255 = strong CW jamming)	

Byte Offset	Number Format	Scaling	Name	Unit	Description
21 + 24*N	I1	-	ofsI	-	Imbalance of I-part of complex signal, scaled (-128 = max. negative imbalance, 127 = max. positive imbalance)
22 + 24*N	U1	-	magI	-	Magnitude of I-part of complex signal, scaled (0= no signal, 255 = max. magnitude)
23 + 24*N	I1	-	ofsQ	-	Imbalance of Q-part of complex signal, scaled (-128 = max. negative imbalance, 127 = max. positive imbalance)
24 + 24*N	U1	-	magQ	-	Magnitude of Q-part of complex signal, scaled (0= no signal, 255 = max. magnitude)
25 + 24*N	U1[3]	-	reserved3	-	Reserved
End of repeated block					

This graphic explains the bits of flags



### 5.15.12.1 Receiver Buffer Status

UBX-19000811 - R01

UBX-MON-RXBUF continued

Byte Offset	Number Format	Scaling	Name	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

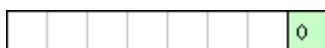
### 5.15.13 UBX-MON-RXR (0x0A 0x21)

#### 5.15.13.1 Receiver Status Information

Message	<b>UBX-MON-RXR</b>					
Description	<b>Receiver Status Information</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
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
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	X1	-	flags	-	Receiver status flags (see <a href="#">graphic below</a> )	

#### Bitfield flags

This graphic explains the bits of flags



awake

- signed value
- unsigned value
- reserved

Name	Description
awake	not in Backup mode

### 5.15.14 UBX-MON-SPT (0x0A 0x2F)

#### 5.15.14.1 Sensor Production Test Message

Message	UBX-MON-SPT					
Description	Sensor Production Test Message					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)</li></ul>					
Type	Polled					
Comment	<p>This message reports the state of, and measurements made during, sensor self-tests.</p> <p>This message can also be used to retrieve information about detected sensor(s) and driver(s) used.</p> <p>This message is only supported if a sensor is directly connected to the u-blox chip. This includes modules that contain IMUs.</p> <p>Note that this message shows the status of the last self-test since sensor startup. The self-test results are not stored in non-volatile memory.</p>					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x2F	4 + 12*numRes + 4*numSensor	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (=1 for this version)	
1	U1	-	numSensor	-	number of sensors reported in this message	
2	U1	-	numRes	-	number of result items reported in this message	
3	U1	-	reserved1	-	Reserved	
Start of repeated block (numSensor times)						



UBX-MON-SPT continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
4 + 4*N	U1	-	sensorId	-	<p>Sensor ID</p> <p>The following IDs are defined, others are reserved:</p> <p>1: ST LSM6DS0 6-axis IMU with temperature sensor</p> <p>2: Invensense MPU6500 6-axis IMU with temperature sensor</p> <p>3: Bosch BMI160 6-axis IMU with temperature sensor</p> <p>7: ST LSM6DS3 6-axis IMU with temperature sensor</p> <p>9: Bosch SMI130 6-axis IMU with temperature sensor</p> <p>12: MPU6515, 6-axis inertial sensor from Invensense</p> <p>13: ST LSM6DSL 6-axis IMU with temperature sensor</p> <p>14: SMG130, 3-axis gyroscope with temperature sensor from Bosch</p> <p>15: SMI230, 6-axis IMU with temperature sensor from Bosch</p> <p>Not all sensors are supported in any released firmware. Please refer to the release notes to find out which sensor is supported by a certain firmware.</p>
5 + 4*N	X1	-	drvVer	-	Version information (see <a href="#">graphic below</a> )
6 + 4*N	U1	-	testState	-	<p>State of one sensor's test, it can be</p> <p>0: test not yet started</p> <p>1: test started but not yet finished</p> <p>2: test did not finish due to error during execution</p> <p>3: test finished normally, test data is available</p>
7 + 4*N	U1	-	drvFileName	-	0 if the active driver is loaded from image, last character of the file name if it is loaded from separate file.
End of repeated block					
Start of repeated block (numRes times)					
4 + 12*N + 4*numSensor	U2	-	sensorIdRes	-	Sensor ID; eligible values are the same as in sensorIdState field

UBX-MON-SPT continued

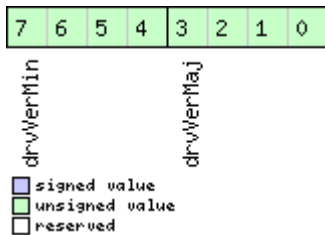
Byte Offset	Number Format	Scaling	Name	Unit	Description
6 + 12*N + 4*numSensor	U2	-	sensorType	-	<p>Sensor type and axis (if applicable) to which the result refers</p> <p>The following values are defined, others are reserved:</p> <p>5: Gyroscope z axis  12: Gyroscope temperature  13: Gyroscope y axis  14: Gyroscope x axis  16: Accelerometer x axis  17: Accelerometer y axis  18: Accelerometer z axis  19: Barometer  22: Magnetometer x axis  23: Magnetometer y axis  24: Magnetometer z axis  25: Barometer temperature</p>
8 + 12*N + 4*numSensor	U2	-	resType	-	<p>The type of result stored in the value field</p> <p>1: Measurement without self-test offset (raw and unscaled digital value)  2: Measurement with positive self-test offset (raw and unscaled digital value)  3: Measurement with negative self-test offset (raw and unscaled digital value)  4: Minimum off-to-positive to pass self-test, as deduced from on-chip trimming information  5: Maximum off-to-positive to pass self-test, as deduced from on-chip trimming information  6: Minimum negative-to-positive to pass self-test, as deduced from on-chip trimming information  7: Maximum negative-to-positive to pass self-test, as deduced from on-chip trimming information  8: Self-test passed; test passed if value = 1 and failed if 0. Used if the decision is read out from the sensor itself.</p>
10 + 12*N + 4*numSensor	U1[2]	-	reserved2	-	Reserved
12 + 12*N + 4*numSensor	I4	-	value	-	value of the specific test result

UBX-MON-SPT continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
End of repeated block					

## Bitfield drvVer

This graphic explains the bits of drvVer



Name	Description
drvVerMaj	Driver major version
drvVerMin	Driver minor version

### 5.15.15 UBX-MON-TEMP (0x0A 0x0E)

#### 5.15.15.1 Poll Temperature value [C] and temperature related state

Message	<b>UBX-MON-TEMP</b>					
Description	<b>Poll Temperature value [C] and temperature related state</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Poll Request					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x0E	0	see below	CK_A CK_B
No payload						

#### 5.15.15.2 Temperature value [C] and temperature related state

Message	<b>UBX-MON-TEMP</b>					
Description	<b>Temperature value [C] and temperature related state</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	Reports Temperature value [C] and current temperature related state					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x0E	12	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	msgVer	-	Message version = 0	
1	U1[3]	-	reserved1	-	<a href="#">Reserved</a>	
4	I2	-	tempValue	-	Temperature value [C]	

UBX-MON-TEMP continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
6	U1	-	reserved2	-	<a href="#">Reserved</a>
7	U1[5]	-	reserved3	-	<a href="#">Reserved</a>

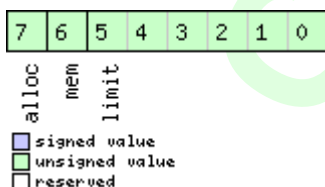
### 5.15.16 UBX-MON-TXBUF (0x0A 0x08)

#### 5.15.16.1 Transmitter Buffer Status

Message	<b>UBX-MON-TXBUF</b>					
Description	<b>Transmitter Buffer Status</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	<b>This message is deprecated in this protocol version. Use <a href="#">UBX-MON-COMMS</a> instead.</b>					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x08	28	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
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 (see <a href="#">graphic below</a> )	
27	U1	-	reserved1	-	<a href="#">Reserved</a>	

### Bitfield errors

This graphic explains the bits of errors



Name	Description
limit	Buffer limit of corresponding target reached
mem	Memory Allocation error
alloc	Allocation error (TX buffer full)

### 5.15.17 UBX-MON-VER (0x0A 0x04)

#### 5.15.17.1 Receiver/Software Version

Message	UBX-MON-VER					
Description	Receiver/Software Version					
Firmware	Supported on: <ul style="list-style-type: none"><li>u-blox 9 with protocol version 30</li></ul>					
Type	Polled					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0A	0x04	40 + 30*N	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	CH[30]	-	swVersion	-	Zero-terminated Software Version String.	
30	CH[10]	-	hwVersion	-	Zero-terminated Hardware Version String	
Start of repeated block (N times)						
40 + 30*N	CH[30]	-	extension	-	Extended software information strings. A series of zero-terminated strings. Each extension field is 30 characters long and contains varying software information. Not all extension fields may appear. Example reported information can be: the software version string of the underlying ROM (when the receiver's firmware is running from flash), the firmware version, the supported protocol version, the module identifier, the Flash Information Structure (FIS) file information, the supported major GNSS, the supported augmentation systems.	
End of repeated block						

## 5.16 UBX-NAV (0x01)

Navigation Results Messages: i.e. Position, Speed, Time, Acceleration, Heading, DOP, SVs used. Messages in the NAV class are used to output navigation data such as position, altitude and velocity in a number of formats. Additionally, status flags and accuracy figures are output. The messages are generated with the configured navigation/measurement rate.

### 5.16.1 UBX-NAV-ATT (0x01 0x05)

#### 5.16.1.1 Attitude Solution

Message	<b>UBX-NAV-ATT</b>					
Description	<b>Attitude Solution</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li>• <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)</li> </ul>					
Type	Periodic/Polled					
Comment	This message outputs the attitude solution as roll, pitch and heading angles. See important comments concerning vehicle attitude given in the ADR section of the <a href="#">Integration manual</a> .					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x05	32	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	U1	-	version	-	Message version (0 for this version)	
5	U1[3]	-	reserved1	-	<a href="#">Reserved</a>	
8	I4	1e-5	roll	deg	Vehicle roll.	
12	I4	1e-5	pitch	deg	Vehicle pitch.	
16	I4	1e-5	heading	deg	Vehicle heading.	
20	U4	1e-5	accRoll	deg	Vehicle roll accuracy (if null, roll angle is not available).	
24	U4	1e-5	accPitch	deg	Vehicle pitch accuracy (if null, pitch angle is not available).	
28	U4	1e-5	accHeading	deg	Vehicle heading accuracy (if null, heading angle is not available).	

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

### 5.16.2.1 Clock Solution

Message	<b>UBX-NAV-CLOCK</b>					
Description	<b>Clock Solution</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x22	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section Navigation epochs in <a href="#">Integration manual</a> for details. See the section iTOW timestamps in <a href="#">Integration manual</a> 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	

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

### 5.16.3.1 Covariance matrices

Message	<b>UBX-NAV-COV</b>					
Description	<b>Covariance matrices</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
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	0x01	0x36	64	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	U1	-	version	-	Message version (0 for this version)	
5	U1	-	posCovValid	-	Position covariance matrix validity flag	
6	U1	-	velCovValid	-	Velocity covariance matrix validity flag	

UBX-NAV-COV continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
7	U1[9]	-	reserved1	-	<a href="#">Reserved</a>
16	R4	-	posCovNN	m <sup>2</sup>	Position covariance matrix value p_NN
20	R4	-	posCovNE	m <sup>2</sup>	Position covariance matrix value p_NE
24	R4	-	posCovND	m <sup>2</sup>	Position covariance matrix value p_ND
28	R4	-	posCovEE	m <sup>2</sup>	Position covariance matrix value p_EE
32	R4	-	posCovED	m <sup>2</sup>	Position covariance matrix value p_ED
36	R4	-	posCovDD	m <sup>2</sup>	Position covariance matrix value p_DD
40	R4	-	velCovNN	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v_NN
44	R4	-	velCovNE	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v_NE
48	R4	-	velCovND	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v_ND
52	R4	-	velCovEE	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v_EE
56	R4	-	velCovED	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v_ED
60	R4	-	velCovDD	m <sup>2</sup> /s <sup>2</sup>	Velocity covariance matrix value v_DD

#### 5.16.4 UBX-NAV-DGPS (0x01 0x31)

##### 5.16.4.1 DGPS Data Used for NAV

Message	<b>UBX-NAV-DGPS</b>					
Description	<b>DGPS Data Used for NAV</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	This message outputs the DGPS correction data that has been applied to the current NAV Solution. See also the notes on the <a href="#">RTCM protocol</a> .					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x31	16 + 12*numCh	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	I4	-	age	ms	Age of newest correction data	
8	I2	-	baseId	-	DGPS base station identifier	
10	I2	-	baseHealth	-	DGPS base station health status	
12	U1	-	numCh	-	Number of channels for which correction data is following	

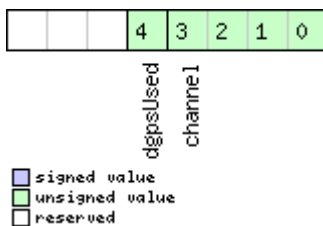


## UBX-NAV-DGPS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
13	U1	-	status	-	DGPS correction type status: 0x00: none 0x01: PR+PRR correction
14	U1[2]	-	reserved1	-	Reserved
Start of repeated block (numCh times)					
16 + 12*N	U1	-	svid	-	Satellite ID
17 + 12*N	X1	-	flags	-	Channel number and usage (see <a href="#">graphic below</a> )
18 + 12*N	U2	-	ageC	ms	Age of latest correction data
20 + 12*N	R4	-	prc	m	Pseudorange correction
24 + 12*N	R4	-	prrc	m/s	Pseudorange rate correction
End of repeated block					

## Bitfield flags

This graphic explains the bits of flags



Name	Description
channel	GPS channel number this SV is on. Channel numbers in the firmware greater than 15 are displayed as having channel number 15
dgpsUsed	1 = DGPS used for this SV

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

### 5.16.5.1 Dilution of precision

Message	<b>UBX-NAV-DOP</b>					
Description	<b>Dilution of precision</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
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	0x01	0x04	18	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	

UBX-NAV-DOP continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.
4	U2	0.01	gDOP	-	Geometric DOP
6	U2	0.01	pDOP	-	Position DOP
8	U2	0.01	tDOP	-	Time DOP
10	U2	0.01	vDOP	-	Vertical DOP
12	U2	0.01	hDOP	-	Horizontal DOP
14	U2	0.01	nDOP	-	Northing DOP
16	U2	0.01	eDOP	-	Easting DOP

### 5.16.6 UBX-NAV-EELL (0x01 0x3d)

#### 5.16.6.1 Position Error Ellipse Parameters

Message	<b>UBX-NAV-EELL</b>					
Description	<b>Position Error Ellipse Parameters</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)					
Type	Periodic/Polled					
Comment	This message outputs the error ellipse parameters for the position solutions.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x3d	16	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	U1	-	version	-	Message version (0 for this version)	
5	U1	-	reserved1	-	<a href="#">Reserved</a>	
6	U2	1e-2	errEllipseOrient	deg	Orientation of semi-major axis of error ellipse (degrees from true north)	
8	U4	-	errEllipseMajor	mm	Semi-major axis of error ellipse	
12	U4	-	errEllipseMinor	mm	Semi-minor axis of error ellipse	

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

#### 5.16.7.1 End Of Epoch

Message	<b>UBX-NAV-EOE</b>					
Description	<b>End Of Epoch</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic					
Comment	This message is intended to be used as a marker to collect all navigation messages of an epoch. It is output after all enabled NAV class messages (except UBX-NAV-HNR) and after all enabled NMEA messages.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x61	4	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	

### 5.16.8 UBX-NAV-HPPOSECEF (0x01 0x13)

#### 5.16.8.1 High Precision Position Solution in ECEF

Message	<b>UBX-NAV-HPPOSECEF</b>					
Description	<b>High Precision Position Solution in ECEF</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	See important comments concerning validity of position given in section Navigation output filters in <a href="#">Integration manual</a> .					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x13	28	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0 for this version)	
1	U1[3]	-	reserved1	-	<a href="#">Reserved</a>	
4	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
8	I4	-	ecefX	cm	ECEF X coordinate	
12	I4	-	ecefY	cm	ECEF Y coordinate	
16	I4	-	ecefZ	cm	ECEF Z coordinate	
20	I1	0.1	ecefXHp	mm	High precision component of ECEF X coordinate. Must be in the range of -99..+99. Precise coordinate in cm = ecefX + (ecefXHp * 1e-2).	

UBX-NAV-HPPOSECEF continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
21	I1	0.1	ecefYHp	mm	High precision component of ECEF Y coordinate. Must be in the range of -99..+99. Precise coordinate in cm = ecefY + (ecefYHp * 1e-2).
22	I1	0.1	ecefZHp	mm	High precision component of ECEF Z coordinate. Must be in the range of -99..+99. Precise coordinate in cm = ecefZ + (ecefZHp * 1e-2).
23	U1	-	reserved2	-	<a href="#">Reserved</a>
24	U4	0.1	pAcc	mm	Position Accuracy Estimate

### 5.16.9 UBX-NAV-HPPOSLLH (0x01 0x14)

#### 5.16.9.1 High Precision Geodetic Position Solution

Message	<b>UBX-NAV-HPPOSLLH</b>					
Description	<b>High Precision Geodetic Position Solution</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	See important comments concerning validity of position given in section Navigation output filters in <a href="#">Integration manual</a> . 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	0x14	36	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0 for this version)	
1	U1[3]	-	reserved1	-	<a href="#">Reserved</a>	
4	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
8	I4	1e-7	lon	deg	Longitude	
12	I4	1e-7	lat	deg	Latitude	
16	I4	-	height	mm	Height above ellipsoid.	
20	I4	-	hMSL	mm	Height above mean sea level	
24	I1	1e-9	lonHp	deg	High precision component of longitude. Must be in the range -99..+99. Precise longitude in deg * 1e-7 = lon + (lonHp * 1e-2).	

## UBX-NAV-HPPOSLLH continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
25	I1	1e-9	latHp	deg	High precision component of latitude. Must be in the range -99..+99. Precise latitude in deg * 1e-7 = lat + (latHp * 1e-2).
26	I1	0.1	heightHp	mm	High precision component of height above ellipsoid. Must be in the range -9..+9. Precise height in mm = height + (heightHp * 0.1).
27	I1	0.1	hMSLHp	mm	High precision component of height above mean sea level. Must be in range -9..+9. Precise height in mm = hMSL + (hMSLHp * 0.1)
28	U4	0.1	hAcc	mm	Horizontal accuracy estimate
32	U4	0.1	vAcc	mm	Vertical accuracy estimate

### 5.16.10 UBX-NAV-ODO (0x01 0x09)

#### 5.16.10.1 Odometer Solution

Message	<b>UBX-NAV-ODO</b>					
Description	<b>Odometer Solution</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	This message outputs the traveled distance since last reset (see <a href="#">UBX-NAV-RESETODO</a> ) together with an associated estimated accuracy and the total cumulated ground distance (can only be reset by a cold start of the receiver).					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x09	20	see below	CK_A CK_B

## Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1	-	version	-	Message version (0 for this version)
1	U1[3]	-	reserved1	-	<a href="#">Reserved</a>
4	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.
8	U4	-	distance	m	Ground distance since last reset
12	U4	-	totalDistance	m	Total cumulative ground distance
16	U4	-	distanceStd	m	Ground distance accuracy (1-sigma)

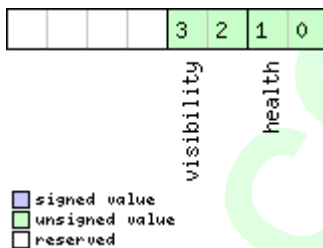
### 5.16.11 UBX-NAV-ORB (0x01 0x34)

#### 5.16.11.1 GNSS Orbit Database Info

Message	UBX-NAV-ORB					
Description	GNSS Orbit Database Info					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a></li></ul>					
Type	Periodic/Polled					
Comment	Status of the GNSS orbit database knowledge.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x34	8 + 6*numSv	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	U1	-	version	-	Message version (1, for this version)	
5	U1	-	numSv	-	Number of SVs in the database	
6	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
Start of repeated block (numSv times)						
8 + 6*N	U1	-	gnssId	-	GNSS ID	
9 + 6*N	U1	-	svId	-	Satellite ID	
10 + 6*N	X1	-	svFlag	-	Information Flags (see <a href="#">graphic below</a> )	
11 + 6*N	X1	-	eph	-	Ephemeris data (see <a href="#">graphic below</a> )	
12 + 6*N	X1	-	alm	-	Almanac data (see <a href="#">graphic below</a> )	
13 + 6*N	X1	-	otherOrb	-	Other orbit data available (see <a href="#">graphic below</a> )	
End of repeated block						

#### Bitfield svFlag

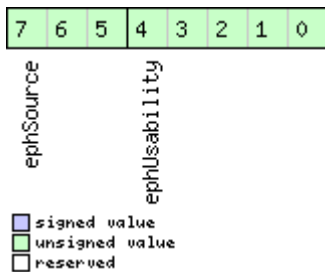
This graphic explains the bits of svFlag



Name	Description
health	SV health: 0: unknown 1: healthy 2: not healthy
visibility	SV health: 0: unknown 1: below horizon 2: above horizon 3: above elevation mask

## Bitfield eph

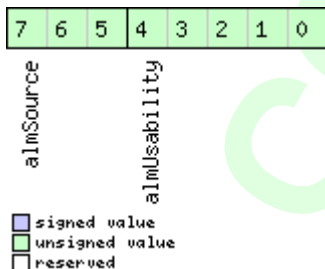
This graphic explains the bits of eph



Name	Description
ephUsability	How long the receiver will be able to use the stored ephemeris data from now on: 31: The usability period is unknown 30: The usability period is more than 450 minutes 30 > n > 0: The usability period is between (n-1)*15 and n*15 minutes 0: Ephemeris can no longer be used
ephSource	0: not available 1: GNSS transmission 2: external aiding 3-7: other

## Bitfield alm

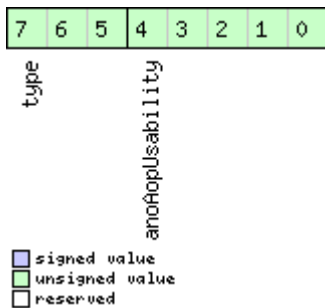
This graphic explains the bits of alm



Name	Description
almUsability	How long the receiver will be able to use the stored almanac data from now on: 31: The usability period is unknown 30: The usability period is more than 30 days 30 > n > 0: The usability period is between n-1 and n days 0: Almanac can no longer be used
almSource	0: not available 1: GNSS transmission 2: external aiding 3-7: other

### Bitfield otherOrb

This graphic explains the bits of otherOrb



Name	Description
anoAopUsability	How long the receiver will be able to use the orbit data from now on: 31: The usability period is unknown 30: The usability period is more than 30 days 30 > n > 0: The usability period is between n-1 and n days 0: Data can no longer be used
type	Type of orbit data: 0: No orbit data available 1: Assist now offline data 2: Assist now autonomous data 3-7: Other orbit data



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

### 5.16.12.1 Position Solution in ECEF

Message	<b>UBX-NAV-POSECEF</b>					
Description	<b>Position Solution in ECEF</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	See important comments concerning validity of position given in section Navigation output filters in <a href="#">Integration manual</a> .					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x01	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> 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	

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

### 5.16.13.1 Geodetic Position Solution

Message	<b>UBX-NAV-POSLLH</b>					
Description	<b>Geodetic Position Solution</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	See important comments concerning validity of position given in section Navigation output filters in <a href="#">Integration manual</a> . 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 Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	I4	1e-7	lon	deg	Longitude	
8	I4	1e-7	lat	deg	Latitude	
12	I4	-	height	mm	Height above ellipsoid	

UBX-NAV-POSLLH continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
16	I4	-	hMSL	mm	Height above mean sea level
20	U4	-	hAcc	mm	Horizontal accuracy estimate
24	U4	-	vAcc	mm	Vertical accuracy estimate

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

##### 5.16.14.1 Navigation Position Velocity Time Solution

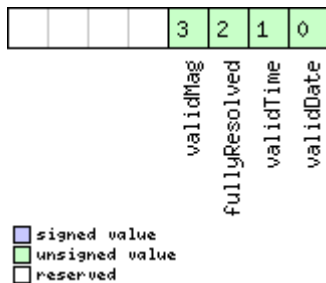
Message	<b>UBX-NAV-PVT</b>					
Description	<b>Navigation Position Velocity Time Solution</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	Note that during a leap second there may be more or less than 60 seconds in a minute. See the section Leap seconds in <a href="#">Integration manual</a> for details. This message combines position, velocity and time solution, including accuracy figures					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x07	92	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> 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 (see <a href="#">graphic below</a> )	
12	U4	-	tAcc	ns	Time accuracy estimate (UTC)	
16	I4	-	nano	ns	Fraction of second, range -1e9 .. 1e9 (UTC)	
20	U1	-	fixType	-	GNSSfix Type: 0: no fix 1: dead reckoning only 2: 2D-fix 3: 3D-fix 4: GNSS + dead reckoning combined 5: time only fix	
21	X1	-	flags	-	Fix status flags (see <a href="#">graphic below</a> )	
22	X1	-	flags2	-	Additional flags (see <a href="#">graphic below</a> )	
23	U1	-	numSV	-	Number of satellites used in Nav Solution	

UBX-NAV-PVT continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
24	I4	1e-7	lon	deg	Longitude
28	I4	1e-7	lat	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	1e-5	headMot	deg	Heading of motion (2-D)
68	U4	-	sAcc	mm/s	Speed accuracy estimate
72	U4	1e-5	headAcc	deg	Heading accuracy estimate (both motion and vehicle)
76	U2	0.01	pDOP	-	Position DOP
78	U1[6]	-	reserved1	-	Reserved
84	I4	1e-5	headVeh	deg	Heading of vehicle (2-D)
88	I2	1e-2	magDec	deg	Magnetic declination
90	U2	1e-2	magAcc	deg	Magnetic declination accuracy

## Bitfield valid

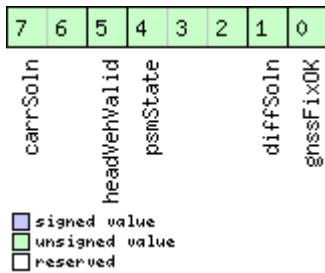
This graphic explains the bits of valid



Name	Description
validDate	1 = valid UTC Date (see section Time validity in <a href="#">Integration manual</a> for details)
validTime	1 = valid UTC Time of Day (see section Time validity in <a href="#">Integration manual</a> for details)
fullyResolved	1 = UTC Time of Day has been fully resolved (no seconds uncertainty). Cannot be used to check if time is completely solved.
validMag	1 = valid Magnetic declination

## Bitfield flags

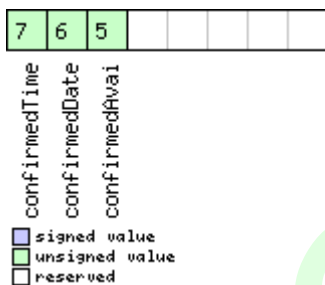
This graphic explains the bits of flags



Name	Description
gnssFixOK	1 = valid fix (i.e within DOP & accuracy masks)
diffSoln	1 = differential corrections were applied
psmState	Power Save Mode state (see Power Management section in <a href="#">Integration manual</a> for details. 0: PSM is not active 1: Enabled (an intermediate state before Acquisition state 2: Acquisition 3: Tracking 4: Power Optimized Tracking 5: Inactive
headVehValid	1 = heading of vehicle is valid
carrSoln	Carrier phase range solution status: 0: no carrier phase range solution 1: carrier phase range solution with floating ambiguities 2: carrier phase range solution with fixed ambiguities

## Bitfield flags2

This graphic explains the bits of flags2



Name	Description
confirmedAvai	1 = information about UTC Date and Time of Day validity confirmation is available (see section Time validity in <a href="#">Integration manual</a> 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>
confirmedDate	1 = UTC Date validity could be confirmed (see section Time validity in <a href="#">Integration manual</a> for details)
confirmedTime	1 = UTC Time of Day could be confirmed (see section Time validity in <a href="#">Integration manual</a> for details)

### 5.16.15 UBX-NAV-RESETODO (0x01 0x10)

#### 5.16.15.1 Reset odometer

Message	<b>UBX-NAV-RESETODO</b>					
Description	<b>Reset odometer</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	This message resets the traveled distance computed by the odometer (see <a href="#">UBX-NAV-ODO</a> ). <a href="#">UBX-ACK-ACK</a> or <a href="#">UBX-ACK-NAK</a> are returned to indicate success or failure.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x10	0	see below	CK_A CK_B
No payload						

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

#### 5.16.16.1 Satellite Information

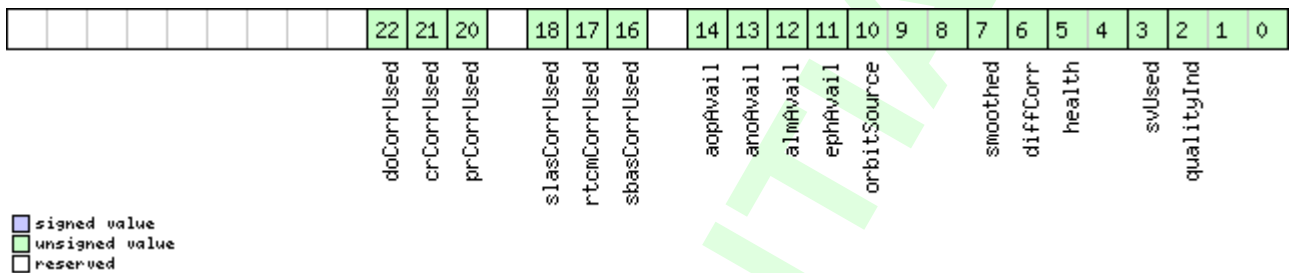
Message	UBX-NAV-SAT					
Description	Satellite Information					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a></li></ul>					
Type	Periodic/Polled					
Comment	This message displays information about SVs which are either known to be visible 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	0x01	0x35	8 + 12*numSvs	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	U1	-	version	-	Message version (1 for this version)	
5	U1	-	numSvs	-	Number of satellites	
6	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
Start of repeated block (numSvs times)						
8 + 12*N	U1	-	gnssId	-	GNSS identifier (see <a href="#">Satellite Numbering</a> ) for assignment	
9 + 12*N	U1	-	svId	-	Satellite identifier (see <a href="#">Satellite Numbering</a> ) for assignment	
10 + 12*N	U1	-	cno	dBHz	Carrier to noise ratio (signal strength)	
11 + 12*N	I1	-	elev	deg	Elevation (range: +/-90), unknown if out of range	
12 + 12*N	I2	-	azim	deg	Azimuth (range 0-360), unknown if elevation is out of range	

UBX-NAV-SAT continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
14 + 12*N	I2	0.1	prRes	m	Pseudorange residual
16 + 12*N	X4	-	flags	-	Bitmask (see <a href="#">graphic below</a> )
End of repeated block					

## Bitfield flags

This graphic explains the bits of flags



Name	Description
qualityInd	Signal quality indicator: 0: no signal 1: searching signal 2: signal acquired 3: signal detected but unusable 4: code locked and time synchronized 5, 6, 7: code and carrier locked and time synchronized Note: Since IMES signals are not time synchronized, a channel tracking an IMES signal can never reach a quality indicator value of higher than 3.
svUsed	1 = Signal in the subset specified in <a href="#">Signal Identifiers</a> is currently being used for navigation
health	Signal health flag: 0: unknown 1: healthy 2: unhealthy
diffCorr	1 = differential correction data is available for this SV
smoothed	1 = carrier smoothed pseudorange used
orbitSource	Orbit source: 0: no orbit information is available for this SV 1: ephemeris is used 2: almanac is used 3: AssistNow Offline orbit is used 4: AssistNow Autonomous orbit is used 5, 6, 7: other orbit information is used
ephAvail	1 = ephemeris is available for this SV
almAvail	1 = almanac is available for this SV
anoAvail	1 = AssistNow Offline data is available for this SV
aopAvail	1 = AssistNow Autonomous data is available for this SV
sbasCorrUsed	1 = SBAS corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
rtcmCorrUsed	1 = RTCM corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>

Bitfield flags Description continued

Name	Description
slasCorrUsed	1 = QZSS SLAS corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
prCorrUsed	1 = Pseudorange corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
crCorrUsed	1 = Carrier range corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>
doCorrUsed	1 = Range rate (Doppler) corrections have been used for a signal in the subset specified in <a href="#">Signal Identifiers</a>

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

#### 5.16.17.1 Signal Information

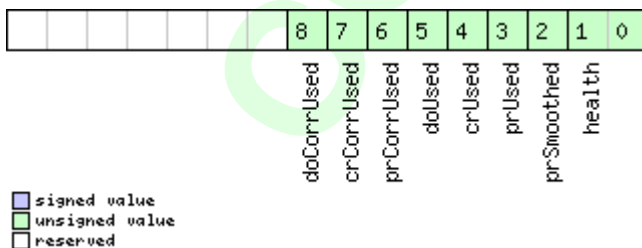
Message	UBX-NAV-SIG						
Description	Signal Information						
Firmware	Supported on: <ul style="list-style-type: none"><li>u-blox 9 with protocol version 30</li></ul>						
Type	Periodic/Polled						
Comment	This message displays information about signals currently tracked by the receiver.						
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum	
	0xB5 0x62	0x01	0x43	8 + 16*numSigs	see below	CK_A CK_B	
Payload Contents:							
Byte Offset	Number Format	Scaling	Name	Unit	Description		
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.		
4	U1	-	version	-	Message version (0x00 for this version)		
5	U1	-	numSigs	-	Number of signals		
6	U1[2]	-	reserved1	-	<a href="#">Reserved</a>		
Start of repeated block (numSigs times)							
8 + 16*N	U1	-	gnssId	-	GNSS identifier (see <a href="#">Satellite Numbering</a> ) for assignment		
9 + 16*N	U1	-	svId	-	Satellite identifier (see <a href="#">Satellite Numbering</a> ) for assignment		
10 + 16*N	U1	-	sigId	-	New style signal identifier (see <a href="#">Signal Identifiers</a> )		
11 + 16*N	U1	-	freqId	-	Only used for GLONASS: This is the frequency slot + 7 (range from 0 to 13)		
12 + 16*N	I2	0.1	prRes	m	Pseudorange residual		
14 + 16*N	U1	-	cno	dBHz	Carrier-to-noise density ratio (signal strength)		

UBX-NAV-SIG continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
15 + 16*N	U1	-	qualityInd	-	Signal quality indicator: 0: no signal 1: searching signal 2: signal acquired 3: signal detected but unusable 4: code locked and time synchronized 5, 6, 7: code and carrier locked and time synchronized Note: Since IMES signals are not time synchronized, a channel tracking an IMES signal can never reach a quality indicator value of higher than 3.
16 + 16*N	U1	-	corrSource	-	Correction source: 0: no corrections 1: SBAS corrections 2: BeiDou corrections 3: RTCM2 corrections 4: RTCM3 OSR corrections 5: RTCM3 SSR corrections 6: QZSS SLAS corrections
17 + 16*N	U1	-	ionoModel	-	Ionospheric model used: 0: no model 1: Klobuchar model transmitted by GPS 2: SBAS model 3: Klobuchar model transmitted by BeiDou 8: Iono delay derived from dual frequency observations
18 + 16*N	X2	-	sigFlags	-	Signal related flags (see <a href="#">graphic below</a> )
20 + 16*N	U1[4]	-	reserved2	-	<a href="#">Reserved</a>
End of repeated block					

## Bitfield sigFlags

This graphic explains the bits of sigFlags





Name	Description
health	Signal health flag: 0: unknown 1: healthy 2: unhealthy
prSmoothed	1 = Pseudorange has been smoothed
prUsed	1 = Pseudorange has been used for this signal
crUsed	1 = Carrier range has been used for this signal
doUsed	1 = Range rate (Doppler) has been used for this signal
prCorrUsed	1 = Pseudorange corrections have been used for this signal
crCorrUsed	1 = Carrier range corrections have been used for this signal
doCorrUsed	1 = Range rate (Doppler) corrections have been used for this signal

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

#### 5.16.18.1 Receiver Navigation Status

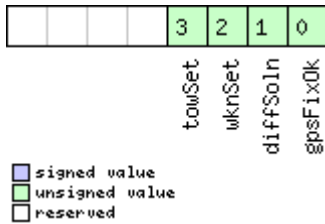
Message	<b>UBX-NAV-STATUS</b>					
Description	<b>Receiver Navigation Status</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	See important comments concerning validity of position given in section Navigation output filters in <a href="#">Integration manual</a> .					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x03	16	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
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. 0x00 = no fix 0x01 = dead reckoning only 0x02 = 2D-fix 0x03 = 3D-fix 0x04 = GPS + dead reckoning combined 0x05 = Time only fix 0x06..0xff = reserved	
5	X1	-	flags	-	Navigation Status Flags (see <a href="#">graphic below</a> )	
6	X1	-	fixStat	-	Fix Status Information (see <a href="#">graphic below</a> )	
7	X1	-	flags2	-	further information about navigation output (see <a href="#">graphic below</a> )	
8	U4	-	ttff	ms	Time to first fix (millisecond time tag)	

## UBX-NAV-STATUS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
12	U4	-	msss	ms	Milliseconds since Startup / Reset

## Bitfield flags

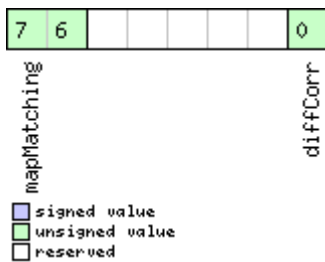
This graphic explains the bits of flags



Name	Description
gpsFixOk	1 = position and velocity valid and within DOP and ACC Masks.
diffSoln	1 = differential corrections were applied
wknSet	1 = Week Number valid (see section Time validity in <a href="#">Integration manual</a> for details)
towSet	1 = Time of Week valid (see section Time validity in <a href="#">Integration manual</a> for details)

## Bitfield fixStat

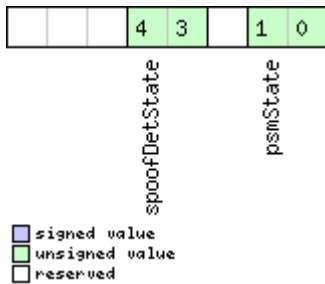
This graphic explains the bits of fixStat



Name	Description
diffCorr	1 = differential corrections available
mapMatching	map matching status: 00: none 01: valid but not used, i.e. map matching data was received, but was too old 10: valid and used, map matching data was applied 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.

## Bitfield flags2

This graphic explains the bits of flags2



Name	Description
psmState	power save mode state 0: ACQUISITION [or when psm disabled] 1: TRACKING 2: POWER OPTIMIZED TRACKING 3: INACTIVE
spooftDetState	Spoofing detection state 0: Unknown or deactivated 1: No spoofing indicated 2: Spoofing indicated 3: Multiple spoofing indications  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 - No spoofing indicated does not mean that the receiver is not spoofed, it simply states that the detector was not triggered in this epoch.

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

#### 5.16.19.1 BDS Time Solution

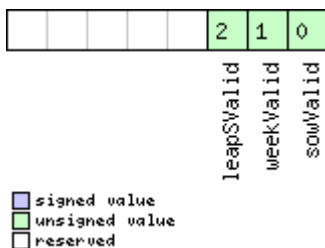
Message	<b>UBX-NAV-TIMEBDS</b>					
Description	<b>BDS Time Solution</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	This message reports the precise BDS time of the most recent navigation solution including validity flags and an accuracy estimate.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x24	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	U4	-	SOW	s	BDS time of week (rounded to seconds)	

## UBX-NAV-TIMEBDS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
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 (see <a href="#">graphic below</a> )
16	U4	-	tAcc	ns	Time Accuracy Estimate

### Bitfield valid

This graphic explains the bits of valid



Name	Description
sowValid	1 = Valid SOW and fSOW (see section Time validity in <a href="#">Integration manual</a> for details)
weekValid	1 = Valid week (see section Time validity in <a href="#">Integration manual</a> for details)
leapSValid	1 = Valid leapS

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

### 5.16.20.1 Galileo Time Solution

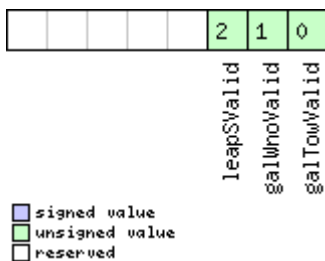
Message	<b>UBX-NAV-TIMEGAL</b>					
Description	<b>Galileo Time Solution</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	This message reports the precise Galileo time of the most recent navigation solution including validity flags and an accuracy estimate.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x25	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	U4	-	galTow	s	Galileo time of week (rounded to seconds)	

## UBX-NAV-TIMEGAL continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
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 (see <a href="#">graphic below</a> )
16	U4	-	tAcc	ns	Time Accuracy Estimate

### Bitfield valid

This graphic explains the bits of valid



Name	Description
galTowValid	1 = Valid galTow and fGalTow (see <a href="#">Time Validity</a> section for details)
galWnoValid	1 = Valid galWno (see <a href="#">Time Validity</a> section for details)
leapSValid	1 = Valid leapS

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

### 5.16.21.1 GLO Time Solution

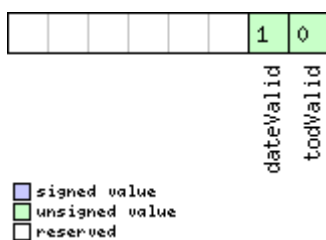
Message	UBX-NAV-TIMEGLO					
Description	GLO Time Solution					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	This message reports the precise GLO time of the most recent navigation solution including validity flags and an accuracy estimate.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x23	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.	
4	U4	-	TOD	s	GLONASS time of day (rounded to integer seconds)	

## UBX-NAV-TIMEGLO continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
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 (see <a href="#">graphic below</a> )
16	U4	-	tAcc	ns	Time Accuracy Estimate

### Bitfield valid

This graphic explains the bits of valid



Name	Description
todValid	1 = Valid TOD and fTOD (see section Time validity in <a href="#">Integration manual</a> for details)
dateValid	1 = Valid N4 and Nt (see section Time validity in <a href="#">Integration manual</a> for details)

## 5.16.22 UBX-NAV-TIMEGPS (0x01 0x20)

### 5.16.22.1 GPS Time Solution

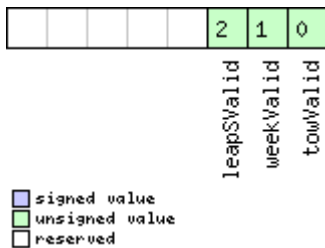
Message	<b>UBX-NAV-TIMEGPS</b>					
Description	<b>GPS Time Solution</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	This message reports the precise GPS time of the most recent navigation solution including validity flags and an accuracy estimate.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x20	16	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	

## UBX-NAV-TIMEGPS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> 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 (see <a href="#">graphic below</a> )
12	U4	-	tAcc	ns	Time Accuracy Estimate

### Bitfield valid

This graphic explains the bits of valid



Name	Description
towValid	1 = Valid GPS time of week (iTOW & fTOW, (see section Time validity in <a href="#">Integration manual</a> for details)
weekValid	1 = Valid GPS week number (see section Time validity in <a href="#">Integration manual</a> for details)
leapSValid	1 = Valid GPS leap seconds

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

### 5.16.23.1 Leap second event information

Message	<b>UBX-NAV-TIMELS</b>					
Description	<b>Leap second event information</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	Information about the upcoming leap second event if one is scheduled.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x26	24	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	

## UBX-NAV-TIMEELS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> for details.
4	U1	-	version	-	Message version (0x00 for this version).
5	U1[3]	-	reserved1	-	<a href="#">Reserved</a>
8	U1	-	srcOfCurrLs	-	Information source for the current number of leap seconds. 0: Default (hardcoded in the firmware, can be outdated) 1: Derived from time difference between GPS and GLONASS time 2: GPS 3: SBAS 4: BeiDou 5: Galileo 6: Aided data 7: Configured 255: Unknown
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. 0: No source 2: GPS 3: SBAS 4: BeiDou 5: Galileo 6: GLONASS
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.
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.

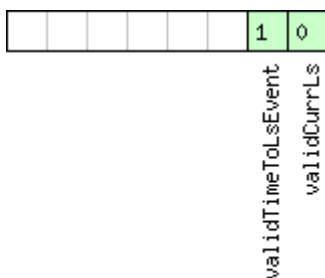


## UBX-NAV-TIMEELS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
16	U2	-	dateOfLsGpsWn	-	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	-	dateOfLsGpsDn	-	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]	-	reserved2	-	Reserved
23	X1	-	valid	-	Validity flags (see <a href="#">graphic below</a> )

### Bitfield valid

This graphic explains the bits of valid



☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
validCurrLs	1 = Valid current number of leap seconds value.
validTimeToLsEvent	1 = Valid time to next leap second event or from the last leap second event if no future event scheduled.

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

### 5.16.24.1 UTC Time Solution

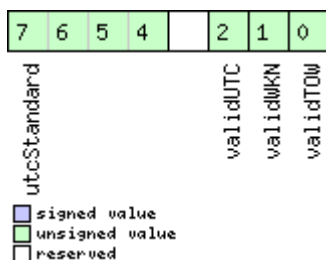
Message	<b>UBX-NAV-TIMEUTC</b>					
Description	<b>UTC Time Solution</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	Note that during a leap second there may be more or less than 60 seconds in a minute. See the section Leap seconds in <a href="#">Integration manual</a> for details.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x21	20	see below	CK_A CK_B
Payload Contents:						

## UBX-NAV-TIMEUTC continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> 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 (see <a href="#">graphic below</a> )

## Bitfield valid

This graphic explains the bits of valid



Name	Description
validTOW	1 = Valid Time of Week (see section Time validity in <a href="#">Integration manual</a> for details)
validWKN	1 = Valid Week Number (see section Time validity in <a href="#">Integration manual</a> for details)
validUTC	1 = Valid UTC Time
utcStandard	UTC standard identifier. 0: Information not available 1: Communications Research Laboratory (CRL) 2: National Institute of Standards and Technology (NIST) 3: U.S. Naval Observatory (USNO) 4: International Bureau of Weights and Measures (BIPM) 5: European Laboratory (tbd) 6: Former Soviet Union (SU) 7: National Time Service Center, China (NTSC) 15: Unknown

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

#### 5.16.25.1 Velocity Solution in ECEF

Message	<b>UBX-NAV-VELECEF</b>					
Description	<b>Velocity Solution in ECEF</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	See important comments concerning validity of position given in section Navigation output filters in <a href="#">Integration manual</a> .					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x11	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> 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	

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

#### 5.16.26.1 Velocity Solution in NED

Message	<b>UBX-NAV-VELNED</b>					
Description	<b>Velocity Solution in NED</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	See important comments concerning validity of position given in section Navigation output filters in <a href="#">Integration manual</a> .					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x01	0x12	36	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	iTOW	ms	GPS time of week of the navigation epoch. See the section iTOW timestamps in <a href="#">Integration manual</a> 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	1e-5	heading	deg	Heading of motion 2-D	

UBX-NAV-VELNED continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
28	U4	-	sAcc	cm/s	Speed accuracy Estimate
32	U4	1e-5	cAcc	deg	Course / Heading accuracy estimate

CONFIDENTIAL

## 5.17 UBX-RXM (0x02)

Receiver Manager Messages: i.e. Satellite Status, RTC Status.

Messages in the RXM class are used to output status and result data from the Receiver Manager.

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

#### 5.17.1.1 Satellite Measurements for RRLP

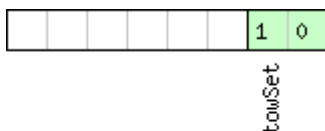
Message	<b>UBX-RXM-MEASX</b>					
Description	<b>Satellite Measurements for RRLP</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	<p>The message payload data is, where possible and appropriate, according to the Radio Resource LCS (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 (GNSS) 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 + 24*numSV	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version, currently 0x01	
1	U1[3]	-	reserved1	-	<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]	-	reserved2	-	<a href="#">Reserved</a>	
20	U4	-	qzssTOW	ms	QZSS measurement reference time	
24	U2	2 <sup>-4</sup>	gpsTOWacc	ms	GPS measurement reference time accuracy (0xffff = > 4s)	
26	U2	2 <sup>-4</sup>	gloTOWacc	ms	GLONASS measurement reference time accuracy (0xffff = > 4s)	
28	U2	2 <sup>-4</sup>	bdsTOWacc	ms	BeiDou measurement reference time accuracy (0xffff = > 4s)	
30	U1[2]	-	reserved3	-	<a href="#">Reserved</a>	
32	U2	2 <sup>-4</sup>	qzssTOWacc	ms	QZSS measurement reference time accuracy (0xffff = > 4s)	

UBX-RXM-MEASX continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
34	U1	-	numSV	-	Number of satellites in repeated block
35	U1	-	flags	-	Flags (see <a href="#">graphic below</a> )
36	U1[8]	-	reserved4	-	<a href="#">Reserved</a>
Start of repeated block (numSV times)					
44 + 24*N	U1	-	gnssId	-	GNSS ID (see <a href="#">Satellite Numbering</a> )
45 + 24*N	U1	-	svId	-	Satellite ID (see <a href="#">Satellite Numbering</a> )
46 + 24*N	U1	-	cNo	-	carrier noise ratio (0..63)
47 + 24*N	U1	-	mpathIndic	-	multipath index (according to [1]) (0 = not measured, 1 = low, 2 = medium, 3 = high)
48 + 24*N	I4	0.04	dopplerMS	m/s	Doppler measurement
52 + 24*N	I4	0.2	dopplerHz	Hz	Doppler measurement
56 + 24*N	U2	-	wholeChips	-	whole value of the code phase measurement (0..1022 for GPS)
58 + 24*N	U2	-	fracChips	-	fractional value of the code phase measurement (0..1023)
60 + 24*N	U4	2 <sup>-21</sup>	codePhase	ms	Code phase
64 + 24*N	U1	-	intCodePhase	ms	Integer (part of the) code phase
65 + 24*N	U1	-	pseuRangeRMSErr	-	pseudorange RMS error index (according to [1]) (0..63)
66 + 24*N	U1[2]	-	reserved5	-	<a href="#">Reserved</a>
End of repeated block					

## Bitfield flags

This graphic explains the bits of flags



- signed value
- unsigned value
- reserved

Name	Description
towSet	TOW set (0 = no, 1 or 2 = yes)

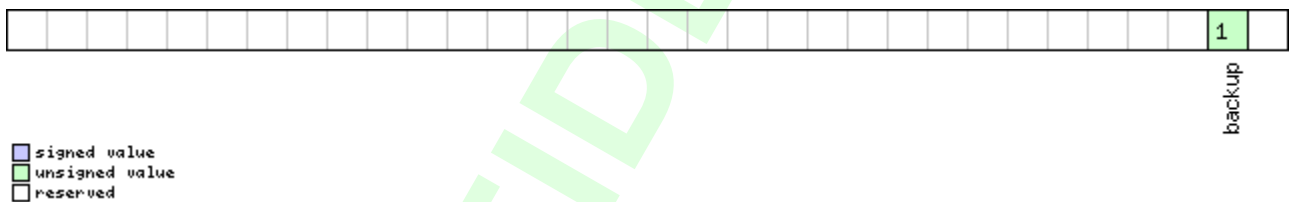
## 5.17.2 UBX-RXM-PMREQ (0x02 0x41)

### 5.17.2.1 Requests a Power Management task

Message	<b>UBX-RXM-PMREQ</b>					
Description	<b>Requests a Power Management task</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	Request of a Power Management related task of the receiver.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x02	0x41	8	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	duration	ms	Duration of the requested task, set to zero for infinite duration. The maximum supported time is 12 days.	
4	X4	-	flags	-	task flags (see <a href="#">graphic below</a> )	

### Bitfield flags

This graphic explains the bits of flags



Name	Description
backup	The receiver goes into backup mode for a time period defined by duration. Provided that it is not connected to USB

### 5.17.2.2 Requests a Power Management task

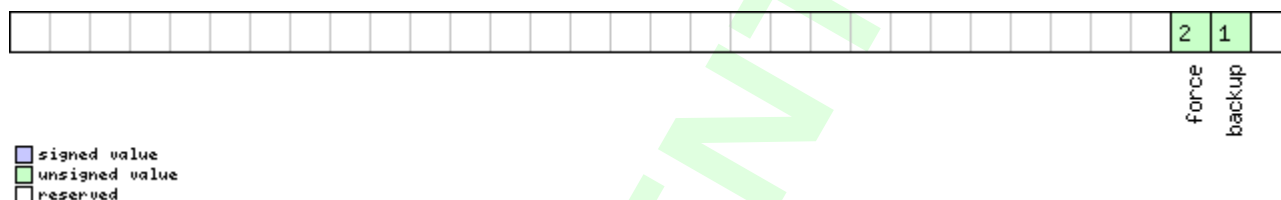
Message	<b>UBX-RXM-PMREQ</b>					
Description	<b>Requests a Power Management task</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	Request of a Power Management related task of the receiver.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x02	0x41	16	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0x00 for this version)	
1	U1[3]	-	reserved1	-	<a href="#">Reserved</a>	

UBX-RXM-PMREQ continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
4	U4	-	duration	ms	Duration of the requested task, set to zero for infinite duration. The maximum supported time is 12 days.
8	X4	-	flags	-	task flags (see <a href="#">graphic below</a> )
12	X4	-	wakeupSources	-	Configure pins to wakeup the receiver. The receiver wakes up if there is either a falling or a rising edge on one of the configured pins (see <a href="#">graphic below</a> )

## Bitfield flags

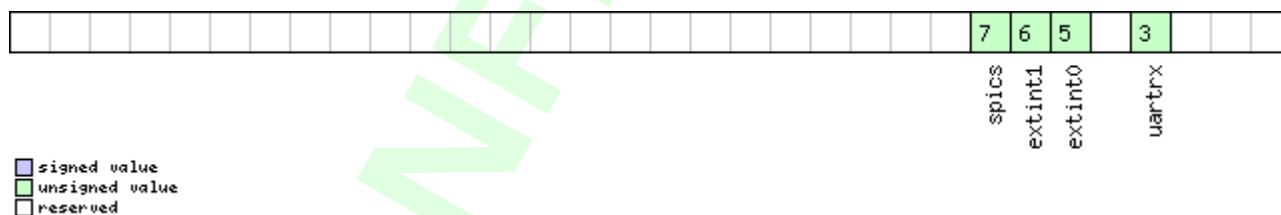
This graphic explains the bits of flags



Name	Description
backup	The receiver goes into backup mode for a time period defined by duration. Provided that it is not connected to USB
force	Force receiver backup while USB is connected. USB interface will be disabled.

## Bitfield wakeupSources

This graphic explains the bits of wakeupSources



Name	Description
uartrx	Wakeup the receiver if there is an edge on the UART RX pin.
extint0	Wakeup the receiver if there is an edge on the EXTINT0 pin.
extint1	Wakeup the receiver if there is an edge on the EXTINT1 pin.
spics	Wakeup the receiver if there is an edge on the SPI CS pin.



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

#### 5.17.3.1 Multi-GNSS Raw Measurement Data

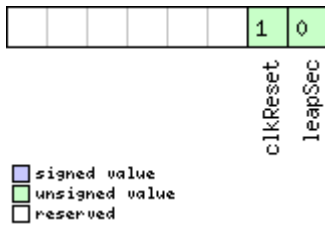
Message	UBX-RXM-RAWX					
Description	Multi-GNSS Raw Measurement Data					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)</li></ul>					
Type	Periodic/Polled					
Comment	<p>This message contains the information needed to be able to generate a <a href="#">RINEX 3</a> multi-GNSS observation file.</p> <p>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.</p>					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x02	0x15	16 + 32*numMeas	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	R8	-	rcvTow	s	<p>Measurement time of week in receiver local time approximately aligned to the GPS time system.</p> <p>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 <a href="#">RINEX 3</a> 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.</p>	
8	U2	-	week	weeks	GPS week number in receiver local time.	
10	I1	-	leapS	s	<p>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.</p>	
11	U1	-	numMeas	-	Number of measurements to follow	
12	X1	-	recStat	-	Receiver tracking status bitfield (see <a href="#">graphic below</a> )	
13	U1	-	version	-	Message version (0x01 for this version).	
14	U1[2]	-	reserved1	-	<a href="#">Reserved</a>	
Start of repeated block (numMeas times)						
16 + 32*N	R8	-	prMes	m	<p>Pseudorange measurement [m].</p> <p>GLONASS inter frequency channel delays are compensated with an internal calibration table.</p>	

UBX-RXM-RAWX continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
24 + 32*N	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 + 32*N	R4	-	doMes	Hz	Doppler measurement (positive sign for approaching satellites) [Hz]
36 + 32*N	U1	-	gnssId	-	GNSS identifier (see <a href="#">Satellite Numbering</a> for a list of identifiers)
37 + 32*N	U1	-	svId	-	Satellite identifier (see <a href="#">Satellite Numbering</a> )
38 + 32*N	U1	-	sigId	-	New style signal identifier (see <a href="#">Signal Identifiers</a> ).
39 + 32*N	U1	-	freqId	-	Only used for GLONASS: This is the frequency slot + 7 (range from 0 to 13)
40 + 32*N	U2	-	locktime	ms	Carrier phase locktime counter (maximum 64500ms)
42 + 32*N	U1	-	cno	dBHz	Carrier-to-noise density ratio (signal strength) [dB-Hz]
43 + 32*N	X1	0.01*2 <sup>n</sup>	prStdev	m	Estimated pseudorange measurement standard deviation (see <a href="#">graphic below</a> )
44 + 32*N	X1	0.004	cpStdev	cycles	Estimated carrier phase measurement standard deviation (note a raw value of 0x0F indicates the value is invalid) (see <a href="#">graphic below</a> )
45 + 32*N	X1	0.002*2 <sup>n</sup>	doStdev	Hz	Estimated Doppler measurement standard deviation. (see <a href="#">graphic below</a> )
46 + 32*N	X1	-	trkStat	-	Tracking status bitfield (see <a href="#">graphic below</a> )
47 + 32*N	U1	-	reserved2	-	<a href="#">Reserved</a>
End of repeated block					

### Bitfield recStat

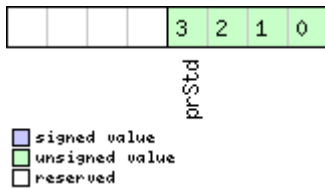
This graphic explains the bits of recStat



Name	Description
leapSec	Leap seconds have been determined
clkReset	Clock reset applied. Typically the receiver clock is changed in increments of integer milliseconds.

### Bitfield prStdev

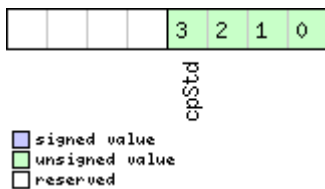
This graphic explains the bits of prStdev



Name	Description
prStd	Estimated pseudorange standard deviation

### Bitfield cpStdev

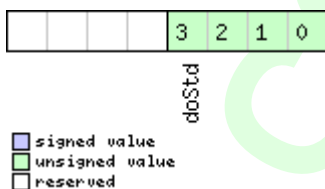
This graphic explains the bits of cpStdev



Name	Description
cpStd	Estimated carrier phase standard deviation

### Bitfield doStdev

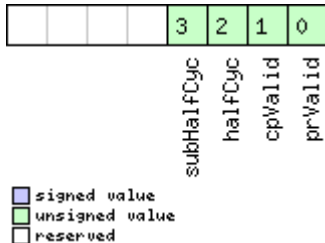
This graphic explains the bits of doStdev



Name	Description
doStd	Estimated Doppler standard deviation

## Bitfield trkStat

This graphic explains the bits of trkStat



Name	Description
prValid	Pseudorange valid
cpValid	Carrier phase valid
halfCyc	Half cycle valid
subHalfCyc	Half cycle subtracted from phase

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

#### 5.17.4.1 Galileo SAR Short-RLM report

Message	<b>UBX-RXM-RLM</b>					
Description	<b>Galileo SAR Short-RLM report</b>					
Firmware	Supported on: <ul style="list-style-type: none"> <li>u-blox 9 with protocol version 30</li> </ul>					
Type	Output					
Comment	This message contains the contents of any Galileo Search and Rescue (SAR) Short Return Link Message detected by the receiver.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x02	0x59	16	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
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	-	reserved1	-	<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	-	reserved2	-	<a href="#">Reserved</a>	

#### 5.17.4.2 Galileo SAR Long-RLM report

Message	<b>UBX-RXM-RLM</b>					
Description	<b>Galileo SAR Long-RLM report</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	This message contains the contents of any Galileo Search and Rescue (SAR) Long Return Link Message detected by the receiver.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x02	0x59	28	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
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	-	reserved1	-	<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]	-	reserved2	-	<a href="#">Reserved</a>	

#### 5.17.5 UBX-RXM-RTC5 (0x02 0x23)

##### 5.17.5.1 Real Time Clock Status

Message	<b>UBX-RXM-RTC5</b>					
Description	<b>Real Time Clock Status</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	Status of the Real time clock					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x02	0x23	28	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	rTagHW	-	RTAG high word	
4	U4	-	rTagLW	-	RTAG low word	
8	U4	-	freq	Hz	Clock frequency	
12	U4	2 <sup>-32</sup>	freqFrac	Hz	Clock frequency fractional part	

UBX-RXM-RTCM5 continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
16	U4	2 <sup>-32</sup>	towFrac	s	Time of week fractional part
20	U4	-	tow	s	Time of week
24	U2	-	wno	-	GPS week number
26	U1	-	towValid	-	TOW is valid flag
27	U1	-	freqValid	-	Frequency is valid flag

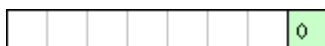
## 5.17.6 UBX-RXM-RTCM (0x02 0x32)

### 5.17.6.1 RTCM input status

Message	<b>UBX-RXM-RTCM</b>					
Description	<b>RTCM input status</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a> (only with ADR products)					
Type	Output					
Comment	Output upon processing of an RTCM input message					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x02	0x32	8	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0x02 for this version)	
1	X1	-	flags	-	RTCM input status flags (see <a href="#">graphic below</a> )	
2	U2	-	subType	-	Message subtype, only applies for RTCM 4072 message	
4	U2	-	refStation	-	Reference station ID	
6	U2	-	msgType	-	Message type	

## Bitfield flags

This graphic explains the bits of flags



■ signed value  
■ unsigned value  
■ reserved

Name	Description
crcFailed	0 when RTCM message received and passed CRC check, 1 when failed in which case refStation and msgType might be corrupted and misleading

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

#### 5.17.7.1 Broadcast Navigation Data Subframe

Message	UBX-RXM-SFRBX					
Description	Broadcast Navigation Data Subframe					
Firmware	Supported on: <ul style="list-style-type: none"><li>u-blox 9 with protocol version 30</li></ul>					
Type	Output					
Comment	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.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x02	0x13	8 + 4*numWords	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	gnssId	-	GNSS identifier (see <a href="#">Satellite Numbering</a> )	
1	U1	-	svId	-	Satellite identifier (see <a href="#">Satellite Numbering</a> )	
2	U1	-	reserved1	-	Reserved	
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 10, 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	-	reserved2	-	Reserved	
Start of repeated block (numWords times)						
8 + 4*N	U4	-	dword	-	The data words	
End of repeated block						

## 5.18 UBX-SEC (0x27)

### Security Feature Messages

Messages in the SEC class are used for security features of the receiver.

#### 5.18.1 UBX-SEC-ECSIGN (0x27 0x04)

##### 5.18.1.1 Signature for output message

Message	<b>UBX-SEC-ECSIGN</b>					
Description	<b>Signature for output message</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	The message contains number of messages, their hash, signature for the hash and a session id. The signature is created with ECDSA.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x27	0x04	108	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0x01 for this version)	
1	U1	-	reserved1	-	<a href="#">Reserved</a>	
2	U2	-	msgNum	-	Number of messages, which were hashed and signed	
4	U1[32]	-	finalHash	-	Hash of the messages	
36	U1[24]	-	sessionId	-	Session Id	
60	U1[48]	-	ecdsaSignature	-	Signature computed for the hash and session id	

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

##### 5.18.2.1 Unique Chip ID

Message	<b>UBX-SEC-UNIQID</b>					
Description	<b>Unique Chip ID</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	This message is used to retrieve a unique chip identifier (40 bits, 5 bytes).					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x27	0x03	9	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (0x01 for this version)	
1	U1[3]	-	reserved1	-	<a href="#">Reserved</a>	
4	U1[5]	-	uniqueId	-	Unique chip ID	



## 5.19 UBX-TIM (0x0D)

Timing Messages: i.e. Time Pulse Output, Time Mark Results.

Messages in the TIM class are used to output timing information from the receiver, like Time Pulse and Time Mark measurements.

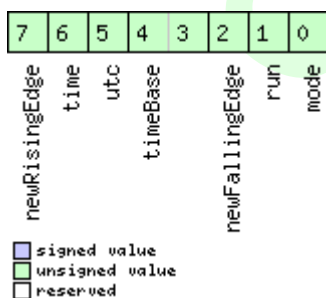
### 5.19.1 UBX-TIM-TM2 (0x0D 0x03)

#### 5.19.1.1 Time mark data

Message	<b>UBX-TIM-TM2</b>					
Description	<b>Time mark data</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	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.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0D	0x03	28	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	ch	-	Channel (i.e. EXTINT) upon which the pulse was measured	
1	X1	-	flags	-	Bitmask (see <a href="#">graphic below</a> )	
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	

### Bitfield flags

This graphic explains the bits of flags



Name	Description
mode	0=single 1=running
run	0=armed 1=stopped
newFallingEdge	new falling edge detected
timeBase	0=Time base is Receiver Time 1=Time base is GNSS Time (the system according to the configuration in <a href="#">CFG-TP Configuration Items</a> for tpIdx=0) 2=Time base is UTC (the variant according to the configuration in <a href="#">CFG-NAVSPG-* Configuration Items</a> )
utc	0=UTC not available 1=UTC available
time	0=Time is not valid 1=Time is valid (Valid GNSS fix)
newRisingEdge	new rising edge detected

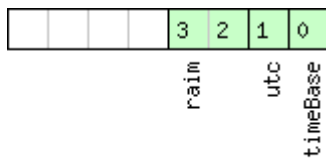
## 5.19.2 UBX-TIM-TP (0x0D 0x01)

### 5.19.2.1 Time Pulse Timedata

Message	<b>UBX-TIM-TP</b>					
Description	<b>Time Pulse Timedata</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	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 1Hz.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0D	0x01	16	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	towMS	ms	Time pulse time of week according to time base	
4	U4	2 <sup>-32</sup>	towSubMS	ms	Submillisecond part of TOWMS	
8	I4	-	qErr	ps	Quantization error of time pulse (not supported for the FTS product variant).	
12	U2	-	week	weeks	Time pulse week number according to time base	
14	X1	-	flags	-	bitmask (see <a href="#">graphic below</a> )	
15	X1	-	refInfo	-	Time reference information (see <a href="#">graphic below</a> )	

## Bitfield flags

This graphic explains the bits of flags

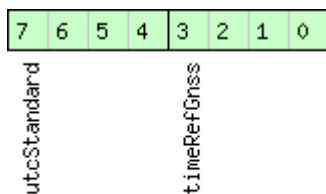


☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
timeBase	0=Time base is GNSS 1=Time base is UTC
utc	0=UTC not available 1=UTC available
raim	(T)RAIM information 0=information not available 1=not active 2=active

## Bitfield refInfo

This graphic explains the bits of refInfo



☐ signed value  
☒ unsigned value  
☐ reserved

Name	Description
timeRefGnss	GNSS reference information (only active if time base is GNSS -> timeBase=0) 0: GPS 1: GLONASS 2: BeiDou 15: Unknown
utcStandard	UTC standard identifier (only active if time base is UTC -> timeBase=1) 0: Information not available 1: Communications Research Laboratory (CRL) 2: National Institute of Standards and Technology (NIST) 3: U.S. Naval Observatory (USNO) 4: International Bureau of Weights and Measures (BIPM) 5: European Laboratory (tbd) 6: Former Soviet Union (SU) 15: Unknown

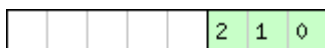
### 5.19.3 UBX-TIM-VRFY (0x0D 0x06)

#### 5.19.3.1 Sourced Time Verification

Message	<b>UBX-TIM-VRFY</b>					
Description	<b>Sourced Time Verification</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Periodic/Polled					
Comment	This message contains verification information about previous time received via AID-INI or from RTC					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x0D	0x06	20	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	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	-	information flags (see <a href="#">graphic below</a> )	
19	U1	-	reserved1	-	<a href="#">Reserved</a>	

#### Bitfield flags

This graphic explains the bits of flags



src

- signed value
- unsigned value
- reserved

Name	Description
src	aiding time source 0: no time aiding done 2: source was RTC 3: source was AID-INI

## 5.20 UBX-UPD (0x09)

Firmware Update Messages: i.e. Memory/Flash erase/write, Reboot, Flash identification, etc.. Messages in the UPD class are used to update the firmware and identify any attached flash device.

### 5.20.1 UBX-UPD-CERASE (0x09 0x16)

#### 5.20.1.1 Chip erase the connected SQI flash

Message	<b>UBX-UPD-CERASE</b>					
Description	<b>Chip erase the connected SQI flash</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	An UBX-ACK-ACK message is sent if the command was received and is valid. A UBX-ACK-NAK is sent if the payload has a wrong size. This response indicates the success state of the command parsing, but does not give an indication whether the command was added to the work queue or had to be discarded because of queue size or memory limitation. If the command could not be added to the queue, the receiver will not provide an additional answer to the UBX-ACK-ACK message. If the command was added to the queue and after flash erase operation was performed, the erase success state is signaled with an UBX-UPD-CERASE output message. Note that depending on the flash it can take up to 5 minutes until the UBX-UPD-CERASE message is output.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x16	0	see below	CK_A CK_B
No payload						

#### 5.20.1.2 Chip erase the connected SQI flash

Message	<b>UBX-UPD-CERASE</b>					
Description	<b>Chip erase the connected SQI flash</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x16	1	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	success	-	1 if success, 0 if chip erase failed	

## 5.20.2 UBX-UPD-CRC (0x09 0x0D)

### 5.20.2.1 Result of CRC check.

Message	<b>UBX-UPD-CRC</b>					
Description	<b>Result of CRC check.</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	Contains the result of a CRC check.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x0D	5	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	X4	-	addr	-	CRC range begin address	
4	U1	-	success	-	1 if CRC OK, 0 if CRC wrong	

## 5.20.3 UBX-UPD-ERASE (0x09 0x0B)

### 5.20.3.1 Erase flash sector

Message	<b>UBX-UPD-ERASE</b>					
Description	<b>Erase flash sector</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	An UBX-ACK-ACK message is sent if the command was received and is valid. A UBX-ACK-NAK is sent if the payload has a wrong size. This response indicates the success state of the command parsing, but does not give an indication whether the command was added to the work queue or had to be discarded because of queue size or memory limitation. If the command could not be added to the queue, the receiver will not provide an additional answer to the UBX-ACK-ACK message. If the command was added to the queue and after flash erase operation was performed, the erase success state is signaled with an UBX-UPD-ERASE output message. Note that depending on the flash it can take up to 10 seconds until the UBX-UPD-ERASE message is output.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x0B	4	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	addr	-	Base address of flash sector	

### 5.20.3.2 Erase flash sector

Message	<b>UBX-UPD-ERASE</b>					
Description	<b>Erase flash sector</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x0B	5	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	X4	-	addr	-	Base address of flash sector	
4	U1	-	success	-	1 if success, 0 if erase failed	

### 5.20.4 UBX-UPD-FLDET (0x09 0x08)

#### 5.20.4.1 Get the Flash manufacturer and device IDs

Message	<b>UBX-UPD-FLDET</b>					
Description	<b>Get the Flash manufacturer and device IDs</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Poll Request					
Comment	An ACK is sent after the answer (UPD-FLDET with payload) was sent. A NAK is sent if the payload has a wrong size.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x08	4	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	address	-	Base address of Flash	

#### 5.20.4.2 Get the Flash manufacturer and device IDs

Message	<b>UBX-UPD-FLDET</b>					
Description	<b>Get the Flash manufacturer and device IDs</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Get					
Comment	This is the response from the receiver					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x08	8	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U4	-	address	-	Base address of Flash	

UBX-UPD-FLDET continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
4	U2	-	manId	-	Manufacturer ID
6	U2	-	devId	-	Device ID

### 5.20.5 UBX-UPD-FLWRI (0x09 0x0C)

#### 5.20.5.1 Write flash data (area must be erased before)

Message	UBX-UPD-FLWRI					
Description	Write flash data (area must be erased before)					
Firmware	Supported on: <ul style="list-style-type: none"><li>• <a href="#">u-blox 9 with protocol version 30</a></li></ul>					
Type	Command					
Comment	An UBX-ACK-ACK message is sent if the command was received and is valid. A UBX-ACK-NAK is sent if the payload has a wrong size or the field 'size' does not match the data payload size. This response indicates the success state of the command parsing, but does not give an indication whether the command was added to the work queue or had to be discarded because of queue size or memory limitation. If the command could not be added to the queue, the receiver will not provide an additional answer to the UBX-ACK-ACK message. If the command was added to the queue and after flash write operation was performed, the write success state is signaled with an UBX-UPD-FLWRI output message.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x0C	8 + 1*size	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	X4	-	addr	-	Base address of write block	
4	U4	-	size	-	Size of data to write	
Start of repeated block (size times)						
8 + 1*N	U1	-	data	-	Data to write	
End of repeated block						



### 5.20.5.2 Write flash data success indication

Message	<b>UBX-UPD-FLWRI</b>					
Description	<b>Write flash data success indication</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	Success report for write command					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x0C	5	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	X4	-	addr	-	Base address of write block	
4	U1	-	success	-	1 if success, 0 if write failed	

### 5.20.6 UBX-UPD-IDEN (0x09 0x06)

#### 5.20.6.1 Identify flash loader version

Message	<b>UBX-UPD-IDEN</b>					
Description	<b>Identify flash loader version</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Poll Request					
Comment	An ACK is sent after the answer (UPD-IDEN including payload) was sent. A NAK is sent if the payload has a wrong size.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x06	0	see below	CK_A CK_B
No payload						

#### 5.20.6.2 Identify flash loader version

Message	<b>UBX-UPD-IDEN</b>					
Description	<b>Identify flash loader version</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Get					
Comment	This is the version response from the receiver.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x06	1	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	X1	-	Version	-	Major.Minor (each 4 Bit)	

## 5.20.7 UBX-UPD-POS (0x09 0x15)

### 5.20.7.1 Enable PLL during safeboot

Message	<b>UBX-UPD-POS</b>					
Description	<b>Enable PLL during safeboot</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	The host can send this message in order to enable precise clock. Clock configuration needs to be loaded beforehand using CFG-VALSET message. NAK is sent if the message has wrong size or enabling PLL failed. Host should wait for ACK which is issued after external oscillator and PLL are started. It might take a few hundreds of ms before it is completed in case of XTO auto tuning and few dozens of milliseconds in other cases.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x15	2	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Message version (1 for this message)	
1	U1	-	skipOsc	-	If true OSC initialization is skipped (It has to be already running!)	

## 5.20.8 UBX-UPD-QSIZE (0x09 0x09)

### 5.20.8.1 Get number of pending commands in queue

Message	<b>UBX-UPD-QSIZE</b>					
Description	<b>Get number of pending commands in queue</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Poll Request					
Comment	Get the number of pending commands in command queue. An ACK is sent after the answer (UPD-QSIZE with payload) was sent. The data will be sent via ANSWER if size is not bigger than 255 and with ANSWER1 otherwise. A NAK is sent if the payload has a wrong size.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x09	0	see below	CK_A CK_B
No payload						

### 5.20.8.2 Number of pending commands in queue

Message	<b>UBX-UPD-QSIZE</b>					
Description	<b>Number of pending commands in queue</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Get					
Comment	The number of pending commands in command queue.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x09	1	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	qSize	-	Number of commands pending	

### 5.20.8.3 Number of pending commands in queue

Message	<b>UBX-UPD-QSIZE</b>					
Description	<b>Number of pending commands in queue</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Get					
Comment	The number of pending commands in command queue.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x09	2	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U2	-	qSize	-	Number of commands pending	

### 5.20.9 UBX-UPD-RBOOT (0x09 0x0E)

#### 5.20.9.1 Performs a watchdog reset

Message	<b>UBX-UPD-RBOOT</b>					
Description	<b>Performs a watchdog reset</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	Performs a watchdog reset after disconnecting USB (if connected). The type of the reset can be compared to a hotstart with an additional operating system reboot. This message is not acknowledged as the system is being reset immediately.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x0E	0	see below	CK_A CK_B
No payload						

## 5.20.10 UBX-UPD-ROM (0x09 0x25)

### 5.20.10.1 Message is holding ROM CRC

Message	<b>UBX-UPD-ROM</b>					
Description	<b>Message is holding ROM CRC</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Polled					
Comment	-					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x25	12	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	version	-	Version (Always 0)	
1	U1[3]	-	reserved1	-	<a href="#">Reserved</a>	
4	U4	-	romCrcLsw	-	Least significant word of ROM CRC (ROM size - 8 bytes)	
8	U4	-	romCrcMsw	-	Most significant word of ROM CRC (ROM size - 4 bytes)	

## 5.20.11 UBX-UPD-SAFE (0x09 0x07)

### 5.20.11.1 Boot in safe environment from ROM or RAM

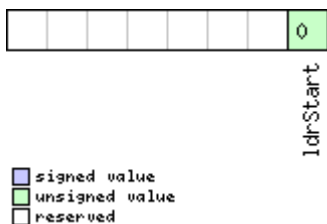
Message	<b>UBX-UPD-SAFE</b>					
Description	<b>Boot in safe environment from ROM or RAM</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	Boot receiver in a safe environment from ROM or RAM. An ACK is sent after receiving the command. A NAK is sent if the payload has a wrong size.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x07	0	see below	CK_A CK_B
No payload						

### 5.20.11.2 Start flash loader task

Message	<b>UBX-UPD-SAFE</b>					
Description	<b>Start flash loader task</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	If already running the firmware from ROM, the Flash loader task has to be started prior to sending update messages (especially flash-write and erase). The receiver does not need to be started in safe environment. An ACK is sent after receiving the command. A NAK is sent if the payload has a wrong size.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x07	1	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	X1	-	flags	-	flags (see <a href="#">graphic below</a> )	

### Bitfield flags

This graphic explains the bits of flags



Name	Description
ldrStart	start flash loader task (flash write and erase routines)

### 5.20.12 UBX-UPD-SETQ (0x09 0x0F)

#### 5.20.12.1 Set maximum of pending commands in queue

Message	<b>UBX-UPD-SETQ</b>					
Description	<b>Set maximum of pending commands in queue</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Set					
Comment	Set the maximum number of pending commands in command queue. An ACK is sent after receiving the command. A NACK is sent if the payload has wrong size.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x0F	1	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	qSize	-	Number of commands allowed to be pending	

### 5.20.12.2 Set maximum of pending commands in queue

Message	<b>UBX-UPD-SETQ</b>					
Description	<b>Set maximum of pending commands in queue</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Set					
Comment	Set the maximum number of pending commands in <b>command queue</b> . An ACK is sent after receiving the command. A NACK is sent if the <b>payload</b> has wrong size.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x0F	2	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U2	-	qSize	-	Number of commands allowed to be pending	

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

#### 5.20.13.1 Poll Backup File Restore Status

Message	<b>UBX-UPD-SOS</b>					
Description	<b>Poll Backup File Restore Status</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Poll Request					
Comment	Sending this (empty / no-payload) message to the receiver results in the receiver returning a System Restored from Backup message as defined below.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x14	0	see below	CK_A CK_B
No payload						

#### 5.20.13.2 Create Backup File in Flash

Message	<b>UBX-UPD-SOS</b>					
Description	<b>Create Backup File in Flash</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Command					
Comment	The host can send this message in order to save part of the BBR memory in a file in 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 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
Payload Contents:						

UBX-UPD-SOS continued

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1	-	cmd	-	Command (must be 0)
1	U1[3]	-	reserved1	-	Reserved

### 5.20.13.3 Clear Backup in Flash

Message	<b>UBX-UPD-SOS</b>				
Description	<b>Clear Backup in Flash</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Command				
Comment	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 'Restored data saved on shutdown' or poll the UBX-UPD-SOS message for getting the status.				
Message Structure	Header	Class	ID	Length (Bytes)	Payload
	0xB5 0x62	0x09	0x14	4	see below
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1	-	cmd	-	Command (must be 1)
1	U1[3]	-	reserved1	-	Reserved

### 5.20.13.4 Backup File Creation Acknowledge

Message	<b>UBX-UPD-SOS</b>				
Description	<b>Backup File Creation Acknowledge</b>				
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>				
Type	Output				
Comment	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 received this message.				
Message Structure	Header	Class	ID	Length (Bytes)	Payload
	0xB5 0x62	0x09	0x14	8	see below
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1	-	cmd	-	Command (must be 2)
1	U1[3]	-	reserved1	-	Reserved
4	U1	-	response	-	0: Not acknowledged 1: Acknowledged
5	U1[3]	-	reserved2	-	Reserved

### 5.20.13.5 System Restored from Backup

Message	<b>UBX-UPD-SOS</b>					
Description	<b>System Restored from Backup</b>					
Firmware	Supported on: • <a href="#">u-blox 9 with protocol version 30</a>					
Type	Output					
Comment	The message is sent from the device to notify the host the BBR has been restored from a backup file in flash. The host should clear the backup file after receiving this message. If the UBX-UPD-SOS message is polled, this message will be resent.					
Message Structure	Header	Class	ID	Length (Bytes)	Payload	Checksum
	0xB5 0x62	0x09	0x14	8	see below	CK_A CK_B
Payload Contents:						
Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1	-	cmd	-	Command (must be 3)	
1	U1[3]	-	reserved1	-	<a href="#">Reserved</a>	
4	U1	-	response	-	0: Unknown 1: Failed restoring from backup file 2: Restored from backup file 3: Not restored (no backup)	
5	U1[3]	-	reserved2	-	<a href="#">Reserved</a>	



## 6 Configuration Interface

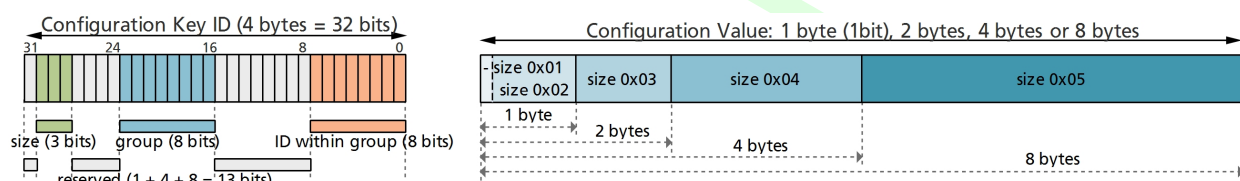
This chapter describes the [Receiver Configuration Database](#) accessible through the [Configuration Interface](#).

### 6.1 Configuration Database

The configuration database in the receiver's RAM holds the current configuration, which is used by the receiver at run-time. It is constructed on startup of the receiver from several sources of configuration. These sources are called Configuration Layers. The current configuration is called the RAM Layer. Any configuration in any layer is organized as Configuration Items, where each Configuration Item is referenced by a unique Configuration Key ID and hold a single Configuration Value.

### 6.2 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 three parts (Note that bits 31, 27..24 and 15..8 are reserved for future use and are currently unused.):

- bits 30..28: 3 bits that indicate the storage size of a Configuration Value (range 0x01-0x05, see below)
- bits 23..16: 8 bits that define a unique group ID (range 0x01-0xfe)
- bits 7..0: 8 bits that define a unique item ID within a group (range 0x01-0xfe)

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 [number formats](#)):

- 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: IEEE754 single (32-bit) and double (64-bit) precision floats
- E1, E2, E4: unsigned little-endian enumeration of 8-, 16-, and 32-bit widths (like U1, U2 and U4)

- 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

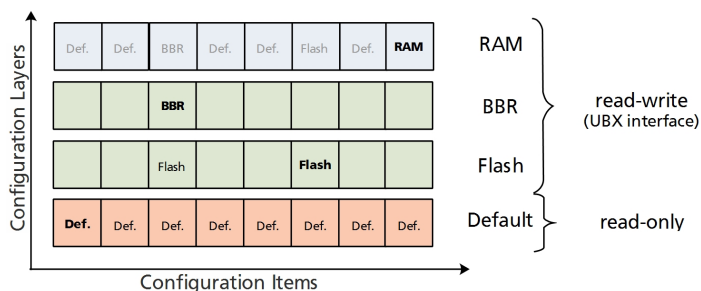
### 6.3 Configuration Layers

Several Configuration Layers exist. They are separate sources of Configuration Items. Some of the layers are read-only and others are modifiable. Layers are organised in terms of priority. Values in a high priority layer will replace values stored in low priority layer. On startup of the receiver all configuration layers are read and the items within each layer are stacked up in order 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 value of any item can be set by the user at run-time (see [UBX Protocol Interface](#) below) and it will become 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 value of any item can be set by the user at run-time (see [UBX Protocol Interface](#) below) and it will become effective upon a restart of the receiver.
- **Flash:** This layer contains items stored permanently in the external flash memory. This layer is only available if there is a usable external flash memory. The value of any item can be set by the user at run-time (see [UBX Protocol Interface](#) below) it will become effective upon a restart of the receiver.
- **Default:** This layer contains all items known to the running receiver software and their hard-coded default values. Data in this layer is not writable.

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 below bold text indicates the source of the value in the Current Configuration (the RAM Layer). Empty boxes indicate that the layer can hold the item but that it is not currently stored there. Boxes with text indicate 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 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

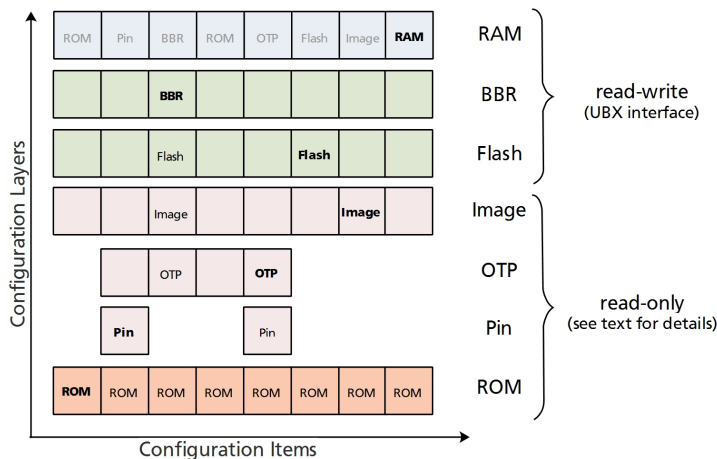
sixth item is changed by the value in the Flash Layer. The value of the last item is changed in the RAM Layer only, i.e. upon startup the value in the RAM Layer was the value from the Default Layer, but the user has changed the value in the RAM Layer at run-time.

### 6.3.1 Default Layer Composite

The Default Layer is a composition of the following four layers. Some of these are writable by special means that differ from the [UBX Protocol Interface](#) used for the read-write layers listed above.

- **Image:** This layer contains items appended to an external flash firmware image. It is not modifiable by the user. It is used to provide firmware images that differ in their default (factory) configuration but not in their software or the items in the ROM layer.
- **OTP:** This layer contains items from the contents of the eFuse OTP (one-time programmable [memory]). See [OTP Layer Configuration](#) for details.
- **Pin:** This layer contains items derived from configuration pins. See [Pin Layer Configuration](#) for details.
- **ROM:** This layer defines all items known to the running receiver software and their hard-coded default value. Data in this layer is not writeable.

The figure below shows all seven layers. An empty space indicates that the item cannot be stored in that layer.



In the example figure above, the first and fourth items are only present in the ROM Layer. Hence the value from the ROM Layer ends up in the RAM Layer. The second item is also present in the Pin Layer and hence that value ends up in the RAM Layer. The third item is present in the ROM, OTP, Image, Flash and BBR Layers. Since the BBR Layer has the highest priority, this value will end up in the RAM Layer. The seventh item is present in the ROM and Image Layers. There is no corresponding item in the Flash or BBR Layers and so the value from the Image Layer ends up in the RAM Layer. The last item is present in the ROM and the RAM Layers. Upon startup the value in the RAM Layer was the value from the ROM Layer. But here the user has changed the value in the RAM Layer at run-time.

## 6.4 Configuration Interface Access

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

### 6.4.1 UBX Protocol Interface

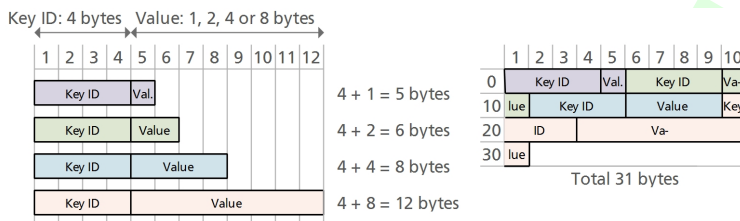
The following UBX protocol messages are available to access the Configuration Database:

- [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

## 6.5 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), 4 bytes (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.



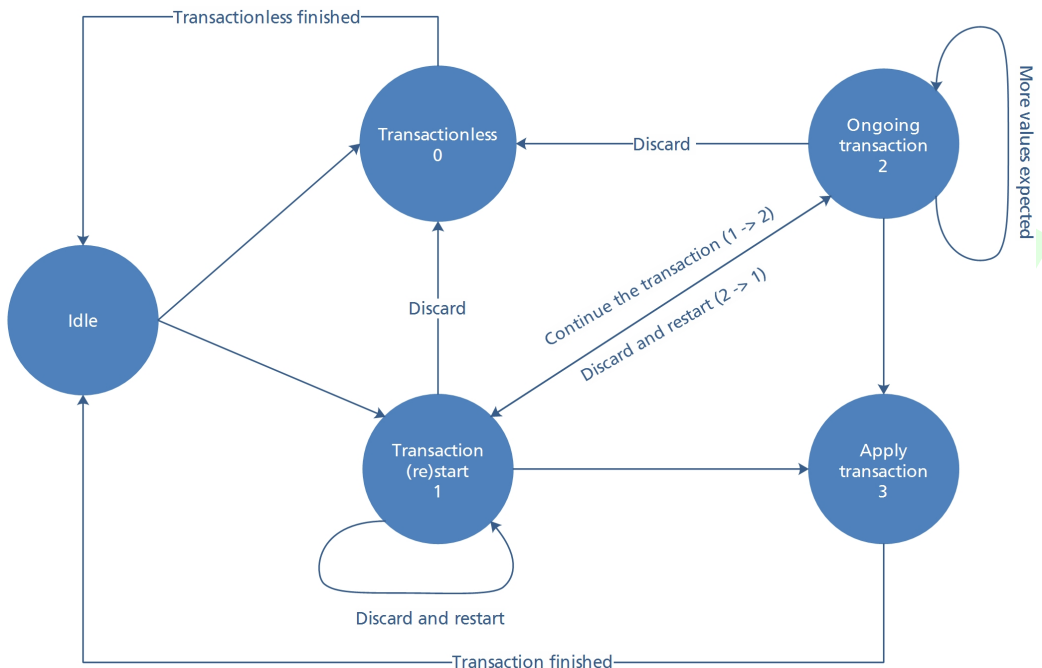
Note that this is an arbitrary example and any number of items of any value storage size can be concatenated the same way.

## 6.6 Configuration Transactions

The configuration concept supports two mechanisms of configuration, 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, the user must specify the layer(s) the changes will be applied to. This list of configuration layer(s) must be observed throughout the transaction states, modifying the configuration layer(s) mid-transaction will cause the transaction to be aborted and no queued changes will be applied.

In the start transaction state, the receiver will lock 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, and that will be queued waiting to be applied.

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

In the apply state, the queued changes will be collectively checked and applied to the requested configuration layer(s). Note that any additional key-value pairs sent within the apply state will be 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 will abort the current transaction and no queued changes would be applied.

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

## 6.7 Reset Behaviour

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

## 6.8 Configuration Reference

See [Configuration Defaults](#) for the default values.

### 6.8.1 CFG-CLOCK: System Clock Configuration

Configuration of system clock tree.

#### CFG-CLOCK-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-CLOCK-OSC_FREQ	0x40a4000d	U4	-	Hz	Oscillator speed

### 6.8.2 CFG-HW: Hardware Configuration

Hardware configuration settings.

#### CFG-HW-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-HW-DCDC_DIS	0x10a30018	L	-	-	DCDC converter disabled
If set to true, DCDC converter is disabled (default), otherwise DCDC converter is enabled.					
CFG-HW-SINGLE_CLK	0x10a30019	L	-	-	Single clock system
If set to true (default), it indicates RTC clock is present and used, otherwise main oscillator is used.					
CFG-HW-OSC_TYPE	0x20a30025	E1	-	-	Oscillator type
See <a href="#">Constants for CFG-HW-OSC_TYPE</a> below for a list of possible constants for this item.					
CFG-HW-CLK_OFFSET	0x40a30028	I4	-	ppb	Clock offset
CFG-HW-CLK_OFFSET_VALID	0x10a30029	L	-	-	Clock offset valid
CFG-HW-CLK_PRECISION	0x40a3002a	U4	-	ppb	Precision of the clock offset
CFG-HW-CLK_MAX_CALIB_DEV	0x40a3002b	U4	-	ppb	Maximum calibration deviation
CFG-HW-CLK_MAX_CALIB_DEV_VALID	0x10a3002c	L	-	-	Max calibration deviation valid
CFG-HW-ANT_CFG_VOLTCTRL	0x10a3002e	L	-	-	Active antenna voltage control flag
Enable active antenna voltage control flag.					
CFG-HW-ANT_CFG_SHORTDET	0x10a3002f	L	-	-	Short antenna detection flag
Enable short antenna detection flag.					
CFG-HW-ANT_CFG_SHORTDET_POL	0x10a30030	L	-	-	Short antenna detection polarity
Set to true if polarity of the antenna short detection is active low.					
CFG-HW-ANT_CFG_OPENDET	0x10a30031	L	-	-	Open antenna detection flag
Enable open antenna detection flag.					
CFG-HW-ANT_CFG_OPENDET_POL	0x10a30032	L	-	-	Open antenna detection polarity
Set to true if polarity of the antenna open detection is active low.					
CFG-HW-ANT_CFG_PWRDOWN	0x10a30033	L	-	-	Power down antenna flag

#### CFG-HW-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
Enable power down antenna logic in the event of antenna short circuit. CFG-HW-ANT_CFG_SHORTDET must be enabled to use this feature.					
CFG-HW-ANT_CFG_PWRDOWN_POL	0x10a30034	L	-	-	Power down antenna logic polarity
Set to true if polarity of the antenna power down logic is active high.					
CFG-HW-ANT_CFG_RECOVER	0x10a30035	L	-	-	Automatic recovery from short state flag
Enable automatic recovery from short state.					
CFG-HW-ANT_SUP_SWITCH_PIN	0x20a30036	U1	-	-	ANT1 PIO number
Antenna Switch (ANT1) PIO number.					
CFG-HW-ANT_SUP_SHORT_PIN	0x20a30037	U1	-	-	ANT0 PIO number
Antenna Short (ANT0) PIO number.					
CFG-HW-ANT_SUP_OPEN_PIN	0x20a30038	U1	-	-	ANT2 PIO number
Antenna Switch (ANT2) PIO number.					

#### Constants for CFG-HW-OSC\_TYPE

Constant	Value	Description
TCXO_D1V2	0x00	TCXO, direct supply 1.2V
TCXO_D1V25	0x01	TCXO, direct supply 1.25V
TCXO_D1V5	0x02	TCXO, direct supply 1.5V
TCXO_D1V8	0x03	TCXO, direct supply 1.8V
TCXO105_D1V2	0x04	TCXO 105°C, direct supply 1.2V
TCXO105_D1V25	0x05	TCXO 105°C, direct supply 1.25V
TCXO105_D1V5	0x06	TCXO 105°C, direct supply 1.5V
TCXO105_D1V8	0x07	TCXO 105°C, direct supply 1.8V
XTO_19PF_AUTO	0x08	XTO with autotuning 19pF
XTO_7PF_AUTO	0x09	XTO with autotuning 7pF
XTO_19PF	0x0a	XTO with 19pF
XTO_7PF	0x0b	XTO with 7pF

### 6.8.3 CFG-I2C: Configuration of the I2C Interface

Settings needed to configure the I2C communication interface.

#### CFG-I2C-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-I2C-ADDRESS	0x20510001	U1	-	-	I2C slave address of the receiver
CFG-I2C-EXTENDEDTIMEOUT	0x10510002	L	-	-	Flag to disable timeouting the interface after 1.5 s
CFG-I2C-ENABLED	0x10510003	L	-	-	Flag to indicate if the I2C interface should be enabled



#### 6.8.4 CFG-I2CINPROT: Input Protocol Configuration of the I2C Interface

Input protocol enable flags of the I2C interface.

##### CFG-I2CINPROT-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-I2CINPROT-UBX	0x10710001	L	-	-	Flag to indicate if UBX should be an input protocol on I2C
CFG-I2CINPROT-NMEA	0x10710002	L	-	-	Flag to indicate if NMEA should be an input protocol on I2C
CFG-I2CINPROT-RTCM3X	0x10710004	L	-	-	Flag to indicate if RTCM3X should be an input protocol on I2C

#### 6.8.5 CFG-I2COUTPROT: Output Protocol Configuration of the I2C Interface

Output protocol enable flags of the I2C interface.

##### CFG-I2COUTPROT-\* Configuration Items

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

#### 6.8.6 CFG-INFMSG: Inf Message Configuration

Information message configuration for the NMEA and UBX protocols.

##### CFG-INFMSG-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-INFMSG-UBX_I2C	0x20920001	X1	-	-	Information message enable flags for the UBX protocol on the I2C interface
See <a href="#">Constants for CFG-INFMSG-UBX_I2C</a> below for a list of possible constants for this item.					
CFG-INFMSG-UBX_UART1	0x20920002	X1	-	-	Information message enable flags for the UBX protocol on the UART1 interface
See <a href="#">Constants for CFG-INFMSG-UBX_UART1</a> below for a list of possible constants for this item.					
CFG-INFMSG-UBX_UART2	0x20920003	X1	-	-	Information message enable flags for the UBX protocol on the UART2 interface
See <a href="#">Constants for CFG-INFMSG-UBX_UART2</a> below for a list of possible constants for this item.					
CFG-INFMSG-UBX_USB	0x20920004	X1	-	-	Information message enable flags for the UBX protocol on the USB interface
See <a href="#">Constants for CFG-INFMSG-UBX_USB</a> below for a list of possible constants for this item.					



## CFG-INFMSG-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-INFMSG-UBX_SPI	0x20920005	X1	-	-	Information message enable flags for the UBX protocol on the SPI interface
See <a href="#">Constants for CFG-INFMSG-UBX_SPI</a> below for a list of possible constants for this item.					
CFG-INFMSG-NMEA_I2C	0x20920006	X1	-	-	Information message enable flags for the NMEA protocol on the I2C interface
See <a href="#">Constants for CFG-INFMSG-NMEA_I2C</a> below for a list of possible constants for this item.					
CFG-INFMSG-NMEA_UART1	0x20920007	X1	-	-	Information message enable flags for the NMEA protocol on the UART1 interface
See <a href="#">Constants for CFG-INFMSG-NMEA_UART1</a> below for a list of possible constants for this item.					
CFG-INFMSG-NMEA_UART2	0x20920008	X1	-	-	Information message enable flags for the NMEA protocol on the UART2 interface
See <a href="#">Constants for CFG-INFMSG-NMEA_UART2</a> below for a list of possible constants for this item.					
CFG-INFMSG-NMEA_USB	0x20920009	X1	-	-	Information message enable flags for the NMEA protocol on the USB interface
See <a href="#">Constants for CFG-INFMSG-NMEA_USB</a> below for a list of possible constants for this item.					
CFG-INFMSG-NMEA_SPI	0x2092000a	X1	-	-	Information message enable flags for the NMEA protocol on the SPI interface
See <a href="#">Constants for CFG-INFMSG-NMEA_SPI</a> below for a list of possible constants for this item.					

**Constants for CFG-INFMSG-UBX\_I2C**

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

**Constants for CFG-INFMSG-UBX\_UART1**

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

**Constants for CFG-INFMSG-UBX\_UART2**

Constant	Value	Description
ERROR	0x01	Enable ERROR information messages
WARNING	0x02	Enable WARNING information messages

Constants for CFG-INFMSG-UBX\_UART2 continued

Constant	Value	Description
NOTICE	0x04	Enable NOTICE information messages
TEST	0x08	Enable TEST information messages
DEBUG	0x10	Enable DEBUG information messages

#### Constants for CFG-INFMSG-UBX\_USB

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

#### Constants for CFG-INFMSG-UBX\_SPI

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

#### Constants for CFG-INFMSG-NMEA\_I2C

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

#### Constants for CFG-INFMSG-NMEA\_UART1

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

#### Constants for CFG-INFMSG-NMEA\_UART2

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

### Constants for CFG-INFMSG-NMEA\_USB

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

### Constants for CFG-INFMSG-NMEA\_SPI

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

### 6.8.7 CFG-ITFM: Jamming/Interference Monitor configuration

Configuration of Jamming/Interference monitor.

#### CFG-ITFM-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-ITFM-BBTHRESHOLD	0x20410001	U1	-	-	Broadband jamming detection threshold
CFG-ITFM-CWTHRESHOLD	0x20410002	U1	-	-	CW jamming detection threshold
CFG-ITFM-ENABLE	0x1041000d	L	-	-	Enable interference detection
CFG-ITFM-ANTSETTING	0x20410010	E1	-	-	Antenna setting
See <a href="#">Constants for CFG-ITFM-ANTSETTING</a> below for a list of possible constants for this item.					
CFG-ITFM-ENABLE_AUX	0x10410013	L	-	-	Set to true to scan auxiliary bands
Supported on u-blox 8 / u-blox M8 only, otherwise ignored.					

### Constants for CFG-ITFM-ANTSETTING

Constant	Value	Description
UNKNOWN	0	Unknown
PASSIVE	1	Passive
ACTIVE	2	Active

### 6.8.8 CFG-LOGFILTER: Data Logger Configuration

This group can be used to configure the data logger, i.e. to enable/disable the log recording and to get/set the position entry filter settings.

Position entries can be filtered based on time difference, position difference or current speed thresholds. Position and speed filtering also have a minimum time interval. A position is logged if any of the thresholds are exceeded. If a threshold is set to zero it is ignored. The maximum rate of position logging is 1Hz.

The filter settings will be configured to the provided values only if the 'applyAllFilterSettings' flag is set. This allows the recording to be enabled/disabled independently of configuring the filter

settings.

It is possible to configure the data logger in the absence of a logging file. By doing so, once the logging file is created, the data logger configuration will take effect immediately and logging recording and filtering will activate according to the configuration.

#### CFG-LOGFILTER-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-LOGFILTER-RECORD_ENA	0x10de0002	L	-	-	Recording enabled
Set to true when recording enabled.					
CFG-LOGFILTER-ONCE_PER_WAKE_UP_ENA	0x10de0003	L	-	-	Once per wakeup
Set to true recording only one single position per PSM on/off mode wake-up period is enabled. Note: the value set here does not take effect unless CFG-LOGFILTER-APPLY_ALL_FILTERS is enabled.					
CFG-LOGFILTER-APPLY_ALL_FILTERS	0x10de0004	L	-	-	Apply all filter settings
Set to true when all filter settings are to be applied, not just recording enabling/disabling.					
CFG-LOGFILTER-MIN_INTERVAL	0x30de0005	U2	-	s	Minimum time interval between logged positions
Minimum time interval between logged positions (0 = not set). <b>This is only applied in combination with the speed and/or position thresholds.</b> If both MIN_INTERVAL and TIME_THRS are set, MIN_INTERVAL must be less than or equal to TIME_THRS. Note: the value set here does not take effect unless CFG-LOGFILTER-APPLY_ALL_FILTERS is enabled.					
CFG-LOGFILTER-TIME_THRS	0x30de0006	U2	-	s	Time threshold
If the time difference is greater than the threshold then the position is logged (0 = not set). Note: the value set here does not take effect unless CFG-LOGFILTER-APPLY_ALL_FILTERS is enabled.					
CFG-LOGFILTER-SPEED_THRS	0x30de0007	U2	-	m/s	Speed threshold
If the current speed is greater than the threshold then the position is logged (0 = not set). MIN_INTERVAL also applies. Note: value set here does not take effect unless CFG-LOGFILTER-APPLY_ALL_FILTERS is enabled.					
CFG-LOGFILTER-POSITION_THRS	0x40de0008	U4	-	m	Position threshold
If the 3D position difference is greater than the threshold then the position is logged (0 = not set). MIN_INTERVAL also applies. Note: the value set here does not take effect unless CFG-LOGFILTER-APPLY_ALL_FILTERS is enabled.					

#### 6.8.9 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.

#### CFG-MOT-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MOT-GNSSSPEED_THRS	0x20250038	U1	0.01	m/s	GNSS speed threshold below which platform is considered as stationary (a.k.a. static hold threshold)
Set this paramter to 0 for a firmware default value or bahaviour.					
CFG-MOT-GNSSDIST_THRS	0x3025003b	U2	-	-	Distance above which GNSS-based stationary motion is exit (a.k.a. static hold distance threshold)
Set this paramter to 0 for a firmware default value or bahaviour.					

#### 6.8.10 CFG-MSGOUT: Message Output Configuration

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

#### CFG-MSGOUT-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-NMEA_ID_DTM_I2C	0x209100a6	U1	-	-	Output rate of the NMEA-GX-DTM message on port I2C
CFG-MSGOUT-NMEA_ID_DTM_SPI	0x209100aa	U1	-	-	Output rate of the NMEA-GX-DTM message on port SPI
CFG-MSGOUT-NMEA_ID_DTM_UART1	0x209100a7	U1	-	-	Output rate of the NMEA-GX-DTM message on port UART1
CFG-MSGOUT-NMEA_ID_DTM_UART2	0x209100a8	U1	-	-	Output rate of the NMEA-GX-DTM message on port UART2
CFG-MSGOUT-NMEA_ID_DTM_USB	0x209100a9	U1	-	-	Output rate of the NMEA-GX-DTM message on port USB
CFG-MSGOUT-NMEA_ID_GBS_I2C	0x209100dd	U1	-	-	Output rate of the NMEA-GX-GBS message on port I2C
CFG-MSGOUT-NMEA_ID_GBS_SPI	0x209100e1	U1	-	-	Output rate of the NMEA-GX-GBS message on port SPI
CFG-MSGOUT-NMEA_ID_GBS_UART1	0x209100de	U1	-	-	Output rate of the NMEA-GX-GBS message on port UART1
CFG-MSGOUT-NMEA_ID_GBS_UART2	0x209100df	U1	-	-	Output rate of the NMEA-GX-GBS message on port UART2
CFG-MSGOUT-NMEA_ID_GBS_USB	0x209100e0	U1	-	-	Output rate of the NMEA-GX-GBS message on port USB
CFG-MSGOUT-NMEA_ID_GGA_I2C	0x209100ba	U1	-	-	Output rate of the NMEA-GX-GGA message on port I2C
CFG-MSGOUT-NMEA_ID_GGA_SPI	0x209100be	U1	-	-	Output rate of the NMEA-GX-GGA message on port SPI
CFG-MSGOUT-NMEA_ID_GGA_UART1	0x209100bb	U1	-	-	Output rate of the NMEA-GX-GGA message on port UART1

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-NMEA_ID_GGA_UART2	0x209100bc	U1	-	-	Output rate of the NMEA-GX-GGA message on port UART2
CFG-MSGOUT-NMEA_ID_GGA_USB	0x209100bd	U1	-	-	Output rate of the NMEA-GX-GGA message on port USB
CFG-MSGOUT-NMEA_ID_GLL_I2C	0x209100c9	U1	-	-	Output rate of the NMEA-GX-GLL message on port I2C
CFG-MSGOUT-NMEA_ID_GLL_SPI	0x209100cd	U1	-	-	Output rate of the NMEA-GX-GLL message on port SPI
CFG-MSGOUT-NMEA_ID_GLL_UART1	0x209100ca	U1	-	-	Output rate of the NMEA-GX-GLL message on port UART1
CFG-MSGOUT-NMEA_ID_GLL_UART2	0x209100cb	U1	-	-	Output rate of the NMEA-GX-GLL message on port UART2
CFG-MSGOUT-NMEA_ID_GLL_USB	0x209100cc	U1	-	-	Output rate of the NMEA-GX-GLL message on port USB
CFG-MSGOUT-NMEA_ID_GNS_I2C	0x209100b5	U1	-	-	Output rate of the NMEA-GX-GNS message on port I2C
CFG-MSGOUT-NMEA_ID_GNS_SPI	0x209100b9	U1	-	-	Output rate of the NMEA-GX-GNS message on port SPI
CFG-MSGOUT-NMEA_ID_GNS_UART1	0x209100b6	U1	-	-	Output rate of the NMEA-GX-GNS message on port UART1
CFG-MSGOUT-NMEA_ID_GNS_UART2	0x209100b7	U1	-	-	Output rate of the NMEA-GX-GNS message on port UART2
CFG-MSGOUT-NMEA_ID_GNS_USB	0x209100b8	U1	-	-	Output rate of the NMEA-GX-GNS message on port USB
CFG-MSGOUT-NMEA_ID_GRS_I2C	0x209100ce	U1	-	-	Output rate of the NMEA-GX-GRS message on port I2C
CFG-MSGOUT-NMEA_ID_GRS_SPI	0x209100d2	U1	-	-	Output rate of the NMEA-GX-GRS message on port SPI
CFG-MSGOUT-NMEA_ID_GRS_UART1	0x209100cf	U1	-	-	Output rate of the NMEA-GX-GRS message on port UART1
CFG-MSGOUT-NMEA_ID_GRS_UART2	0x209100d0	U1	-	-	Output rate of the NMEA-GX-GRS message on port UART2
CFG-MSGOUT-NMEA_ID_GRS_USB	0x209100d1	U1	-	-	Output rate of the NMEA-GX-GRS message on port USB
CFG-MSGOUT-NMEA_ID_GSA_I2C	0x209100bf	U1	-	-	Output rate of the NMEA-GX-GSA message on port I2C
CFG-MSGOUT-NMEA_ID_GSA_SPI	0x209100c3	U1	-	-	Output rate of the NMEA-GX-GSA message on port SPI
CFG-MSGOUT-NMEA_ID_GSA_UART1	0x209100c0	U1	-	-	Output rate of the NMEA-GX-GSA message on port UART1
CFG-MSGOUT-NMEA_ID_GSA_UART2	0x209100c1	U1	-	-	Output rate of the NMEA-GX-GSA message on port UART2
CFG-MSGOUT-NMEA_ID_GSA_USB	0x209100c2	U1	-	-	Output rate of the NMEA-GX-GSA message on port USB



CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-NMEA_ID_GST_I2C	0x209100d3	U1	-	-	Output rate of the NMEA-GX-GST message on port I2C
CFG-MSGOUT-NMEA_ID_GST_SPI	0x209100d7	U1	-	-	Output rate of the NMEA-GX-GST message on port SPI
CFG-MSGOUT-NMEA_ID_GST_UART1	0x209100d4	U1	-	-	Output rate of the NMEA-GX-GST message on port UART1
CFG-MSGOUT-NMEA_ID_GST_UART2	0x209100d5	U1	-	-	Output rate of the NMEA-GX-GST message on port UART2
CFG-MSGOUT-NMEA_ID_GST_USB	0x209100d6	U1	-	-	Output rate of the NMEA-GX-GST message on port USB
CFG-MSGOUT-NMEA_ID_GSV_I2C	0x209100c4	U1	-	-	Output rate of the NMEA-GX-GSV message on port I2C
CFG-MSGOUT-NMEA_ID_GSV_SPI	0x209100c8	U1	-	-	Output rate of the NMEA-GX-GSV message on port SPI
CFG-MSGOUT-NMEA_ID_GSV_UART1	0x209100c5	U1	-	-	Output rate of the NMEA-GX-GSV message on port UART1
CFG-MSGOUT-NMEA_ID_GSV_UART2	0x209100c6	U1	-	-	Output rate of the NMEA-GX-GSV message on port UART2
CFG-MSGOUT-NMEA_ID_GSV_USB	0x209100c7	U1	-	-	Output rate of the NMEA-GX-GSV message on port USB
CFG-MSGOUT-NMEA_ID_RMC_I2C	0x209100ab	U1	-	-	Output rate of the NMEA-GX-RMC message on port I2C
CFG-MSGOUT-NMEA_ID_RMC_SPI	0x209100af	U1	-	-	Output rate of the NMEA-GX-RMC message on port SPI
CFG-MSGOUT-NMEA_ID_RMC_UART1	0x209100ac	U1	-	-	Output rate of the NMEA-GX-RMC message on port UART1
CFG-MSGOUT-NMEA_ID_RMC_UART2	0x209100ad	U1	-	-	Output rate of the NMEA-GX-RMC message on port UART2
CFG-MSGOUT-NMEA_ID_RMC_USB	0x209100ae	U1	-	-	Output rate of the NMEA-GX-RMC message on port USB
CFG-MSGOUT-NMEA_ID_THS_I2C	0x209100e2	U1	-	-	Output rate of the NMEA-GX-THS message on port I2C
CFG-MSGOUT-NMEA_ID_THS_SPI	0x209100e6	U1	-	-	Output rate of the NMEA-GX-THS message on port SPI
CFG-MSGOUT-NMEA_ID_THS_UART1	0x209100e3	U1	-	-	Output rate of the NMEA-GX-THS message on port UART1
CFG-MSGOUT-NMEA_ID_THS_UART2	0x209100e4	U1	-	-	Output rate of the NMEA-GX-THS message on port UART2
CFG-MSGOUT-NMEA_ID_THS_USB	0x209100e5	U1	-	-	Output rate of the NMEA-GX-THS message on port USB
CFG-MSGOUT-NMEA_ID_VLW_I2C	0x209100e7	U1	-	-	Output rate of the NMEA-GX-VLW message on port I2C
CFG-MSGOUT-NMEA_ID_VLW_SPI	0x209100eb	U1	-	-	Output rate of the NMEA-GX-VLW message on port SPI

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-NMEA_ID_VLW_UART1	0x209100e8	U1	-	-	Output rate of the NMEA-GX-VLW message on port UART1
CFG-MSGOUT-NMEA_ID_VLW_UART2	0x209100e9	U1	-	-	Output rate of the NMEA-GX-VLW message on port UART2
CFG-MSGOUT-NMEA_ID_VLW_USB	0x209100ea	U1	-	-	Output rate of the NMEA-GX-VLW message on port USB
CFG-MSGOUT-NMEA_ID_VTG_I2C	0x209100b0	U1	-	-	Output rate of the NMEA-GX-VTG message on port I2C
CFG-MSGOUT-NMEA_ID_VTG_SPI	0x209100b4	U1	-	-	Output rate of the NMEA-GX-VTG message on port SPI
CFG-MSGOUT-NMEA_ID_VTG_UART1	0x209100b1	U1	-	-	Output rate of the NMEA-GX-VTG message on port UART1
CFG-MSGOUT-NMEA_ID_VTG_UART2	0x209100b2	U1	-	-	Output rate of the NMEA-GX-VTG message on port UART2
CFG-MSGOUT-NMEA_ID_VTG_USB	0x209100b3	U1	-	-	Output rate of the NMEA-GX-VTG message on port USB
CFG-MSGOUT-NMEA_ID_ZDA_I2C	0x209100d8	U1	-	-	Output rate of the NMEA-GX-ZDA message on port I2C
CFG-MSGOUT-NMEA_ID_ZDA_SPI	0x209100dc	U1	-	-	Output rate of the NMEA-GX-ZDA message on port SPI
CFG-MSGOUT-NMEA_ID_ZDA_UART1	0x209100d9	U1	-	-	Output rate of the NMEA-GX-ZDA message on port UART1
CFG-MSGOUT-NMEA_ID_ZDA_UART2	0x209100da	U1	-	-	Output rate of the NMEA-GX-ZDA message on port UART2
CFG-MSGOUT-NMEA_ID_ZDA_USB	0x209100db	U1	-	-	Output rate of the NMEA-GX-ZDA message on port USB
CFG-MSGOUT-PUBX_ID_POLYP_I2C	0x209100ec	U1	-	-	Output rate of the NMEA-GX-PUBX00 message on port I2C
CFG-MSGOUT-PUBX_ID_POLYP_SPI	0x209100f0	U1	-	-	Output rate of the NMEA-GX-PUBX00 message on port SPI
CFG-MSGOUT-PUBX_ID_POLYP_UART1	0x209100ed	U1	-	-	Output rate of the NMEA-GX-PUBX00 message on port UART1
CFG-MSGOUT-PUBX_ID_POLYP_UART2	0x209100ee	U1	-	-	Output rate of the NMEA-GX-PUBX00 message on port UART2
CFG-MSGOUT-PUBX_ID_POLYP_USB	0x209100ef	U1	-	-	Output rate of the NMEA-GX-PUBX00 message on port USB
CFG-MSGOUT-PUBX_ID_POLYS_I2C	0x209100f1	U1	-	-	Output rate of the NMEA-GX-PUBX03 message on port I2C
CFG-MSGOUT-PUBX_ID_POLYS_SPI	0x209100f5	U1	-	-	Output rate of the NMEA-GX-PUBX03 message on port SPI
CFG-MSGOUT-PUBX_ID_POLYS_UART1	0x209100f2	U1	-	-	Output rate of the NMEA-GX-PUBX03 message on port UART1
CFG-MSGOUT-PUBX_ID_POLYS_UART2	0x209100f3	U1	-	-	Output rate of the NMEA-GX-PUBX03 message on port UART2



CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-PUBX_ID_POLYS_USB	0x209100f4	U1	-	-	Output rate of the NMEA-GX-PUBX03 message on port USB
CFG-MSGOUT-PUBX_ID_POLYT_I2C	0x209100f6	U1	-	-	Output rate of the NMEA-GX-PUBX04 message on port I2C
CFG-MSGOUT-PUBX_ID_POLYT_SPI	0x209100fa	U1	-	-	Output rate of the NMEA-GX-PUBX04 message on port SPI
CFG-MSGOUT-PUBX_ID_POLYT_UART1	0x209100f7	U1	-	-	Output rate of the NMEA-GX-PUBX04 message on port UART1
CFG-MSGOUT-PUBX_ID_POLYT_UART2	0x209100f8	U1	-	-	Output rate of the NMEA-GX-PUBX04 message on port UART2
CFG-MSGOUT-PUBX_ID_POLYT_USB	0x209100f9	U1	-	-	Output rate of the NMEA-GX-PUBX04 message on port USB
CFG-MSGOUT-UBX_ESF_ALG_I2C	0x2091010f	U1	-	-	Output rate of the UBX-ESF-ALG message on port I2C
CFG-MSGOUT-UBX_ESF_ALG_SPI	0x20910113	U1	-	-	Output rate of the UBX-ESF-ALG message on port SPI
CFG-MSGOUT-UBX_ESF_ALG_UART1	0x20910110	U1	-	-	Output rate of the UBX-ESF-ALG message on port UART1
CFG-MSGOUT-UBX_ESF_ALG_UART2	0x20910111	U1	-	-	Output rate of the UBX-ESF-ALG message on port UART2
CFG-MSGOUT-UBX_ESF_ALG_USB	0x20910112	U1	-	-	Output rate of the UBX-ESF-ALG message on port USB
CFG-MSGOUT-UBX_ESF_INS_I2C	0x20910114	U1	-	-	Output rate of the UBX-ESF-INS message on port I2C
CFG-MSGOUT-UBX_ESF_INS_SPI	0x20910118	U1	-	-	Output rate of the UBX-ESF-INS message on port SPI
CFG-MSGOUT-UBX_ESF_INS_UART1	0x20910115	U1	-	-	Output rate of the UBX-ESF-INS message on port UART1
CFG-MSGOUT-UBX_ESF_INS_UART2	0x20910116	U1	-	-	Output rate of the UBX-ESF-INS message on port UART2
CFG-MSGOUT-UBX_ESF_INS_USB	0x20910117	U1	-	-	Output rate of the UBX-ESF-INS message on port USB
CFG-MSGOUT-UBX_ESF_MEAS_I2C	0x20910277	U1	-	-	Output rate of the UBX-ESF-MEAS message on port I2C
CFG-MSGOUT-UBX_ESF_MEAS_SPI	0x2091027b	U1	-	-	Output rate of the UBX-ESF-MEAS message on port SPI
CFG-MSGOUT-UBX_ESF_MEAS_UART1	0x20910278	U1	-	-	Output rate of the UBX-ESF-MEAS message on port UART1
CFG-MSGOUT-UBX_ESF_MEAS_UART2	0x20910279	U1	-	-	Output rate of the UBX-ESF-MEAS message on port UART2
CFG-MSGOUT-UBX_ESF_MEAS_USB	0x2091027a	U1	-	-	Output rate of the UBX-ESF-MEAS message on port USB
CFG-MSGOUT-UBX_ESF_RAW_I2C	0x2091029f	U1	-	-	Output rate of the UBX-ESF-RAW message on port I2C

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_ESF_RAW_SPI	0x209102a3	U1	-	-	Output rate of the UBX-ESF-RAW message on port SPI
CFG-MSGOUT-UBX_ESF_RAW_UART1	0x209102a0	U1	-	-	Output rate of the UBX-ESF-RAW message on port UART1
CFG-MSGOUT-UBX_ESF_RAW_UART2	0x209102a1	U1	-	-	Output rate of the UBX-ESF-RAW message on port UART2
CFG-MSGOUT-UBX_ESF_RAW_USB	0x209102a2	U1	-	-	Output rate of the UBX-ESF-RAW message on port USB
CFG-MSGOUT-UBX_ESF_STATUS_I2C	0x20910105	U1	-	-	Output rate of the UBX-ESF-STATUS message on port I2C
CFG-MSGOUT-UBX_ESF_STATUS_SPI	0x20910109	U1	-	-	Output rate of the UBX-ESF-STATUS message on port SPI
CFG-MSGOUT-UBX_ESF_STATUS_UART1	0x20910106	U1	-	-	Output rate of the UBX-ESF-STATUS message on port UART1
CFG-MSGOUT-UBX_ESF_STATUS_UART2	0x20910107	U1	-	-	Output rate of the UBX-ESF-STATUS message on port UART2
CFG-MSGOUT-UBX_ESF_STATUS_USB	0x20910108	U1	-	-	Output rate of the UBX-ESF-STATUS message on port USB
CFG-MSGOUT-UBX_HNR_ATT_I2C	0x20910377	U1	-	-	Output rate of the UBX-HNR-ATT message on port I2C
CFG-MSGOUT-UBX_HNR_ATT_SPI	0x2091037b	U1	-	-	Output rate of the UBX-HNR-ATT message on port SPI
CFG-MSGOUT-UBX_HNR_ATT_UART1	0x20910378	U1	-	-	Output rate of the UBX-HNR-ATT message on port UART1
CFG-MSGOUT-UBX_HNR_ATT_UART2	0x20910379	U1	-	-	Output rate of the UBX-HNR-ATT message on port UART2
CFG-MSGOUT-UBX_HNR_ATT_USB	0x2091037a	U1	-	-	Output rate of the UBX-HNR-ATT message on port USB
CFG-MSGOUT-UBX_HNR_INS_I2C	0x20910372	U1	-	-	Output rate of the UBX-HNR-INS message on port I2C
CFG-MSGOUT-UBX_HNR_INS_SPI	0x20910376	U1	-	-	Output rate of the UBX-HNR-INS message on port SPI
CFG-MSGOUT-UBX_HNR_INS_UART1	0x20910373	U1	-	-	Output rate of the UBX-HNR-INS message on port UART1
CFG-MSGOUT-UBX_HNR_INS_UART2	0x20910374	U1	-	-	Output rate of the UBX-HNR-INS message on port UART2
CFG-MSGOUT-UBX_HNR_INS_USB	0x20910375	U1	-	-	Output rate of the UBX-HNR-INS message on port USB
CFG-MSGOUT-UBX_HNR_PVT_I2C	0x2091028b	U1	-	-	Output rate of the UBX-HNR-PVT message on port I2C
CFG-MSGOUT-UBX_HNR_PVT_SPI	0x2091028f	U1	-	-	Output rate of the UBX-HNR-PVT message on port SPI
CFG-MSGOUT-UBX_HNR_PVT_UART1	0x2091028c	U1	-	-	Output rate of the UBX-HNR-PVT message on port UART1

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_HNR_PVT_UART2	0x2091028d	U1	-	-	Output rate of the UBX-HNR-PVT message on port UART2
CFG-MSGOUT-UBX_HNR_PVT_USB	0x2091028e	U1	-	-	Output rate of the UBX-HNR-PVT message on port USB
CFG-MSGOUT-UBX_LOG_INFO_I2C	0x20910259	U1	-	-	Output rate of the UBX-LOG-INFO message on port I2C
CFG-MSGOUT-UBX_LOG_INFO_SPI	0x2091025d	U1	-	-	Output rate of the UBX-LOG-INFO message on port SPI
CFG-MSGOUT-UBX_LOG_INFO_UART1	0x2091025a	U1	-	-	Output rate of the UBX-LOG-INFO message on port UART1
CFG-MSGOUT-UBX_LOG_INFO_UART2	0x2091025b	U1	-	-	Output rate of the UBX-LOG-INFO message on port UART2
CFG-MSGOUT-UBX_LOG_INFO_USB	0x2091025c	U1	-	-	Output rate of the UBX-LOG-INFO message on port USB
CFG-MSGOUT-UBX_MON_COMMS_I2C	0x2091034f	U1	-	-	Output rate of the UBX-MON-COMMS message on port I2C
CFG-MSGOUT-UBX_MON_COMMS_SPI	0x20910353	U1	-	-	Output rate of the UBX-MON-COMMS message on port SPI
CFG-MSGOUT-UBX_MON_COMMS_UART1	0x20910350	U1	-	-	Output rate of the UBX-MON-COMMS message on port UART1
CFG-MSGOUT-UBX_MON_COMMS_UART2	0x20910351	U1	-	-	Output rate of the UBX-MON-COMMS message on port UART2
CFG-MSGOUT-UBX_MON_COMMS_USB	0x20910352	U1	-	-	Output rate of the UBX-MON-COMMS message on port USB
CFG-MSGOUT-UBX_MON_HW2_I2C	0x209101b9	U1	-	-	Output rate of the UBX-MON-HW2 message on port I2C
CFG-MSGOUT-UBX_MON_HW2_SPI	0x209101bd	U1	-	-	Output rate of the UBX-MON-HW2 message on port SPI
CFG-MSGOUT-UBX_MON_HW2_UART1	0x209101ba	U1	-	-	Output rate of the UBX-MON-HW2 message on port UART1
CFG-MSGOUT-UBX_MON_HW2_UART2	0x209101bb	U1	-	-	Output rate of the UBX-MON-HW2 message on port UART2
CFG-MSGOUT-UBX_MON_HW2_USB	0x209101bc	U1	-	-	Output rate of the UBX-MON-HW2 message on port USB
CFG-MSGOUT-UBX_MON_HW3_I2C	0x20910354	U1	-	-	Output rate of the UBX-MON-HW3 message on port I2C
CFG-MSGOUT-UBX_MON_HW3_SPI	0x20910358	U1	-	-	Output rate of the UBX-MON-HW3 message on port SPI
CFG-MSGOUT-UBX_MON_HW3_UART1	0x20910355	U1	-	-	Output rate of the UBX-MON-HW3 message on port UART1
CFG-MSGOUT-UBX_MON_HW3_UART2	0x20910356	U1	-	-	Output rate of the UBX-MON-HW3 message on port UART2
CFG-MSGOUT-UBX_MON_HW3_USB	0x20910357	U1	-	-	Output rate of the UBX-MON-HW3 message on port USB

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_MON_HW_I2C	0x209101b4	U1	-	-	Output rate of the UBX-MON-HW message on port I2C
CFG-MSGOUT-UBX_MON_HW_SPI	0x209101b8	U1	-	-	Output rate of the UBX-MON-HW message on port SPI
CFG-MSGOUT-UBX_MON_HW_UART1	0x209101b5	U1	-	-	Output rate of the UBX-MON-HW message on port UART1
CFG-MSGOUT-UBX_MON_HW_UART2	0x209101b6	U1	-	-	Output rate of the UBX-MON-HW message on port UART2
CFG-MSGOUT-UBX_MON_HW_USB	0x209101b7	U1	-	-	Output rate of the UBX-MON-HW message on port USB
CFG-MSGOUT-UBX_MON_IO_I2C	0x209101a5	U1	-	-	Output rate of the UBX-MON-IO message on port I2C
CFG-MSGOUT-UBX_MON_IO_SPI	0x209101a9	U1	-	-	Output rate of the UBX-MON-IO message on port SPI
CFG-MSGOUT-UBX_MON_IO_UART1	0x209101a6	U1	-	-	Output rate of the UBX-MON-IO message on port UART1
CFG-MSGOUT-UBX_MON_IO_UART2	0x209101a7	U1	-	-	Output rate of the UBX-MON-IO message on port UART2
CFG-MSGOUT-UBX_MON_IO_USB	0x209101a8	U1	-	-	Output rate of the UBX-MON-IO message on port USB
CFG-MSGOUT-UBX_MON_MSGPP_I2C	0x20910196	U1	-	-	Output rate of the UBX-MON-MSGPP message on port I2C
CFG-MSGOUT-UBX_MON_MSGPP_SPI	0x2091019a	U1	-	-	Output rate of the UBX-MON-MSGPP message on port SPI
CFG-MSGOUT-UBX_MON_MSGPP_UART1	0x20910197	U1	-	-	Output rate of the UBX-MON-MSGPP message on port UART1
CFG-MSGOUT-UBX_MON_MSGPP_UART2	0x20910198	U1	-	-	Output rate of the UBX-MON-MSGPP message on port UART2
CFG-MSGOUT-UBX_MON_MSGPP_USB	0x20910199	U1	-	-	Output rate of the UBX-MON-MSGPP message on port USB
CFG-MSGOUT-UBX_MON_PT2_I2C	0x20910209	U1	-	-	Output rate of the UBX-MON-PT2 message on port I2C
CFG-MSGOUT-UBX_MON_PT2_SPI	0x2091020d	U1	-	-	Output rate of the UBX-MON-PT2 message on port SPI
CFG-MSGOUT-UBX_MON_PT2_UART1	0x2091020a	U1	-	-	Output rate of the UBX-MON-PT2 message on port UART1
CFG-MSGOUT-UBX_MON_PT2_UART2	0x2091020b	U1	-	-	Output rate of the UBX-MON-PT2 message on port UART2
CFG-MSGOUT-UBX_MON_PT2_USB	0x2091020c	U1	-	-	Output rate of the UBX-MON-PT2 message on port USB
CFG-MSGOUT-UBX_MON_RF_I2C	0x20910359	U1	-	-	Output rate of the UBX-MON-RF message on port I2C
CFG-MSGOUT-UBX_MON_RF_SPI	0x2091035d	U1	-	-	Output rate of the UBX-MON-RF message on port SPI

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_MON_RF_UART1	0x2091035a	U1	-	-	Output rate of the UBX-MON-RF message on port UART1
CFG-MSGOUT-UBX_MON_RF_UART2	0x2091035b	U1	-	-	Output rate of the UBX-MON-RF message on port UART2
CFG-MSGOUT-UBX_MON_RF_USB	0x2091035c	U1	-	-	Output rate of the UBX-MON-RF message on port USB
CFG-MSGOUT-UBX_MON_RXBUF_I2C	0x209101a0	U1	-	-	Output rate of the UBX-MON-RXBUF message on port I2C
CFG-MSGOUT-UBX_MON_RXBUF_SPI	0x209101a4	U1	-	-	Output rate of the UBX-MON-RXBUF message on port SPI
CFG-MSGOUT-UBX_MON_RXBUF_UART1	0x209101a1	U1	-	-	Output rate of the UBX-MON-RXBUF message on port UART1
CFG-MSGOUT-UBX_MON_RXBUF_UART2	0x209101a2	U1	-	-	Output rate of the UBX-MON-RXBUF message on port UART2
CFG-MSGOUT-UBX_MON_RXBUF_USB	0x209101a3	U1	-	-	Output rate of the UBX-MON-RXBUF message on port USB
CFG-MSGOUT-UBX_MON_RXR_I2C	0x20910187	U1	-	-	Output rate of the UBX-MON-RXR message on port I2C
CFG-MSGOUT-UBX_MON_RXR_SPI	0x2091018b	U1	-	-	Output rate of the UBX-MON-RXR message on port SPI
CFG-MSGOUT-UBX_MON_RXR_UART1	0x20910188	U1	-	-	Output rate of the UBX-MON-RXR message on port UART1
CFG-MSGOUT-UBX_MON_RXR_UART2	0x20910189	U1	-	-	Output rate of the UBX-MON-RXR message on port UART2
CFG-MSGOUT-UBX_MON_RXR_USB	0x2091018a	U1	-	-	Output rate of the UBX-MON-RXR message on port USB
CFG-MSGOUT-UBX_MON_TEMP_I2C	0x20910331	U1	-	-	Temperature measurement result and temperature related warning flags
CFG-MSGOUT-UBX_MON_TEMP_SPI	0x20910335	U1	-	-	Temperature measurement result and temperature related warning flags
CFG-MSGOUT-UBX_MON_TEMP_UART1	0x20910332	U1	-	-	Temperature measurement result and temperature related warning flags
CFG-MSGOUT-UBX_MON_TEMP_UART2	0x20910333	U1	-	-	Temperature measurement result and temperature related warning flags
CFG-MSGOUT-UBX_MON_TEMP_USB	0x20910334	U1	-	-	Temperature measurement result and temperature related warning flags
CFG-MSGOUT-UBX_MON_TXBUF_I2C	0x2091019b	U1	-	-	Output rate of the UBX-MON-TXBUF message on port I2C



CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_MON_TXBUF_SPI	0x2091019f	U1	-	-	Output rate of the UBX-MON-TXBUF message on port SPI
CFG-MSGOUT-UBX_MON_TXBUF_UART1	0x2091019c	U1	-	-	Output rate of the UBX-MON-TXBUF message on port UART1
CFG-MSGOUT-UBX_MON_TXBUF_UART2	0x2091019d	U1	-	-	Output rate of the UBX-MON-TXBUF message on port UART2
CFG-MSGOUT-UBX_MON_TXBUF_USB	0x2091019e	U1	-	-	Output rate of the UBX-MON-TXBUF message on port USB
CFG-MSGOUT-UBX_NAV_ATT_I2C	0x2091001f	U1	-	-	Output rate of the UBX-NAV-ATT message on port I2C
CFG-MSGOUT-UBX_NAV_ATT_SPI	0x20910023	U1	-	-	Output rate of the UBX-NAV-ATT message on port SPI
CFG-MSGOUT-UBX_NAV_ATT_UART1	0x20910020	U1	-	-	Output rate of the UBX-NAV-ATT message on port UART1
CFG-MSGOUT-UBX_NAV_ATT_UART2	0x20910021	U1	-	-	Output rate of the UBX-NAV-ATT message on port UART2
CFG-MSGOUT-UBX_NAV_ATT_USB	0x20910022	U1	-	-	Output rate of the UBX-NAV-ATT message on port USB
CFG-MSGOUT-UBX_NAV_CLOCK_I2C	0x20910065	U1	-	-	Output rate of the UBX-NAV-CLOCK message on port I2C
CFG-MSGOUT-UBX_NAV_CLOCK_SPI	0x20910069	U1	-	-	Output rate of the UBX-NAV-CLOCK message on port SPI
CFG-MSGOUT-UBX_NAV_CLOCK_UART1	0x20910066	U1	-	-	Output rate of the UBX-NAV-CLOCK message on port UART1
CFG-MSGOUT-UBX_NAV_CLOCK_UART2	0x20910067	U1	-	-	Output rate of the UBX-NAV-CLOCK message on port UART2
CFG-MSGOUT-UBX_NAV_CLOCK_USB	0x20910068	U1	-	-	Output rate of the UBX-NAV-CLOCK message on port USB
CFG-MSGOUT-UBX_NAV_COV_I2C	0x20910083	U1	-	-	Output rate of the UBX-NAV-COV message on port I2C
CFG-MSGOUT-UBX_NAV_COV_SPI	0x20910087	U1	-	-	Output rate of the UBX-NAV-COV message on port SPI
CFG-MSGOUT-UBX_NAV_COV_UART1	0x20910084	U1	-	-	Output rate of the UBX-NAV-COV message on port UART1
CFG-MSGOUT-UBX_NAV_COV_UART2	0x20910085	U1	-	-	Output rate of the UBX-NAV-COV message on port UART2
CFG-MSGOUT-UBX_NAV_COV_USB	0x20910086	U1	-	-	Output rate of the UBX-NAV-COV message on port USB
CFG-MSGOUT-UBX_NAV_DOP_I2C	0x20910038	U1	-	-	Output rate of the UBX-NAV-DOP message on port I2C
CFG-MSGOUT-UBX_NAV_DOP_SPI	0x2091003c	U1	-	-	Output rate of the UBX-NAV-DOP message on port SPI
CFG-MSGOUT-UBX_NAV_DOP_UART1	0x20910039	U1	-	-	Output rate of the UBX-NAV-DOP message on port UART1

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_NAV_DOP_UART2	0x2091003a	U1	-	-	Output rate of the UBX-NAV-DOP message on port UART2
CFG-MSGOUT-UBX_NAV_DOP_USB	0x2091003b	U1	-	-	Output rate of the UBX-NAV-DOP message on port USB
CFG-MSGOUT-UBX_NAV_EELL_I2C	0x20910313	U1	-	-	Output rate of the UBX-NAV-EELL message on port I2C
CFG-MSGOUT-UBX_NAV_EELL_SPI	0x20910317	U1	-	-	Output rate of the UBX-NAV-EELL message on port SPI
CFG-MSGOUT-UBX_NAV_EELL_UART1	0x20910314	U1	-	-	Output rate of the UBX-NAV-EELL message on port UART1
CFG-MSGOUT-UBX_NAV_EELL_UART2	0x20910315	U1	-	-	Output rate of the UBX-NAV-EELL message on port UART2
CFG-MSGOUT-UBX_NAV_EELL_USB	0x20910316	U1	-	-	Output rate of the UBX-NAV-EELL message on port USB
CFG-MSGOUT-UBX_NAV_EOE_I2C	0x2091015f	U1	-	-	Output rate of the UBX-NAV-EOE message on port I2C
CFG-MSGOUT-UBX_NAV_EOE_SPI	0x20910163	U1	-	-	Output rate of the UBX-NAV-EOE message on port SPI
CFG-MSGOUT-UBX_NAV_EOE_UART1	0x20910160	U1	-	-	Output rate of the UBX-NAV-EOE message on port UART1
CFG-MSGOUT-UBX_NAV_EOE_UART2	0x20910161	U1	-	-	Output rate of the UBX-NAV-EOE message on port UART2
CFG-MSGOUT-UBX_NAV_EOE_USB	0x20910162	U1	-	-	Output rate of the UBX-NAV-EOE message on port USB
CFG-MSGOUT-UBX_NAV_GEOFENCE_I2C	0x209100a1	U1	-	-	Output rate of the UBX-NAV-GEOFENCE message on port I2C
CFG-MSGOUT-UBX_NAV_GEOFENCE_SPI	0x209100a5	U1	-	-	Output rate of the UBX-NAV-GEOFENCE message on port SPI
CFG-MSGOUT-UBX_NAV_GEOFENCE_UART1	0x209100a2	U1	-	-	Output rate of the UBX-NAV-GEOFENCE message on port UART1
CFG-MSGOUT-UBX_NAV_GEOFENCE_UART2	0x209100a3	U1	-	-	Output rate of the UBX-NAV-GEOFENCE message on port UART2
CFG-MSGOUT-UBX_NAV_GEOFENCE_USB	0x209100a4	U1	-	-	Output rate of the UBX-NAV-GEOFENCE message on port USB
CFG-MSGOUT-UBX_NAV_HNR_I2C	0x20910286	U1	-	-	Output rate of the UBX-NAV-HNR message on port I2C
CFG-MSGOUT-UBX_NAV_HNR_SPI	0x2091028a	U1	-	-	Output rate of the UBX-NAV-HNR message on port SPI
CFG-MSGOUT-UBX_NAV_HNR_UART1	0x20910287	U1	-	-	Output rate of the UBX-NAV-HNR message on port UART1
CFG-MSGOUT-UBX_NAV_HNR_UART2	0x20910288	U1	-	-	Output rate of the UBX-NAV-HNR message on port UART2

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_NAV_HNR_USB	0x20910289	U1	-	-	Output rate of the UBX-NAV-HNR message on port USB
CFG-MSGOUT-UBX_NAV_HPPOSECEF_I2C	0x2091002e	U1	-	-	Output rate of the UBX-NAV-HPPOSECEF message on port I2C
CFG-MSGOUT-UBX_NAV_HPPOSECEF_SPI	0x20910032	U1	-	-	Output rate of the UBX-NAV-HPPOSECEF message on port SPI
CFG-MSGOUT-UBX_NAV_HPPOSECEF_UART1	0x2091002f	U1	-	-	Output rate of the UBX-NAV-HPPOSECEF message on port UART1
CFG-MSGOUT-UBX_NAV_HPPOSECEF_UART2	0x20910030	U1	-	-	Output rate of the UBX-NAV-HPPOSECEF message on port UART2
CFG-MSGOUT-UBX_NAV_HPPOSECEF_USB	0x20910031	U1	-	-	Output rate of the UBX-NAV-HPPOSECEF message on port USB
CFG-MSGOUT-UBX_NAV_HPPOSLLH_I2C	0x20910033	U1	-	-	Output rate of the UBX-NAV-HPPOSLLH message on port I2C
CFG-MSGOUT-UBX_NAV_HPPOSLLH_SPI	0x20910037	U1	-	-	Output rate of the UBX-NAV-HPPOSLLH message on port SPI
CFG-MSGOUT-UBX_NAV_HPPOSLLH_UART1	0x20910034	U1	-	-	Output rate of the UBX-NAV-HPPOSLLH message on port UART1
CFG-MSGOUT-UBX_NAV_HPPOSLLH_UART2	0x20910035	U1	-	-	Output rate of the UBX-NAV-HPPOSLLH message on port UART2
CFG-MSGOUT-UBX_NAV_HPPOSLLH_USB	0x20910036	U1	-	-	Output rate of the UBX-NAV-HPPOSLLH message on port USB
CFG-MSGOUT-UBX_NAV_ODO_I2C	0x2091007e	U1	-	-	Output rate of the UBX-NAV-ODO message on port I2C
CFG-MSGOUT-UBX_NAV_ODO_SPI	0x20910082	U1	-	-	Output rate of the UBX-NAV-ODO message on port SPI
CFG-MSGOUT-UBX_NAV_ODO_UART1	0x2091007f	U1	-	-	Output rate of the UBX-NAV-ODO message on port UART1
CFG-MSGOUT-UBX_NAV_ODO_UART2	0x20910080	U1	-	-	Output rate of the UBX-NAV-ODO message on port UART2
CFG-MSGOUT-UBX_NAV_ODO_USB	0x20910081	U1	-	-	Output rate of the UBX-NAV-ODO message on port USB
CFG-MSGOUT-UBX_NAV_ORB_I2C	0x20910010	U1	-	-	Output rate of the UBX-NAV-ORB message on port I2C
CFG-MSGOUT-UBX_NAV_ORB_SPI	0x20910014	U1	-	-	Output rate of the UBX-NAV-ORB message on port SPI



CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_NAV_ORB_UART1	0x20910011	U1	-	-	Output rate of the UBX-NAV-ORB message on port UART1
CFG-MSGOUT-UBX_NAV_ORB_UART2	0x20910012	U1	-	-	Output rate of the UBX-NAV-ORB message on port UART2
CFG-MSGOUT-UBX_NAV_ORB_USB	0x20910013	U1	-	-	Output rate of the UBX-NAV-ORB message on port USB
CFG-MSGOUT-UBX_NAV_POSECEF_I2C	0x20910024	U1	-	-	Output rate of the UBX-NAV-POSECEF message on port I2C
CFG-MSGOUT-UBX_NAV_POSECEF_SPI	0x20910028	U1	-	-	Output rate of the UBX-NAV-POSECEF message on port SPI
CFG-MSGOUT-UBX_NAV_POSECEF_UART1	0x20910025	U1	-	-	Output rate of the UBX-NAV-POSECEF message on port UART1
CFG-MSGOUT-UBX_NAV_POSECEF_UART2	0x20910026	U1	-	-	Output rate of the UBX-NAV-POSECEF message on port UART2
CFG-MSGOUT-UBX_NAV_POSECEF_USB	0x20910027	U1	-	-	Output rate of the UBX-NAV-POSECEF message on port USB
CFG-MSGOUT-UBX_NAV_POSLLH_I2C	0x20910029	U1	-	-	Output rate of the UBX-NAV-POSLLH message on port I2C
CFG-MSGOUT-UBX_NAV_POSLLH_SPI	0x2091002d	U1	-	-	Output rate of the UBX-NAV-POSLLH message on port SPI
CFG-MSGOUT-UBX_NAV_POSLLH_UART1	0x2091002a	U1	-	-	Output rate of the UBX-NAV-POSLLH message on port UART1
CFG-MSGOUT-UBX_NAV_POSLLH_UART2	0x2091002b	U1	-	-	Output rate of the UBX-NAV-POSLLH message on port UART2
CFG-MSGOUT-UBX_NAV_POSLLH_USB	0x2091002c	U1	-	-	Output rate of the UBX-NAV-POSLLH message on port USB
CFG-MSGOUT-UBX_NAV_PVT_I2C	0x20910006	U1	-	-	Output rate of the UBX-NAV-PVT message on port I2C
CFG-MSGOUT-UBX_NAV_PVT_SPI	0x2091000a	U1	-	-	Output rate of the UBX-NAV-PVT message on port SPI
CFG-MSGOUT-UBX_NAV_PVT_UART1	0x20910007	U1	-	-	Output rate of the UBX-NAV-PVT message on port UART1
CFG-MSGOUT-UBX_NAV_PVT_UART2	0x20910008	U1	-	-	Output rate of the UBX-NAV-PVT message on port UART2
CFG-MSGOUT-UBX_NAV_PVT_USB	0x20910009	U1	-	-	Output rate of the UBX-NAV-PVT message on port USB
CFG-MSGOUT-UBX_NAV_RELPOSNED_I2C	0x2091008d	U1	-	-	Output rate of the UBX-NAV-RELPOSNED message on port I2C
CFG-MSGOUT-UBX_NAV_RELPOSNED_SPI	0x20910091	U1	-	-	Output rate of the UBX-NAV-RELPOSNED message on port SPI

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_NAV_RELPOS_NED_UART1	0x2091008e	U1	-	-	Output rate of the UBX-NAV-RELPOS_NED message on port UART1
CFG-MSGOUT-UBX_NAV_RELPOS_NED_UART2	0x2091008f	U1	-	-	Output rate of the UBX-NAV-RELPOS_NED message on port UART2
CFG-MSGOUT-UBX_NAV_RELPOS_NED_USB	0x20910090	U1	-	-	Output rate of the UBX-NAV-RELPOS_NED message on port USB
CFG-MSGOUT-UBX_NAV_SAT_I2C	0x20910015	U1	-	-	Output rate of the UBX-NAV-SAT message on port I2C
CFG-MSGOUT-UBX_NAV_SAT_SPI	0x20910019	U1	-	-	Output rate of the UBX-NAV-SAT message on port SPI
CFG-MSGOUT-UBX_NAV_SAT_UART1	0x20910016	U1	-	-	Output rate of the UBX-NAV-SAT message on port UART1
CFG-MSGOUT-UBX_NAV_SAT_UART2	0x20910017	U1	-	-	Output rate of the UBX-NAV-SAT message on port UART2
CFG-MSGOUT-UBX_NAV_SAT_USB	0x20910018	U1	-	-	Output rate of the UBX-NAV-SAT message on port USB
CFG-MSGOUT-UBX_NAV_SBAS_I2C	0x2091006a	U1	-	-	Output rate of the UBX-NAV-SBAS message on port I2C
CFG-MSGOUT-UBX_NAV_SBAS_SPI	0x2091006e	U1	-	-	Output rate of the UBX-NAV-SBAS message on port SPI
CFG-MSGOUT-UBX_NAV_SBAS_UART1	0x2091006b	U1	-	-	Output rate of the UBX-NAV-SBAS message on port UART1
CFG-MSGOUT-UBX_NAV_SBAS_UART2	0x2091006c	U1	-	-	Output rate of the UBX-NAV-SBAS message on port UART2
CFG-MSGOUT-UBX_NAV_SBAS_USB	0x2091006d	U1	-	-	Output rate of the UBX-NAV-SBAS message on port USB
CFG-MSGOUT-UBX_NAV_SIG_I2C	0x20910345	U1	-	-	Output rate of the UBX-NAV-SIG message on port I2C
CFG-MSGOUT-UBX_NAV_SIG_SPI	0x20910349	U1	-	-	Output rate of the UBX-NAV-SIG message on port SPI
CFG-MSGOUT-UBX_NAV_SIG_UART1	0x20910346	U1	-	-	Output rate of the UBX-NAV-SIG message on port UART1
CFG-MSGOUT-UBX_NAV_SIG_UART2	0x20910347	U1	-	-	Output rate of the UBX-NAV-SIG message on port UART2
CFG-MSGOUT-UBX_NAV_SIG_USB	0x20910348	U1	-	-	Output rate of the UBX-NAV-SIG message on port USB
CFG-MSGOUT-UBX_NAV_STATUS_I2C	0x2091001a	U1	-	-	Output rate of the UBX-NAV-STATUS message on port I2C
CFG-MSGOUT-UBX_NAV_STATUS_SPI	0x2091001e	U1	-	-	Output rate of the UBX-NAV-STATUS message on port SPI

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_NAV_STATUS_UART1	0x2091001b	U1	-	-	Output rate of the UBX-NAV-STATUS message on port UART1
CFG-MSGOUT-UBX_NAV_STATUS_UART2	0x2091001c	U1	-	-	Output rate of the UBX-NAV-STATUS message on port UART2
CFG-MSGOUT-UBX_NAV_STATUS_USB	0x2091001d	U1	-	-	Output rate of the UBX-NAV-STATUS message on port USB
CFG-MSGOUT-UBX_NAV_TIMEBDS_I2C	0x20910051	U1	-	-	Output rate of the UBX-NAV-TIMEBDS message on port I2C
CFG-MSGOUT-UBX_NAV_TIMEBDS_SPI	0x20910055	U1	-	-	Output rate of the UBX-NAV-TIMEBDS message on port SPI
CFG-MSGOUT-UBX_NAV_TIMEBDS_UART1	0x20910052	U1	-	-	Output rate of the UBX-NAV-TIMEBDS message on port UART1
CFG-MSGOUT-UBX_NAV_TIMEBDS_UART2	0x20910053	U1	-	-	Output rate of the UBX-NAV-TIMEBDS message on port UART2
CFG-MSGOUT-UBX_NAV_TIMEBDS_USB	0x20910054	U1	-	-	Output rate of the UBX-NAV-TIMEBDS message on port USB
CFG-MSGOUT-UBX_NAV_TIMEGAL_I2C	0x20910056	U1	-	-	Output rate of the UBX-NAV-TIMEGAL message on port I2C
CFG-MSGOUT-UBX_NAV_TIMEGAL_SPI	0x2091005a	U1	-	-	Output rate of the UBX-NAV-TIMEGAL message on port SPI
CFG-MSGOUT-UBX_NAV_TIMEGAL_UART1	0x20910057	U1	-	-	Output rate of the UBX-NAV-TIMEGAL message on port UART1
CFG-MSGOUT-UBX_NAV_TIMEGAL_UART2	0x20910058	U1	-	-	Output rate of the UBX-NAV-TIMEGAL message on port UART2
CFG-MSGOUT-UBX_NAV_TIMEGAL_USB	0x20910059	U1	-	-	Output rate of the UBX-NAV-TIMEGAL message on port USB
CFG-MSGOUT-UBX_NAV_TIMEGLO_I2C	0x2091004c	U1	-	-	Output rate of the UBX-NAV-TIMEGLO message on port I2C
CFG-MSGOUT-UBX_NAV_TIMEGLO_SPI	0x20910050	U1	-	-	Output rate of the UBX-NAV-TIMEGLO message on port SPI
CFG-MSGOUT-UBX_NAV_TIMEGLO_UART1	0x2091004d	U1	-	-	Output rate of the UBX-NAV-TIMEGLO message on port UART1
CFG-MSGOUT-UBX_NAV_TIMEGLO_UART2	0x2091004e	U1	-	-	Output rate of the UBX-NAV-TIMEGLO message on port UART2
CFG-MSGOUT-UBX_NAV_TIMEGLO_USB	0x2091004f	U1	-	-	Output rate of the UBX-NAV-TIMEGLO message on port USB
CFG-MSGOUT-UBX_NAV_TIMEGPS_I2C	0x20910047	U1	-	-	Output rate of the UBX-NAV-TIMEGPS message on port I2C

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_NAV_TIMEGPS_SPI	0x2091004b	U1	-	-	Output rate of the UBX-NAV-TIMEGPS message on port SPI
CFG-MSGOUT-UBX_NAV_TIMEGPS_UART1	0x20910048	U1	-	-	Output rate of the UBX-NAV-TIMEGPS message on port UART1
CFG-MSGOUT-UBX_NAV_TIMEGPS_UART2	0x20910049	U1	-	-	Output rate of the UBX-NAV-TIMEGPS message on port UART2
CFG-MSGOUT-UBX_NAV_TIMEGPS_USB	0x2091004a	U1	-	-	Output rate of the UBX-NAV-TIMEGPS message on port USB
CFG-MSGOUT-UBX_NAV_TIMELS_I2C	0x20910060	U1	-	-	Output rate of the UBX-NAV-TIMELS message on port I2C
CFG-MSGOUT-UBX_NAV_TIMELS_SPI	0x20910064	U1	-	-	Output rate of the UBX-NAV-TIMELS message on port SPI
CFG-MSGOUT-UBX_NAV_TIMELS_UART1	0x20910061	U1	-	-	Output rate of the UBX-NAV-TIMELS message on port UART1
CFG-MSGOUT-UBX_NAV_TIMELS_UART2	0x20910062	U1	-	-	Output rate of the UBX-NAV-TIMELS message on port UART2
CFG-MSGOUT-UBX_NAV_TIMELS_USB	0x20910063	U1	-	-	Output rate of the UBX-NAV-TIMELS message on port USB
CFG-MSGOUT-UBX_NAV_TIMEUTC_I2C	0x2091005b	U1	-	-	Output rate of the UBX-NAV-TIMEUTC message on port I2C
CFG-MSGOUT-UBX_NAV_TIMEUTC_SPI	0x2091005f	U1	-	-	Output rate of the UBX-NAV-TIMEUTC message on port SPI
CFG-MSGOUT-UBX_NAV_TIMEUTC_UART1	0x2091005c	U1	-	-	Output rate of the UBX-NAV-TIMEUTC message on port UART1
CFG-MSGOUT-UBX_NAV_TIMEUTC_UART2	0x2091005d	U1	-	-	Output rate of the UBX-NAV-TIMEUTC message on port UART2
CFG-MSGOUT-UBX_NAV_TIMEUTC_USB	0x2091005e	U1	-	-	Output rate of the UBX-NAV-TIMEUTC message on port USB
CFG-MSGOUT-UBX_NAV_VELECEF_I2C	0x2091003d	U1	-	-	Output rate of the UBX-NAV-VELECEF message on port I2C
CFG-MSGOUT-UBX_NAV_VELECEF_SPI	0x20910041	U1	-	-	Output rate of the UBX-NAV-VELECEF message on port SPI
CFG-MSGOUT-UBX_NAV_VELECEF_UART1	0x2091003e	U1	-	-	Output rate of the UBX-NAV-VELECEF message on port UART1
CFG-MSGOUT-UBX_NAV_VELECEF_UART2	0x2091003f	U1	-	-	Output rate of the UBX-NAV-VELECEF message on port UART2
CFG-MSGOUT-UBX_NAV_VELECEF_USB	0x20910040	U1	-	-	Output rate of the UBX-NAV-VELECEF message on port USB

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_NAV_VELNED_I2C	0x20910042	U1	-	-	Output rate of the UBX-NAV-VELNED message on port I2C
CFG-MSGOUT-UBX_NAV_VELNED_SPI	0x20910046	U1	-	-	Output rate of the UBX-NAV-VELNED message on port SPI
CFG-MSGOUT-UBX_NAV_VELNED_UART1	0x20910043	U1	-	-	Output rate of the UBX-NAV-VELNED message on port UART1
CFG-MSGOUT-UBX_NAV_VELNED_UART2	0x20910044	U1	-	-	Output rate of the UBX-NAV-VELNED message on port UART2
CFG-MSGOUT-UBX_NAV_VELNED_USB	0x20910045	U1	-	-	Output rate of the UBX-NAV-VELNED message on port USB
CFG-MSGOUT-UBX_RXM_MEASX_I2C	0x20910204	U1	-	-	Output rate of the UBX-RXM-MEASX message on port I2C
CFG-MSGOUT-UBX_RXM_MEASX_SPI	0x20910208	U1	-	-	Output rate of the UBX-RXM-MEASX message on port SPI
CFG-MSGOUT-UBX_RXM_MEASX_UART1	0x20910205	U1	-	-	Output rate of the UBX-RXM-MEASX message on port UART1
CFG-MSGOUT-UBX_RXM_MEASX_UART2	0x20910206	U1	-	-	Output rate of the UBX-RXM-MEASX message on port UART2
CFG-MSGOUT-UBX_RXM_MEASX_USB	0x20910207	U1	-	-	Output rate of the UBX-RXM-MEASX message on port USB
CFG-MSGOUT-UBX_RXM_RAWX_I2C	0x209102a4	U1	-	-	Output rate of the UBX-RXM-RAWX message on port I2C
CFG-MSGOUT-UBX_RXM_RAWX_SPI	0x209102a8	U1	-	-	Output rate of the UBX-RXM-RAWX message on port SPI
CFG-MSGOUT-UBX_RXM_RAWX_UART1	0x209102a5	U1	-	-	Output rate of the UBX-RXM-RAWX message on port UART1
CFG-MSGOUT-UBX_RXM_RAWX_UART2	0x209102a6	U1	-	-	Output rate of the UBX-RXM-RAWX message on port UART2
CFG-MSGOUT-UBX_RXM_RAWX_USB	0x209102a7	U1	-	-	Output rate of the UBX-RXM-RAWX message on port USB
CFG-MSGOUT-UBX_RXM_RLM_I2C	0x2091025e	U1	-	-	Output rate of the UBX-RXM-RLM message on port I2C
CFG-MSGOUT-UBX_RXM_RLM_SPI	0x20910262	U1	-	-	Output rate of the UBX-RXM-RLM message on port SPI
CFG-MSGOUT-UBX_RXM_RLM_UART1	0x2091025f	U1	-	-	Output rate of the UBX-RXM-RLM message on port UART1
CFG-MSGOUT-UBX_RXM_RLM_UART2	0x20910260	U1	-	-	Output rate of the UBX-RXM-RLM message on port UART2
CFG-MSGOUT-UBX_RXM_RLM_USB	0x20910261	U1	-	-	Output rate of the UBX-RXM-RLM message on port USB
CFG-MSGOUT-UBX_RXM_RTC5_I2C	0x20910155	U1	-	-	Output rate of the UBX-RXM-RTC5 message on port I2C
CFG-MSGOUT-UBX_RXM_RTC5_SPI	0x20910159	U1	-	-	Output rate of the UBX-RXM-RTC5 message on port SPI



CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_RXM_RTC5_UART1	0x20910156	U1	-	-	Output rate of the UBX-RXM-RTC5 message on port UART1
CFG-MSGOUT-UBX_RXM_RTC5_UART2	0x20910157	U1	-	-	Output rate of the UBX-RXM-RTC5 message on port UART2
CFG-MSGOUT-UBX_RXM_RTC5_USB	0x20910158	U1	-	-	Output rate of the UBX-RXM-RTC5 message on port USB
CFG-MSGOUT-UBX_RXM_RTCM_I2C	0x20910268	U1	-	-	Output rate of the UBX-RXM-RTCM message on port I2C
CFG-MSGOUT-UBX_RXM_RTCM_SPI	0x2091026c	U1	-	-	Output rate of the UBX-RXM-RTCM message on port SPI
CFG-MSGOUT-UBX_RXM_RTCM_UART1	0x20910269	U1	-	-	Output rate of the UBX-RXM-RTCM message on port UART1
CFG-MSGOUT-UBX_RXM_RTCM_UART2	0x2091026a	U1	-	-	Output rate of the UBX-RXM-RTCM message on port UART2
CFG-MSGOUT-UBX_RXM_RTCM_USB	0x2091026b	U1	-	-	Output rate of the UBX-RXM-RTCM message on port USB
CFG-MSGOUT-UBX_RXM_SFRBX_I2C	0x20910231	U1	-	-	Output rate of the UBX-RXM-SFRBX message on port I2C
CFG-MSGOUT-UBX_RXM_SFRBX_SPI	0x20910235	U1	-	-	Output rate of the UBX-RXM-SFRBX message on port SPI
CFG-MSGOUT-UBX_RXM_SFRBX_UART1	0x20910232	U1	-	-	Output rate of the UBX-RXM-SFRBX message on port UART1
CFG-MSGOUT-UBX_RXM_SFRBX_UART2	0x20910233	U1	-	-	Output rate of the UBX-RXM-SFRBX message on port UART2
CFG-MSGOUT-UBX_RXM_SFRBX_USB	0x20910234	U1	-	-	Output rate of the UBX-RXM-SFRBX message on port USB
CFG-MSGOUT-UBX_SEC_ECSIGN_I2C	0x2091034a	U1	-	-	Output rate of the UBX-SEC-ECSIGN message on port I2C
CFG-MSGOUT-UBX_SEC_ECSIGN_SPI	0x2091034e	U1	-	-	Output rate of the UBX-SEC-ECSIGN message on port SPI
CFG-MSGOUT-UBX_SEC_ECSIGN_UART1	0x2091034b	U1	-	-	Output rate of the UBX-SEC-ECSIGN message on port UART1
CFG-MSGOUT-UBX_SEC_ECSIGN_UART2	0x2091034c	U1	-	-	Output rate of the UBX-SEC-ECSIGN message on port UART2
CFG-MSGOUT-UBX_SEC_ECSIGN_USB	0x2091034d	U1	-	-	Output rate of the UBX-SEC-ECSIGN message on port USB
CFG-MSGOUT-UBX_TIM_TM2_I2C	0x20910178	U1	-	-	Output rate of the UBX-TIM-TM2 message on port I2C
CFG-MSGOUT-UBX_TIM_TM2_SPI	0x2091017c	U1	-	-	Output rate of the UBX-TIM-TM2 message on port SPI
CFG-MSGOUT-UBX_TIM_TM2_UART1	0x20910179	U1	-	-	Output rate of the UBX-TIM-TM2 message on port UART1
CFG-MSGOUT-UBX_TIM_TM2_UART2	0x2091017a	U1	-	-	Output rate of the UBX-TIM-TM2 message on port UART2

CFG-MSGOUT-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-MSGOUT-UBX_TIM_TM2_USB	0x2091017b	U1	-	-	Output rate of the UBX-TIM-TM2 message on port USB
CFG-MSGOUT-UBX_TIM_TP_I2C	0x2091017d	U1	-	-	Output rate of the UBX-TIM-TP message on port I2C
CFG-MSGOUT-UBX_TIM_TP_SPI	0x20910181	U1	-	-	Output rate of the UBX-TIM-TP message on port SPI
CFG-MSGOUT-UBX_TIM_TP_UART1	0x2091017e	U1	-	-	Output rate of the UBX-TIM-TP message on port UART1
CFG-MSGOUT-UBX_TIM_TP_UART2	0x2091017f	U1	-	-	Output rate of the UBX-TIM-TP message on port UART2
CFG-MSGOUT-UBX_TIM_TP_USB	0x20910180	U1	-	-	Output rate of the UBX-TIM-TP message on port USB
CFG-MSGOUT-UBX_TIM_VRFY_I2C	0x20910092	U1	-	-	Output rate of the UBX-TIM-VRFY message on port I2C
CFG-MSGOUT-UBX_TIM_VRFY_SPI	0x20910096	U1	-	-	Output rate of the UBX-TIM-VRFY message on port SPI
CFG-MSGOUT-UBX_TIM_VRFY_UART1	0x20910093	U1	-	-	Output rate of the UBX-TIM-VRFY message on port UART1
CFG-MSGOUT-UBX_TIM_VRFY_UART2	0x20910094	U1	-	-	Output rate of the UBX-TIM-VRFY message on port UART2
CFG-MSGOUT-UBX_TIM_VRFY_USB	0x20910095	U1	-	-	Output rate of the UBX-TIM-VRFY message on port USB

### 6.8.11 CFG-NAVHPG: High Precision Navigation Configuration

This group configures items related to the operation of the receiver in high precision, for example Differential correction and other related features.

#### CFG-NAVHPG-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-NAVHPG-DGNSSMODE	0x20140011	E1	-	-	Differential corrections mode

See [Constants for CFG-NAVHPG-DGNSSMODE](#) below for a list of possible constants for this item.

#### Constants for CFG-NAVHPG-DGNSSMODE

Constant	Value	Description
RTK_FLOAT	2	No attempts made to fix ambiguities
RTK_FIXED	3	Ambiguities are fixed whenever possible

### 6.8.12 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.

### CFG-NAVSPG-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-NAVSPG-FIXMODE	0x20110011	E1	-	-	Position fix mode
See <a href="#">Constants for CFG-NAVSPG-FIXMODE</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 will be set correctly from this week up to 1024 weeks after this week. Range is from 1 to 4096.					
CFG-NAVSPG-USE_PPP	0x10110019	L	-	-	Use Precise Point Positioning
Only available with the PPP product variant.					
CFG-NAVSPG-UTCSTANDARD	0x2011001c	E1	-	-	UTC standard to be used
See also <a href="#">GNSS time bases</a> .					
.					
See <a href="#">Constants for CFG-NAVSPG-UTCSTANDARD</a> below for a list of possible constants for this item.					
CFG-NAVSPG-DYNMODEL	0x20110021	E1	-	-	Dynamic platform model
See <a href="#">Constants for CFG-NAVSPG-DYNMODEL</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
This must be set together with all CFG-NAVSPG-USERDAT_* parameters.					
CFG-NAVSPG-USRDAT_MAJA	0x50110062	R8	-	m	Geodetic datum semi-major axis
Accepted range is from 6,300,000.0 to 6,500,000.0 meters This will only be used if CFG-NAVSPG-USE_USERDAT is set. It must be set together with all other CFG-NAVSPG-USERDAT_* parameters.					
CFG-NAVSPG-USRDAT_FLAT	0x50110063	R8	-	-	Geodetic datum 1.0 / flattening
Accepted range is 0.0 to 500.0. This will only be used if CFG-NAVSPG-USE_USERDAT is set. It must be set together with all other CFG-NAVSPG-USERDAT_* parameters.					
CFG-NAVSPG-USRDAT_DX	0x40110064	R4	-	m	Geodetic datum X axis shift at the origin
Accepted range is +/- 5000.0 meters. This will only be used if CFG-NAVSPG-USE_USERDAT is set. It must be set together with all other CFG-NAVSPG-USERDAT_* parameters.					
CFG-NAVSPG-USRDAT_DY	0x40110065	R4	-	m	Geodetic datum Y axis shift at the origin
Accepted range is +/- 5000.0 meters. This will only be used if CFG-NAVSPG-USE_USERDAT is set. It must be set together with all other CFG-NAVSPG-USERDAT_* parameters.					
CFG-NAVSPG-USRDAT_DZ	0x40110066	R4	-	m	Geodetic datum Z axis shift at the origin
Accepted range is +/- 5000.0 meters. This will only be used if CFG-NAVSPG-USE_USERDAT is set. It must be set together with all other CFG-NAVSPG-USERDAT_* parameters.					



## CFG-NAVSPG-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-NAVSPG-USRDAT_ROT_X	0x40110067	R4	-	arcsec	Geodetic datum rotation about the X axis
Accepted range is +/- 20.0 milli arc seconds. This will only be used if CFG-NAVSPG-USE_USERDAT is set. It must be set together with all other CFG-NAVSPG-USERDAT_* parameters.					
CFG-NAVSPG-USRDAT_ROT_Y	0x40110068	R4	-	arcsec	Geodetic datum rotation about the Y axis (°)
Accepted range is +/- 20.0 milli-arc seconds. This will only be used if CFG-NAVSPG-USE_USERDAT is set. It must be set together with all other CFG-NAVSPG-USERDAT_* parameters.					
CFG-NAVSPG-USRDAT_ROT_Z	0x40110069	R4	-	arcsec	Geodetic datum rotation about the Z axis
Accepted range is +/- 20.0 milli-arc seconds. This will only be used if CFG-NAVSPG-USE_USERDAT is set. It must be set together with all other CFG-NAVSPG-USERDAT_* parameters.					
CFG-NAVSPG-USRDAT_SCALE	0x4011006a	R4	-	ppm	Geodetic datum scale factor
Accepted range is 0.0 to 50.0 parts per million. This will only be used if CFG-NAVSPG-USE_USERDAT is set. It must be set together with all other CFG-NAVSPG-USERDAT_* parameters.					
CFG-NAVSPG-INFIL_MINSVS	0x201100a1	U1	-	-	Minimum number of satellites for navigation
CFG-NAVSPG-INFIL_MAXSVS	0x201100a2	U1	-	-	Maximum number of satellites for navigation
CFG-NAVSPG-INFIL_MINCNO	0x201100a3	U1	-	dBHz	Minimum satellite signal level for navigation
CFG-NAVSPG-INFIL_MINELEV	0x201100a4	I1	-	deg	Minimum elevation for a GNSS satellite to be used in navigation
CFG-NAVSPG-INFIL_NCNOTHRS	0x201100aa	U1	-	-	Number of satellites required to have C/N0 above CFG-NAVSPG-INFIL_CN0THRS for a fix to be attempted
.					
CFG-NAVSPG-INFIL_CN0THRS	0x201100ab	U1	-	-	C/N0 threshold for deciding whether to attempt a fix
.					
CFG-NAVSPG-OUTFIL_PDOP	0x301100b1	U2	0.1	-	Output filter position DOP mask (threshold)
CFG-NAVSPG-OUTFIL_TDOP	0x301100b2	U2	0.1	-	Output filter time DOP mask (threshold)
CFG-NAVSPG-OUTFIL_PACC	0x301100b3	U2	-	m	Output filter position accuracy mask (threshold)
CFG-NAVSPG-OUTFIL_TACC	0x301100b4	U2	-	m	Output filter time accuracy mask (threshold)

CFG-NAVSPG-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-NAVSPG-OUTFIL_FACC	0x301100b5	U2	0.01	m/s	Output filter frequency accuracy mask (threshold)
CFG-NAVSPG-CONSTR_ALT	0x401100c1	I4	0.01	m	Fixed altitude (mean sea level) for 2D fix mode
CFG-NAVSPG-CONSTR_ALTVAR	0x401100c2	U4	0.0001	m <sup>2</sup>	Fixed altitude variance for 2D mode
CFG-NAVSPG-CONSTR_DGNSSTO	0x201100c4	U1	-	s	DGNSS timeout

#### Constants for CFG-NAVSPG-FIXMODE

Constant	Value	Description
2DONLY	1	2d only
3DONLY	2	3d only
AUTO	3	Auto 2d/3d

#### Constants for CFG-NAVSPG-UTCSTANDARD

Constant	Value	Description
AUTO	0	Automatic; receiver selects based on GNSS configuration
USNO	3	UTC as operated by the U.S. Naval Observatory (USNO); derived from GPS time
SU	6	UTC as operated by the former Soviet Union; derived from GLONASS time
NTSC	7	UTC as operated by the National Time Service Center, China; derived from BeiDou time

#### Constants for CFG-NAVSPG-DYNMODEL

Constant	Value	Description
PORT	0	Portable
STAT	2	Stationary
PED	3	Pedestrian
AUTOMOT	4	Automotive
SEA	5	Sea
AIR1	6	Airborne with <1g acceleration
AIR2	7	Airborne with <2g acceleration
AIR4	8	Airborne with <4g acceleration
WRIST	9	Wrist worn watch
.		

#### 6.8.13 CFG-NMEA: NMEA Protocol Configuration

Configures the [NMEA protocol](#). See section [NMEA Protocol Configuration](#) for a detailed description of the configuration effects on NMEA output.

### CFG-NMEA-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-NMEA-PROTVER	0x20930001	E1	-	-	NMEA protocol version
See <a href="#">Constants for CFG-NMEA-PROTVER</a> below for a list of possible constants for this item.					
CFG-NMEA-MAXSVS	0x20930002	E1	-	-	Maximum number of SVs to report per Talker ID
See <a href="#">Constants for CFG-NMEA-MAXSVS</a> below for a list of possible constants for this item.					
CFG-NMEA-COMPAT	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.					
CFG-NMEA-CONSIDER	0x10930004	L	-	-	Enable considering mode
This will affect NMEA output used satellite count. If set, also considered satellites (e.g. RAIMED) are counted as used satellites as well.					
CFG-NMEA-LIMIT82	0x10930005	L	-	-	Enable strict limit to 82 characters maximum NMEA message length
CFG-NMEA-HIGHPREC	0x10930006	L	-	-	Enable high precision mode
This flag cannot be set in conjunction with either CFG-NMEA-COMPAT or CFG-NMEA-LIMIT82 Mode.					
CFG-NMEA-SVNUMBERING	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="#">Constants for CFG-NMEA-SVNUMBERING</a> below for a list of possible constants for this item.					
CFG-NMEA-FILT_GPS	0x10930011	L	-	-	Disable reporting of GPS satellites
CFG-NMEA-FILT_SBAS	0x10930012	L	-	-	Disable reporting of SBAS satellites
CFG-NMEA-FILT_QZSS	0x10930015	L	-	-	Disable reporting of QZSS satellites
CFG-NMEA-FILT_GLO	0x10930016	L	-	-	Disable reporting of GLONASS satellites
CFG-NMEA-FILT_BDS	0x10930017	L	-	-	Disable reporting of BeiDou satellites
CFG-NMEA-OUT_INVFIX	0x10930021	L	-	-	Enable position output for failed or invalid fixes
CFG-NMEA-OUT_MSKFIX	0x10930022	L	-	-	Enable position output for invalid fixes
CFG-NMEA-OUT_INVTIME	0x10930023	L	-	-	Enable time output for invalid times
CFG-NMEA-OUT_INVDATE	0x10930024	L	-	-	Enable date output for invalid dates

## CFG-NMEA-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-NMEA-OUT_ONLYGPS	0x10930025	L	-	-	Restrict output to GPS satellites only
CFG-NMEA-OUT_FROZENCOG	0x10930026	L	-	-	Enable course over ground output even if it is frozen
CFG-NMEA-MAINTALKERID	0x20930031	E1	-	-	Main Talker ID
<p>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>).</p> <p>This field enables the main Talker ID to be overridden.</p> <p>See <a href="#">Constants for CFG-NMEA-MAINTALKERID</a> below for a list of possible constants for this item.</p>					
CFG-NMEA-GSVTALKERID	0x20930032	E1	-	-	Talker ID for GSV NMEA messages
<p>By default the Talker ID for GSV messages is GNSS specific (as defined by NMEA).</p> <p>This field enables the GSV Talker ID to be overridden.</p> <p>See <a href="#">Constants for CFG-NMEA-GSVTALKERID</a> below for a list of possible constants for this item.</p>					
CFG-NMEA-BDSTALKERID	0x30930033	U2	-	-	BeiDou Talker ID
<p>Sets the two ASCII characters that should be used for the BeiDou Talker ID.</p> <p>If these are set to zero, the default BeiDou TalkerID will be used.</p>					

**Constants for CFG-NMEA-PROTVER**

Constant	Value	Description
V21	21	NMEA protocol version 2.1
V23	23	NMEA protocol version 2.3
V40	40	NMEA protocol version 4.0
.		
V41	41	NMEA protocol version 4.10
.		

**Constants for CFG-NMEA-MAXSVS**

Constant	Value	Description
UNLIM	0	Unlimited
8SVS	8	8 SVs
12SVS	12	12 SVs
16SVS	16	16 SVs

**Constants for CFG-NMEA-SVNUMBERING**

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

**Constants for CFG-NMEA-MAINTALKERID**

Constant	Value	Description
AUTO	0	Main Talker ID is not overridden
GP	1	Set main Talker ID to 'GP'
GL	2	Set main Talker ID to 'GL'
GN	3	Set main Talker ID to 'GN'

Constants for CFG-NMEA-MAINTALKERID continued

Constant	Value	Description
GA	4	Set main Talker ID to 'GA'
.		
GB	5	Set main Talker ID to 'GB'
.		

#### Constants for CFG-NMEA-GSVTALKERID

Constant	Value	Description
GNSS	0	Use GNSS specific Talker ID (as defined by NMEA)
MAIN	1	Use the main Talker ID

#### 6.8.14 CFG-ODO: Odometer and Low-Speed Course Over Ground Filter Configuration

The items in this group allow the user to configure the Odometer feature and Low-Speed Course Over Ground Filter.

##### CFG-ODO-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-ODO-USE_ODO	0x10220001	L	-	-	Use odometer
CFG-ODO-USE_COG	0x10220002	L	-	-	Use low-speed course over ground filter
CFG-ODO-OUTLPVEL	0x10220003	L	-	-	Output low-pass filtered velocity
CFG-ODO-OUTLPCOG	0x10220004	L	-	-	Output low-pass filtered course over ground (heading)
CFG-ODO-PROFILE	0x20220005	E1	-	-	Odometer profile configuration
See <a href="#">Constants for CFG-ODO-PROFILE</a> below for a list of possible constants for this item.					
CFG-ODO-COGMAXSPEED	0x20220021	U1	-	m/s	Upper speed limit for low-speed course over ground filter
CFG-ODO-COGMAXPOSACC	0x20220022	U1	-	-	Maximum acceptable position accuracy for computing low-speed filtered course over ground
CFG-ODO-VELLPGAIN	0x20220031	U1	-	-	Velocity low-pass filter level
Range is from 0 to 255.					
CFG-ODO-COGLPGAIN	0x20220032	U1	-	-	Course over ground low-pass filter level (at speed < 8 m/s)
Range is from 0 to 255.					

##### Constants for CFG-ODO-PROFILE

Constant	Value	Description
RUN	0	Running
CYCL	1	Cycling
SWIM	2	Swimming
CAR	3	Car
CUSTOM	4	Custom

### 6.8.15 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 will always be aligned to the top of a second zero (first second of the week) of the configured reference time system.

For protocol version 18 and later the navigation period is an integer multiple of the measurement period.

#### CFG-RATE-\* Configuration Items

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

#### Constants for CFG-RATE-TIMEREF

Constant	Value	Description
UTC	0	Align measurements to UTC time
GPS	1	Align measurements to GPS time
GLO	2	Align measurements to GLONASS time
.		
BDS	3	Align measurements to BeiDou time
.		
GAL	4	Align measurements to Galileo time
.		

### 6.8.16 CFG-RINV: Remote Inventory

The Remote Inventory enables storing user-defined data in the non-volatile memory of the receiver. 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.

#### CFG-RINV-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-RINV-DUMP	0x10c70001	L	-	-	Dump data at startup
When true, data will be dumped to the interface on startup, unless CFG-RINV-BINARY is set.					
CFG-RINV-BINARY	0x10c70002	L	-	-	Data is binary
When true, the data is treated as binary data.					

CFG-RINV-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-RINV-DATA_SIZE	0x20c70003	U1	-	-	Size of data
Size of data to store/be stored in the Remote Inventory (maximum 30 bytes).					
CFG-RINV-CHUNK0	0x50c70004	X8	-	-	Data bytes 1-8 (LSB)
Data to store/be stored in Remote Inventory - max 8 bytes, left-most in LSB, e.g. string ABCD will appear as 0x44434241.					
CFG-RINV-CHUNK1	0x50c70005	X8	-	-	Data bytes 9-16
Data to store/be stored in Remote Inventory - max 8 bytes, left-most in LSB, e.g. string ABCD will appear as 0x44434241.					
CFG-RINV-CHUNK2	0x50c70006	X8	-	-	Data bytes 17-24
Data to store/be stored in Remote Inventory - max 8 bytes, left-most in LSB, e.g. string ABCD will appear as 0x44434241.					
CFG-RINV-CHUNK3	0x50c70007	X8	-	-	Data bytes 25-30 (MSB)
Data to store/be stored in Remote Inventory - max 6 bytes, left-most in LSB, e.g. string ABCD will appear as 0x44434241.					

### 6.8.17 CFG-SBAS: SBAS Configuration

This message configures the SBAS receiver subsystem (i.e. WAAS, EGNOS, MSAS). See the [SBAS Configuration Settings Description](#) for a detailed description of how these settings affect receiver operation.

#### CFG-SBAS-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-SBAS-USE_TESTMODE	0x10360002	L	-	-	Use SBAS data when it is in test mode (SBAS msg 0)
CFG-SBAS-USE_RANGING	0x10360003	L	-	-	Use SBAS GEOs as a ranging source (for navigation)
CFG-SBAS-USE_DIFFCORR	0x10360004	L	-	-	Use SBAS differential corrections
CFG-SBAS-USE_INTEGRITY	0x10360005	L	-	-	Use SBAS integrity information
CFG-SBAS-PRNSCANMASK	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="#">Constants for CFG-SBAS-PRNSCANMASK</a> below for a list of possible constants for this item.					

#### Constants for CFG-SBAS-PRNSCANMASK

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



Constants for CFG-SBAS-PRNSCANMASK continued

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

## 6.8.18 CFG-SEC: Security configuration

Security configuration.

### CFG-SEC-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-SEC-ECCFGSESSIONID0	0x50f60006	U8	-	-	ECSIGN configuration session id part 0
ECSIGN configuration session id part 0 (least significant part)					
CFG-SEC-ECCFGSESSIONID1	0x50f60007	U8	-	-	ECSIGN configuration session id part 1



## CFG-SEC-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
ECSIGN configuration session id part 1					
CFG-SEC-ECCFGSESSIONID2	0x50f60008	U8	-	-	ECSIGN configuration session id part 2
ECSIGN configuration session id part 2 (most significant part)					

### 6.8.19 CFG-SFCORE: Sensor Fusion (SF) Core Config

This group contains configuration items for Dead Reckoning (DR) products.

More details on the configuration parameters can be found in the the ADR section of the [Integration manual](#)

#### CFG-SFCORE-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-SFCORE-USE_SF	0x10080001	L	-	-	Use ADR/UDR sensor fusion
CFG-SFCORE-IMU2CRP_LA_X	0x30080002	I2	-	cm	X coordinate of IMU-to-CRP lever-arm in the installation frame
CFG-SFCORE-IMU2CRP_LA_Y	0x30080003	I2	-	cm	Y coordinate of IMU-to-CRP lever-arm in the installation frame
CFG-SFCORE-IMU2CRP_LA_Z	0x30080004	I2	-	cm	Z coordinate of IMU-to-CRP lever-arm in the installation frame
CFG-SFCORE-SEN_TTAG_FACT	0x40080006	U4	1e-6	-	Sensor time tag scale factor to seconds
CFG-SFCORE-SEN_TTAG_MAX	0x40080007	U4	-	-	Sensor time tag maximum value (roll-over - 1)
CFG-SFCORE-OUTFIL_PACC	0x3008000f	U2	0.01	m/s	ADR/UDR position accuracy mask (threshold)
CFG-SFCORE-SIGATTENCOMPmode	0x20080010	E1	-	-	Permanently attenuated signal compensation mode
See <a href="#">Constants for CFG-SFCORE-SIGATTENCOMPmode</a> below for a list of possible constants for this item.					
CFG-SFCORE-HNR_RATE	0x2008001a	U1	-	Hz	Rate of navigation solution output

#### Constants for CFG-SFCORE-SIGATTENCOMPmode

Constant	Value	Description
DIS	0	Disable signal attenuation compensation
AUTO	255	Automatic signal attenuation compensation
01DBHZ	1	Maximum expected C/NO level is 1 dBHz
02DBHZ	2	Maximum expected C/NO level is 2 dBHz
03DBHZ	3	Maximum expected C/NO level is 3 dBHz
04DBHZ	4	Maximum expected C/NO level is 4 dBHz
05DBHZ	5	Maximum expected C/NO level is 5 dBHz
06DBHZ	6	Maximum expected C/NO level is 6 dBHz
07DBHZ	7	Maximum expected C/NO level is 7 dBHz

Constants for CFG-SFCORE-SIGATTENCOMPMODE continued

Constant	Value	Description
08DBHZ	8	Maximum expected C/NO level is 8 dBHz
09DBHZ	9	Maximum expected C/NO level is 9 dBHz
10DBHZ	10	Maximum expected C/NO level is 10 dBHz
11DBHZ	11	Maximum expected C/NO level is 11 dBHz
12DBHZ	12	Maximum expected C/NO level is 12 dBHz
13DBHZ	13	Maximum expected C/NO level is 13 dBHz
14DBHZ	14	Maximum expected C/NO level is 14 dBHz
15DBHZ	15	Maximum expected C/NO level is 15 dBHz
16DBHZ	16	Maximum expected C/NO level is 16 dBHz
17DBHZ	17	Maximum expected C/NO level is 17 dBHz
18DBHZ	18	Maximum expected C/NO level is 18 dBHz
19DBHZ	19	Maximum expected C/NO level is 19 dBHz
20DBHZ	20	Maximum expected C/NO level is 20 dBHz
21DBHZ	21	Maximum expected C/NO level is 21 dBHz
22DBHZ	22	Maximum expected C/NO level is 22 dBHz
23DBHZ	23	Maximum expected C/NO level is 23 dBHz
24DBHZ	24	Maximum expected C/NO level is 24 dBHz
25DBHZ	25	Maximum expected C/NO level is 25 dBHz
26DBHZ	26	Maximum expected C/NO level is 26 dBHz
27DBHZ	27	Maximum expected C/NO level is 27 dBHz
28DBHZ	28	Maximum expected C/NO level is 28 dBHz
29DBHZ	29	Maximum expected C/NO level is 29 dBHz
30DBHZ	30	Maximum expected C/NO level is 30 dBHz
31DBHZ	31	Maximum expected C/NO level is 31 dBHz
32DBHZ	32	Maximum expected C/NO level is 32 dBHz
33DBHZ	33	Maximum expected C/NO level is 33 dBHz
34DBHZ	34	Maximum expected C/NO level is 34 dBHz
35DBHZ	35	Maximum expected C/NO level is 35 dBHz
36DBHZ	36	Maximum expected C/NO level is 36 dBHz
37DBHZ	37	Maximum expected C/NO level is 37 dBHz
38DBHZ	38	Maximum expected C/NO level is 38 dBHz
39DBHZ	39	Maximum expected C/NO level is 39 dBHz
40DBHZ	40	Maximum expected C/NO level is 40 dBHz
41DBHZ	41	Maximum expected C/NO level is 41 dBHz
42DBHZ	42	Maximum expected C/NO level is 42 dBHz
43DBHZ	43	Maximum expected C/NO level is 43 dBHz
44DBHZ	44	Maximum expected C/NO level is 44 dBHz
45DBHZ	45	Maximum expected C/NO level is 45 dBHz
46DBHZ	46	Maximum expected C/NO level is 46 dBHz
47DBHZ	47	Maximum expected C/NO level is 47 dBHz
48DBHZ	48	Maximum expected C/NO level is 48 dBHz
49DBHZ	49	Maximum expected C/NO level is 49 dBHz
50DBHZ	50	Maximum expected C/NO level is 50 dBHz
51DBHZ	51	Maximum expected C/NO level is 51 dBHz
52DBHZ	52	Maximum expected C/NO level is 52 dBHz

Constants for CFG-SFCORE-SIGATTENCOMPmode continued

Constant	Value	Description
53DBHZ	53	Maximum expected C/NO level is 53 dBHz
54DBHZ	54	Maximum expected C/NO level is 54 dBHz
55DBHZ	55	Maximum expected C/NO level is 55 dBHz
56DBHZ	56	Maximum expected C/NO level is 56 dBHz
57DBHZ	57	Maximum expected C/NO level is 57 dBHz
58DBHZ	58	Maximum expected C/NO level is 58 dBHz
59DBHZ	59	Maximum expected C/NO level is 59 dBHz
60DBHZ	60	Maximum expected C/NO level is 60 dBHz
61DBHZ	61	Maximum expected C/NO level is 61 dBHz
62DBHZ	62	Maximum expected C/NO level is 62 dBHz
63DBHZ	63	Maximum expected C/NO level is 63 dBHz

### 6.8.20 CFG-SFIMU: Sensor Fusion (SF) Inertial Measurement Unit (IMU) Configuration

This group contains configuration items related to the Inertial Measurement Unit (IMU) for Dead Reckoning (DR) products.

More details on the configuration parameters can be found in the the ADR section of the [Integration manual](#)

#### CFG-SFIMU-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-SFIMU-GYRO_TC_UPDATE_PERIOD	0x30060007	U2	-	s	Time period between each update for the saved temperature-dependent gyroscope bias table
CFG-SFIMU-GYRO_RMSTHDL	0x20060008	U1	2 <sup>-8</sup>	deg/s	Gyroscope sensor RMS threshold
Gyroscope sensor RMS threshold below which automatically estimated gyroscope noise-level (accuracy) is updated.					
CFG-SFIMU-GYRO_FREQUENCY	0x20060009	U1	-	Hz	Nominal gyroscope sensor data sampling frequency
CFG-SFIMU-GYRO_LATENCY	0x3006000a	U2	-	ms	Gyroscope sensor data latency due to e.g. CAN bus
CFG-SFIMU-GYRO_ACCURACY	0x3006000b	U2	1e-3	deg/s	Gyroscope sensor data accuracy
Accuracy of gyroscope sensor data. If GYRO_ACCURACY is not set, the accuracy is estimated automatically.					
CFG-SFIMU-ACCEL_RMSTHDL	0x20060015	U1	2 <sup>-6</sup>	m/s <sup>2</sup>	Accelerometer RMS threshold
Accelerometer RMS threshold below which automatically estimated accelerometer noise-level (accuracy) is updated.					
CFG-SFIMU-ACCEL_FREQUENCY	0x20060016	U1	-	Hz	Nominal accelerometer sensor data sampling frequency
CFG-SFIMU-ACCEL_LATENCY	0x30060017	U2	-	ms	Accelerometer sensor data latency due to e.g. CAN bus
CFG-SFIMU-ACCEL_ACCURACY	0x30060018	U2	1e-4	m/s <sup>2</sup>	Accelerometer sensor data accuracy

CFG-SFIMU-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
Accuracy of accelerometer sensor data. If ACCEL_ACCURACY is not set, the accuracy is estimated automatically.					
CFG-SFIMU-IMU_I2C_SCL_PIO	0x2006001e	U1	-	-	SCL PIO of the IMU I2C
IMU I2C SCL PIO number that should be used by the FW for communication with the sensor.					
CFG-SFIMU-IMU_I2C_SDA_PIO	0x2006001f	U1	-	-	SDA PIO of the IMU I2C
IMU I2C SDA PIO number that should be used by the FW for communication with the sensor.					
CFG-SFIMU-IMU2ANT_LA_X	0x30060020	I2	-	cm	X coordinate of IMU-to-ANT lever-arm in the installation frame
CFG-SFIMU-IMU2ANT_LA_Y	0x30060021	I2	-	cm	Y coordinate of IMU-to-ANT lever-arm in the installation frame
CFG-SFIMU-IMU2ANT_LA_Z	0x30060022	I2	-	cm	Z coordinate of IMU-to-ANT lever-arm in the installation frame
CFG-SFIMU-AUTO_MNTALG_ENA	0x10060027	L	-	-	Enable automatic IMU-mount alignment
Enable automatic IMU-mount alignment. This flag can only be used with modules containing an internal IMU.					
CFG-SFIMU-IMU_MNTALG_YAW	0x4006002d	U4	1e-2	deg	User-defined IMU-mount yaw angle [0, 360]
CFG-SFIMU-IMU_MNTALG_PITCH	0x3006002e	I2	1e-2	deg	User-defined IMU-mount pitch angle [-90, 90]
CFG-SFIMU-IMU_MNTALG_ROLL	0x3006002f	I2	1e-2	deg	User-defined IMU-mount roll angle [-180, 180]

### 6.8.21 CFG-SFODO: Sensor Fusion (SF) Odometer Configuration

This group contains configuration items related to odometer sensors for Dead Reckoning (DR) products.

More details on the configuration parameters can be found in the the ADR section of the [Integration manual](#)

#### CFG-SFODO-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-SFODO-COMBINE_TICKS	0x10070001	L	-	-	Use combined rear wheel-ticks instead of the single tick
CFG-SFODO-USE_SPEED	0x10070003	L	-	-	Use speed measurements
Use speed measurements (data type 11 in ESF-MEAS) instead of single ticks (data type 10)					
CFG-SFODO-DIS_AUTOCOUNTMAX	0x10070004	L	-	-	Disable automatic estimation of maximum absolute wheel-tick counter
Disable automatic estimation of maximum absolute wheel-tick counter value. See <a href="#">CFG-SFODO-COUNT_MAX</a> item description for more details.					

## CFG-SFODO-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-SFODO-DIS_AUTODIRPINPOL	0x10070005	L	-	-	Disable automatic wheel-tick direction pin polarity detection
Disable automatic wheel-tick direction pin polarity detection. See <a href="#">CFG-SFODO-DIR_PINPOL</a> item description for more details.					
CFG-SFODO-DIS_AUTOSPEED	0x10070006	L	-	-	Disable automatic receiver reconfiguration for processing speed data instead of wheel-tick data
Disable automatic receiver reconfiguration for processing speed data instead of wheel-tick data if no wheel-tick data are available but speed data were detected. See <a href="#">CFG-SFODO-USE_SPEED</a> item description for more details.					
CFG-SFODO-FACTOR	0x40070007	U4	1e-6	-	Wheel-tick scale factor
Wheel-tick scale factor to obtain distance [m] from wheel-ticks.					
CFG-SFODO-QUANT_ERROR	0x40070008	U4	1e-6	m (or m/s)	Wheel-tick quantization
Wheel-tick quantization. If <a href="#">CFG-SFODO-USE_SPEED</a> is set then this is interpreted as the speed measurement error RMS.					
CFG-SFODO-COUNT_MAX	0x40070009	U4	-	-	Wheel-tick counter maximum value
Wheel-tick counter maximum value (rollover - 1). If null, relative wheel-tick counts are assumed (and therefore no rollover). If not null, absolute wheel-tick counts are assumed and the value corresponds to the highest tick count value before rollover happens. If <a href="#">CFG-SFODO-USE_SPEED</a> is set then this value is ignored. If value is set to 1, absolute wheel-tick counts are assumed and the value will be automatic calculated if possible. It is only possible for automatic calibration to calculate wheel-tick counter maximum value if it can be represented as a number of set bits (i.e. $2^N$ ). If it cannot be represented in this way it must be set to the correct absolute tick value manually.					
CFG-SFODO-LATENCY	0x3007000a	U2	-	ms	Wheel-tick data latency due to e. g. CAN bus
CFG-SFODO-FREQUENCY	0x2007000b	U1	-	Hz	Nominal wheel-tick data frequency (0 = not set)
CFG-SFODO-CNT_BOTH_EDGES	0x1007000d	L	-	-	Count both rising and falling edges on wheel-tick signal
Count both rising and falling edges on wheel-tick signal (only relevant if wheel-tick is measured by the u-blox receiver). Only turn on this feature if the wheel-tick signal has 50 % duty cycle. Turning on this feature with fixed-width pulses can lead to severe degradation of performance. Use wheel-tick pin for speed measurement. This field can only be used with modules supporting analog wheel-tick signals.					
CFG-SFODO-SPEED_BAND	0x3007000e	U2	-	cm/s	Speed sensor dead band (0 = not set)
CFG-SFODO-USE_WT_PIN	0x1007000f	L	-	-	Wheel tick signal enabled
Flag indicating that wheel tick signal is connected.					
CFG-SFODO-DIR_PINPOL	0x10070010	L	-	-	Wheeltick direction pin polarity

CFG-SFODO-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
0 : Pin high means forwards direction 1 : Pin high means backwards direction					
CFG-SFODO-DIS_AUTOSW	0x10070011	L	-	-	Disable automatic use of wheel-tick or speed data received over the software interface
Disable automatic use of wheel-tick or speed data received over the software interface if available. In this case, data coming from the hardware interface (wheel-tick pins) will automatically be ignored if wheel-tick/speed data are available from the software interface. See <a href="#">CFG-SFODO-USE_WT_PIN</a> item description for more details.					
CFG-SFODO-IMU2VRP_LA_X	0x30070012	I2	-	cm	X coordinate of IMU-to-VRP lever-arm in the installation frame
CFG-SFODO-IMU2VRP_LA_Y	0x30070013	I2	-	cm	Y coordinate of IMU-to-VRP lever-arm in the installation frame
CFG-SFODO-IMU2VRP_LA_Z	0x30070014	I2	-	cm	Z coordinate of IMU-to-VRP lever-arm in the installation frame

### 6.8.22 CFG-SIGNAL: Satellite Systems (GNSS) Signal Configuration

It is necessary for at least one signal and constellation from a [major GNSS](#) to be enabled, after applying the new configuration to the current one.

The individual signals enable keys are governed by their corresponding constellation enable key. See GNSS Signal Configuration for more details.

Configuration specific to a GNSS system can be done via other groups (e.g. **CFG-SBAS-\***).

Note that changes to any items within this group will trigger a reset to the GNSS subsystem.

#### CFG-SIGNAL-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-SIGNAL-GPS_ENA	0x1031001f	L	-	-	GPS enable
CFG-SIGNAL-GPS_L1CA_ENA	0x10310001	L	-	-	GPS L1C/A
CFG-SIGNAL-GPS_L2C_ENA	0x10310003	L	-	-	GPS L2C (only on u-blox F9 platform products)
CFG-SIGNAL-SBAS_ENA	0x10310020	L	-	-	SBAS enable
CFG-SIGNAL-SBAS_L1CA_ENA	0x10310005	L	-	-	SBAS L1C/A
CFG-SIGNAL-GAL_ENA	0x10310021	L	-	-	Galileo enable
CFG-SIGNAL-GAL_E1_ENA	0x10310007	L	-	-	Galileo E1
CFG-SIGNAL-GAL_E5B_ENA	0x1031000a	L	-	-	Galileo E5b (only on u-blox F9 platform products)
CFG-SIGNAL-BDS_ENA	0x10310022	L	-	-	BeiDou Enable
CFG-SIGNAL-BDS_B1_ENA	0x1031000d	L	-	-	BeiDou B1I
CFG-SIGNAL-BDS_B2_ENA	0x1031000e	L	-	-	BeiDou B2I (only on u-blox F9 platform products)
CFG-SIGNAL-QZSS_ENA	0x10310024	L	-	-	QZSS enable
CFG-SIGNAL-QZSS_L1CA_ENA	0x10310012	L	-	-	QZSS L1C/A



CFG-SIGNAL-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-SIGNAL-QZSS_L1S_ENA	0x10310014	L	-	-	QZSS L1S
CFG-SIGNAL-QZSS_L2C_ENA	0x10310015	L	-	-	QZSS L2C (only on u-blox F9 platform products)
CFG-SIGNAL-GLO_ENA	0x10310025	L	-	-	GLONASS enable
CFG-SIGNAL-GLO_L1_ENA	0x10310018	L	-	-	GLONASS L1
CFG-SIGNAL-GLO_L2_ENA	0x1031001a	L	-	-	GLONASS L2 (only on u-blox F9 platform products)

### 6.8.23 CFG-SPI: Configuration of the SPI Interface

Settings needed to configure the SPI communication interface.

#### CFG-SPI-\* Configuration Items

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

### 6.8.24 CFG-SPIINPROT: Input Protocol Configuration of the SPI Interface

Input protocol enable flags of the SPI interface.

#### CFG-SPIINPROT-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-SPIINPROT-UBX	0x10790001	L	-	-	Flag to indicate if UBX should be an input protocol on SPI
CFG-SPIINPROT-NMEA	0x10790002	L	-	-	Flag to indicate if NMEA should be an input protocol on SPI
CFG-SPIINPROT-RTCM3X	0x10790004	L	-	-	Flag to indicate if RTCM3X should be an input protocol on SPI

### 6.8.25 CFG-SPIOUTPROT: Output Protocol Configuration of the SPI Interface

Output protocol enable flags of the SPI interface.

#### CFG-SPIOUTPROT-\* Configuration Items

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

### 6.8.26 CFG-TP: Timepulse Configuration

Use this group to configure the generation of timepulses.

#### CFG-TP-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-TP-PULSE_DEF	0x20050023	E1	-	-	Determines whether the time pulse is interpreted as frequency or period?
See <a href="#">Constants for CFG-TP-PULSE_DEF</a> below for a list of possible constants for this item.					
CFG-TP-PULSE_LENGTH_DEF	0x20050030	E1	-	-	Determines whether the time pulse length is interpreted as length[us] or pulse ratio[%]?
See <a href="#">Constants for CFG-TP-PULSE_LENGTH_DEF</a> below for a list of possible constants for this item.					
CFG-TP-ANT_CABLEDELAY	0x30050001	I2	0.00000001	s	Antenna cable delay
CFG-TP-PERIOD_TP1	0x40050002	U4	0.000001	s	Time pulse period (TP1)
CFG-TP-PERIOD_LOCK_TP1	0x40050003	U4	0.000001	s	Time pulse period when locked to GNSS time (TP1)
Only used if CFG-TP-USE_LOCKED_TP1 is set.					
CFG-TP-FREQ_TP1	0x40050024	U4	-	Hz	Time pulse frequency (TP1)
This will only be used if CFG-TP-PULSE_DEF=FREQ.					
CFG-TP-FREQ_LOCK_TP1	0x40050025	U4	-	Hz	Time pulse frequency when locked to GNSS time (TP1)
Only used if CFG-TP-USE_LOCKED_TP1 is set.					
CFG-TP-LEN_TP1	0x40050004	U4	0.000001	s	Time pulse length (TP1)
CFG-TP-LEN_LOCK_TP1	0x40050005	U4	0.000001	s	Time pulse length when locked to GNSS time (TP1)



## CFG-TP-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
Only used if CFG-TP-USE_LOCKED_TP1 is set.					
CFG-TP-DUTY_TP1	0x5005002a	R8	-	%	Time pulse duty cycle (TP1)
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)
Only used if CFG-TP-PULSE_LENGTH_DEF=RATIO and CFG-TP-USE_LOCKED_TP1 are set.					
CFG-TP-USER_DELAY_TP1	0x40050006	I4	0.000000001	s	User configurable time pulse delay (TP1)
CFG-TP-TP1_ENA	0x10050007	L	-	-	Enable the first timepulse
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, if not set or not available, use local clock. Ignored by time-frequency product variants, which will attempt to use the best available time/frequency reference (not necessarily GNSS).					
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 if not valid or not set, 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-USE_LOCKED_TP1 must be set. Time pulse period must be an integer fraction of 1 second. Ignored in time-frequency product variants, where it is assumed always enabled.					
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-USE_LOCKED_TP1 and ALIGN_TO_TOW_TP1 are 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 will attempt 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="#">Constants for CFG-TP-TIMEGRID_TP1</a> below for a list of possible constants for this item.					

**Constants for CFG-TP-PULSE\_DEF**

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

### Constants for CFG-TP-PULSE\_LENGTH\_DEF

Constant	Value	Description
RATIO	0	Time pulse ratio
LENGTH	1	Time pulse length

### Constants for CFG-TP-TIMEGRID\_TP1

Constant	Value	Description
UTC	0	UTC time reference
GPS	1	GPS time reference
GLO	2	GLONASS time reference
BDS	3	BeiDuo time reference
GAL	4	Galileo time reference

## 6.8.27 CFG-TXREADY: Tx-Ready Configuration

Configuration of the tx ready pin.

### CFG-TXREADY-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-TXREADY-ENABLED	0x10a20001	L	-	-	Flag to indicate if tx ready pin mechanism should be enabled
CFG-TXREADY-POLARITY	0x10a20002	L	-	-	The polarity of the tx ready pin: false:high-active, true:low-active
CFG-TXREADY-PIN	0x20a20003	U1	-	-	Pin number to use for the tx ready functionality
CFG-TXREADY-THRESHOLD	0x30a20004	U2	-	-	Amount of data that should be ready on the interface before triggering the tx ready pin
CFG-TXREADY-INTERFACE	0x20a20005	E1	-	-	Interface where the tx ready feature should be linked to
See <a href="#">Constants for CFG-TXREADY-INTERFACE</a> below for a list of possible constants for this item.					

### Constants for CFG-TXREADY-INTERFACE

Constant	Value	Description
I2C	0	I2C interface
SPI	1	SPI interface

## 6.8.28 CFG-UART1: Configuration of the UART1 Interface

Settings needed to configure the UART1 communication interface.

### CFG-UART1-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-UART1-BAUDRATE	0x40520001	U4	-	-	The baud rate that should be configured on the UART1
CFG-UART1-STOPBITS	0x20520002	E1	-	-	Number of stopbits that should be used on UART1
See <a href="#">Constants for CFG-UART1-STOPBITS</a> below for a list of possible constants for this item.					

#### CFG-UART1-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-UART1-DATABITS	0x20520003	E1	-	-	Number of databits that should be used on UART1
See <a href="#">Constants for CFG-UART1-DATABITS</a> below for a list of possible constants for this item.					
CFG-UART1-PARITY	0x20520004	E1	-	-	Parity mode that should be used on UART1
See <a href="#">Constants for CFG-UART1-PARITY</a> below for a list of possible constants for this item.					
CFG-UART1-ENABLED	0x10520005	L	-	-	Flag to indicate if the UART1 should be enabled
CFG-UART1-REMAP	0x10520006	L	-	-	UART1 Remapping

#### Constants for CFG-UART1-STOPBITS

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

#### Constants for CFG-UART1-DATABITS

Constant	Value	Description
EIGHT	0	8 databits
SEVEN	1	7 databits

#### Constants for CFG-UART1-PARITY

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

### 6.8.29 CFG-UART1INPROT: Input Protocol Configuration of the UART1 Interface

Input protocol enable flags of the UART1 interface.

#### CFG-UART1INPROT-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-UART1INPROT-UBX	0x10730001	L	-	-	Flag to indicate if UBX should be an input protocol on UART1
CFG-UART1INPROT-NMEA	0x10730002	L	-	-	Flag to indicate if NMEA should be an input protocol on UART1
CFG-UART1INPROT-RTCM3X	0x10730004	L	-	-	Flag to indicate if RTCM3X should be an input protocol on UART1

### 6.8.30 CFG-UART1OUTPROT: Output Protocol Configuration of the UART1 Interface

Output protocol enable flags of the UART1 interface.

#### CFG-UART1OUTPROT-\* Configuration Items

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

### 6.8.31 CFG-UART2: Configuration of the UART2 Interface

Settings needed to configure the UART2 communication interface.

#### CFG-UART2-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-UART2-BAUDRATE	0x40530001	U4	-	-	The baud rate that should be configured on the UART2
CFG-UART2-STOPBITS	0x20530002	E1	-	-	Number of stopbits that should be used on UART2
See <a href="#">Constants for CFG-UART2-STOPBITS</a> below for a list of possible constants for this item.					
CFG-UART2-DATABITS	0x20530003	E1	-	-	Number of databits that should be used on UART2
See <a href="#">Constants for CFG-UART2-DATABITS</a> below for a list of possible constants for this item.					
CFG-UART2-PARITY	0x20530004	E1	-	-	Parity mode that should be used on UART2
See <a href="#">Constants for CFG-UART2-PARITY</a> below for a list of possible constants for this item.					
CFG-UART2-ENABLED	0x10530005	L	-	-	Flag to indicate if the UART2 should be enabled
CFG-UART2-REMAP	0x10530006	L	-	-	UART2 Remapping

#### Constants for CFG-UART2-STOPBITS

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

#### Constants for CFG-UART2-DATABITS

Constant	Value	Description
EIGHT	0	8 databits
SEVEN	1	7 databits

#### Constants for CFG-UART2-PARITY

Constant	Value	Description
NONE	0	No parity bit
ODD	1	Add an odd parity bit

Constants for CFG-UART2-PARITY continued

Constant	Value	Description
EVEN	2	Add an even parity bit

### 6.8.32 CFG-UART2INPROT: Input Protocol Configuration of the UART2 Interface

Input protocol enable flags of the UART2 interface.

#### CFG-UART2INPROT-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-UART2INPROT-UBX	0x10750001	L	-	-	Flag to indicate if UBX should be an input protocol on UART2
CFG-UART2INPROT-NMEA	0x10750002	L	-	-	Flag to indicate if NMEA should be an input protocol on UART2
CFG-UART2INPROT-RTCM3X	0x10750004	L	-	-	Flag to indicate if RTCM3X should be an input protocol on UART2

### 6.8.33 CFG-UART2OUTPROT: Output Protocol Configuration of the UART2 Interface

Output protocol enable flags of the UART2 interface.

#### CFG-UART2OUTPROT-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-UART2OUTPROT-UBX	0x10760001	L	-	-	Flag to indicate if UBX should be an output protocol on UART2
CFG-UART2OUTPROT-NMEA	0x10760002	L	-	-	Flag to indicate if NMEA should be an output protocol on UART2

### 6.8.34 CFG-USB: Configuration of the USB Interface

Settings needed to configure the USB communication interface.

#### CFG-USB-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-USB-ENABLED	0x10650001	L	-	-	Flag to indicate if the USB interface should be enabled
CFG-USB-SELFPOW	0x10650002	L	-	-	Self-Powered device
CFG-USB-VENDOR_ID	0x3065000a	U2	-	-	Vendor ID
CFG-USB-PRODUCT_ID	0x3065000b	U2	-	-	Vendor ID
CFG-USB-POWER	0x3065000c	U2	-	mA	Power consumption
CFG-USB-VENDOR_STR0	0x5065000d	X8	-	-	Vendor string characters 0-7
CFG-USB-VENDOR_STR1	0x5065000e	X8	-	-	Vendor string characters 8-15
CFG-USB-VENDOR_STR2	0x5065000f	X8	-	-	Vendor string characters 16-23
CFG-USB-VENDOR_STR3	0x50650010	X8	-	-	Vendor string characters 24-31
CFG-USB-PRODUCT_STR0	0x50650011	X8	-	-	Product string characters 0-7
CFG-USB-PRODUCT_STR1	0x50650012	X8	-	-	Product string characters 8-15
CFG-USB-PRODUCT_STR2	0x50650013	X8	-	-	Product string characters 16-23

CFG-USB-\* Configuration Items continued

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-USB-PRODUCT_STR3	0x50650014	X8	-	-	Product string characters 24-31
CFG-USB-SERIAL_NO_STR0	0x50650015	X8	-	-	Serial number string characters 0-7
CFG-USB-SERIAL_NO_STR1	0x50650016	X8	-	-	Serial number string characters 8-15
CFG-USB-SERIAL_NO_STR2	0x50650017	X8	-	-	Serial number string characters 16-23
CFG-USB-SERIAL_NO_STR3	0x50650018	X8	-	-	Serial number string characters 24-31

### 6.8.35 CFG-USBINPROT: Input Protocol Configuration of the USB Interface

Input protocol enable flags of the USB interface.

#### CFG-USBINPROT-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-USBINPROT-UBX	0x10770001	L	-	-	Flag to indicate if UBX should be an input protocol on USB
CFG-USBINPROT-NMEA	0x10770002	L	-	-	Flag to indicate if NMEA should be an input protocol on USB
CFG-USBINPROT-RTCM3X	0x10770004	L	-	-	Flag to indicate if RTCM3X should be an input protocol on USB

### 6.8.36 CFG-USBOUTPROT: Output Protocol Configuration of the USB Interface

Output protocol enable flags of the USB interface.

#### CFG-USBOUTPROT-\* Configuration Items

Configuration Item	Key ID	Type	Scale	Unit	Description
CFG-USBOUTPROT-UBX	0x10780001	L	-	-	Flag to indicate if UBX should be an output protocol on USB
CFG-USBOUTPROT-NMEA	0x10780002	L	-	-	Flag to indicate if NMEA should be an output protocol on USB

## 6.9 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.

#### UBX Messages Fields and the Corresponding Configuration Items

UBX Message and Field Name	Configuration Item
UBX-CFG-OTP.payload	CFG-HW-DCDC_DIS
UBX-CFG-OTP.payload	CFG-HW-OSC_TYPE
UBX-CFG-OTP.payload	CFG-HW-SINGLE_CLK
UBX-CFG-OTP.payload	CFG-UART1-REMAP

## 7 RTCM Protocol

### 7.1 RTCM version 3

#### 7.1.1 Supported Messages

The following RTCM 3.3 input messages are supported:

##### Supported RTCM 3.3 Input Messages

Message Type	Description
1001	L1-only GPS RTK observations
1002	Extended L1-only GPS RTK observations
1003	L1/L2 GPS RTK observations
1004	Extended L1/L2 GPS RTK observations
1005	Stationary RTK reference station ARP
1006	Stationary RTK reference station ARP with antenna height
1007	Antenna descriptor
1009	L1-only GLONASS RTK observations
1010	Extended L1-only GLONASS RTK observations
1011	L1/L2 GLONASS RTK observations
1012	Extended L1/L2 GLONASS RTK observations
1033	Receiver and antenna descriptors
1074	GPS MSM4
1075	GPS MSM5
1077	GPS MSM7
1084	GLONASS MSM4
1085	GLONASS MSM5
1087	GLONASS MSM7
1094	Galileo MSM4
1095	Galileo MSM5
1097	Galileo MSM7
1124	BeiDou MSM4
1125	BeiDou MSM5
1127	BeiDou MSM7
1230	GLONASS code-phase biases

#### 7.1.2 Configuration

The RTCM3 protocol can be disabled/enabled on communication interfaces by means of the configuration items, for example [CFG-UART1OUTPROT-RTCM3X](#).

# Appendix

## A Satellite Numbering

A summary of all the SV numbering schemes is provided in the following table.

### Satellite numbering

GNSS Type	SV range	UBX gnssId: svId	UBX svId	NMEA 2.X- 4.0 (strict)	NMEA 2.X-4.0 (extended)	NMEA 4.10+ (strict)	NMEA 4.10+ (extended)
GPS	G1-G32	0:1-32	1-32	1-32	1-32	1-32	1-32
SBAS	S120- S158	1:120-158	120-158	33-64	33-64,152- 158	33-64	33-64,152- 158
Galileo	E1-E36	2:1-36	211-246	-	301-336	1-36	1-36
BeiDou	B1-B37	3:1-37	159-163,33- 64	-	401-437	1-37	1-37
QZSS	Q1-Q5	5:1-5	193-197	-	193-197	-	193-197
GLONASS	R1-R32, R?	6:1-32, 6: 255	65-96, 255	65-96, null	65-96, null	65-96, null	65-96, null

## B UBX and NMEA Signal Identifiers

UBX and NMEA protocols use signal identifiers (commonly abbreviated to "sigId") to distinguish between different signals from GNSS.

Signal identifiers are only valid when combined with a GNSS identifier (see [above](#)). The table below shows the range of identifiers currently supported in the firmware.

The following table shows the mapping of GNSS signals to UBX / NMEA signal identifier.

### Signal Identifiers

Signal name	UBX gnssId	UBX sigId	NMEA 4.10+ gnssId	NMEA 4.10+ sigId
GPS L1C/A*	0	0	1	1
GPS L2 CL	0	3	1	6
GPS L2 CM	0	4	1	5
Galileo E1 C*	2	0	3	7
Galileo E1 B*	2	1	3	7
Galileo E5 bI	2	5	3	2
Galileo E5 bQ	2	6	3	2
BeiDou B1I D1*	3	0	4**	1**
BeiDou B1I D2*	3	1	4**	1**
BeiDou B2I D1	3	2	4**	3**
BeiDou B2I D2	3	3	4**	3**
QZSS L1C/A*	5	0		
QZSS L2 CM	5	4		
QZSS L2 CL	5	5		
GLONASS L1 OF*	6	0	2	1
GLONASS L2 OF	6	2	2	3

UBX messages, that don't have an explicit sigId field, contain information about the subset of signals marked with (\*).



BeiDou gnssId and sigId are not defined in the NMEA protocol version 4.10, values shown in the table are valid for u-blox products only (\*\*).

## C Configuration Defaults

The configuration defaults given in this section apply to the receiver firmwares given below.

These values assume that the defaults have not been changed using eFuse OTP or Pin configuration (see [Default Layer Composite](#)).

### C.1 u-blox 9 ZED-F9K (version 1.03 LAP 1.00B03)

This section lists the configuration defaults for the u-blox 9 ZED-F9K (version 1.03 LAP 1.00B03), protocol version 30.00.

#### System Clock Configuration (CFG-CLOCK-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
<a href="#">CFG-CLOCK-OSC_FREQ</a>	0x40a4000d	U4	-	Hz	26000000

#### Hardware Configuration (CFG-HW-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
<a href="#">CFG-HW-DCDC_DIS</a>	0x10a30018	L	-	-	1 (true)
<a href="#">CFG-HW-SINGLE_CLK</a>	0x10a30019	L	-	-	0 (false)
<a href="#">CFG-HW-OSC_TYPE</a>	0x20a30025	E1	-	-	0 (TCXO_D1V2)
<a href="#">CFG-HW-CLK_OFFSET</a>	0x40a30028	I4	-	ppb	0
<a href="#">CFG-HW-CLK_OFFSET_VALID</a>	0x10a30029	L	-	-	0 (false)
<a href="#">CFG-HW-CLK_PRECISION</a>	0x40a3002a	U4	-	ppb	0
<a href="#">CFG-HW-CLK_MAX_CALIB_DEV</a>	0x40a3002b	U4	-	ppb	0
<a href="#">CFG-HW-CLK_MAX_CALIB_DEV_VALID</a>	0x10a3002c	L	-	-	0 (false)
<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	-	-	16
<a href="#">CFG-HW-ANT_SUP_SHORT_PIN</a>	0x20a30037	U1	-	-	15
<a href="#">CFG-HW-ANT_SUP_OPEN_PIN</a>	0x20a30038	U1	-	-	8

#### Configuration of the I2C Interface (CFG-I2C-\*) 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	-	-	1 (true)

### Input Protocol Configuration of the I2C Interface (CFG-I2CINPROT-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-I2CINPROT-UBX	0x10710001	L	-	-	1 (true)
CFG-I2CINPROT-NMEA	0x10710002	L	-	-	1 (true)
CFG-I2CINPROT-RTCM3X	0x10710004	L	-	-	1 (true)

### Output Protocol Configuration of the I2C Interface (CFG-I2COUTPROT-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-I2COUTPROT-UBX	0x10720001	L	-	-	1 (true)
CFG-I2COUTPROT-NMEA	0x10720002	L	-	-	1 (true)

### Inf Message Configuration (CFG-INFMSG-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-INFMSG-UBX_I2C	0x20920001	X1	-	-	0x00
CFG-INFMSG-UBX_UART1	0x20920002	X1	-	-	0x00
CFG-INFMSG-UBX_UART2	0x20920003	X1	-	-	0x00
CFG-INFMSG-UBX_USB	0x20920004	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_UART2	0x20920008	X1	-	-	0x07 (ERROR   WARNING   NOTICE)
CFG-INFMSG-NMEA_USB	0x20920009	X1	-	-	0x07 (ERROR   WARNING   NOTICE)
CFG-INFMSG-NMEA_SPI	0x2092000a	X1	-	-	0x07 (ERROR   WARNING   NOTICE)

### Jamming/Interference Monitor configuration (CFG-ITFM-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-ITFM-BBTHRESHOLD	0x20410001	U1	-	-	3
CFG-ITFM-CWTHRESHOLD	0x20410002	U1	-	-	15
CFG-ITFM-ENABLE	0x1041000d	L	-	-	0 (false)
CFG-ITFM-ANTSETTING	0x20410010	E1	-	-	0 (UNKNOWN)
CFG-ITFM-ENABLE_AUX	0x10410013	L	-	-	0 (false)

### Data Logger Configuration (CFG-LOGFILTER-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-LOGFILTER-RECORD_ENA	0x10de0002	L	-	-	0 (false)
CFG-LOGFILTER-ONCE_PER_WAKE_UP_ENA	0x10de0003	L	-	-	0 (false)
CFG-LOGFILTER-APPLY_ALL_FILTERS	0x10de0004	L	-	-	0 (false)

## Data Logger Configuration (CFG-LOGFILTER-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-LOGFILTER-MIN_INTERVAL	0x30de0005	U2	-	s	0
CFG-LOGFILTER-TIME_THRS	0x30de0006	U2	-	s	0
CFG-LOGFILTER-SPEED_THRS	0x30de0007	U2	-	m/s	0
CFG-LOGFILTER-POSITION_THRS	0x40de0008	U4	-	m	0

## Motion Detector Configuration (CFG-MOT-\*) 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	-	-	0

## Message Output Configuration (CFG-MSGOUT-\*) 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_DTM_UART2	0x209100a8	U1	-	-	0
CFG-MSGOUT-NMEA_ID_DTM_USB	0x209100a9	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_GBS_UART2	0x209100df	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GBS_USB	0x209100e0	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_GGA_UART2	0x209100bc	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GGA_USB	0x209100bd	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_GLL_UART2	0x209100cb	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GLL_USB	0x209100cc	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_GNS_UART2	0x209100b7	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GNS_USB	0x209100b8	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_GRS_UART2	0x209100d0	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GRS_USB	0x209100d1	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GSA_I2C	0x209100bf	U1	-	-	1

Message Output Configuration (CFG-MSGOUT-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-MSGOUT-NMEA_ID_GSA_SPI	0x209100c3	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GSA_UART1	0x209100c0	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GSA_UART2	0x209100c1	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GSA_USB	0x209100c2	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_GST_UART2	0x209100d5	U1	-	-	0
CFG-MSGOUT-NMEA_ID_GST_USB	0x209100d6	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_GSV_UART2	0x209100c6	U1	-	-	1
CFG-MSGOUT-NMEA_ID_GSV_USB	0x209100c7	U1	-	-	1
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_RMC_UART2	0x209100ad	U1	-	-	1
CFG-MSGOUT-NMEA_ID_RMC_USB	0x209100ae	U1	-	-	1
CFG-MSGOUT-NMEA_ID_THS_I2C	0x209100e2	U1	-	-	0
CFG-MSGOUT-NMEA_ID_THS_SPI	0x209100e6	U1	-	-	0
CFG-MSGOUT-NMEA_ID_THS_UART1	0x209100e3	U1	-	-	0
CFG-MSGOUT-NMEA_ID_THS_UART2	0x209100e4	U1	-	-	0
CFG-MSGOUT-NMEA_ID_THS_USB	0x209100e5	U1	-	-	0
CFG-MSGOUT-NMEA_ID_VLW_I2C	0x209100e7	U1	-	-	0
CFG-MSGOUT-NMEA_ID_VLW_SPI	0x209100eb	U1	-	-	0
CFG-MSGOUT-NMEA_ID_VLW_UART1	0x209100e8	U1	-	-	0
CFG-MSGOUT-NMEA_ID_VLW_UART2	0x209100e9	U1	-	-	0
CFG-MSGOUT-NMEA_ID_VLW_USB	0x209100ea	U1	-	-	0
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_VTG_UART2	0x209100b2	U1	-	-	1
CFG-MSGOUT-NMEA_ID_VTG_USB	0x209100b3	U1	-	-	1
CFG-MSGOUT-NMEA_ID_ZDA_I2C	0x209100d8	U1	-	-	0
CFG-MSGOUT-NMEA_ID_ZDA_SPI	0x209100dc	U1	-	-	0
CFG-MSGOUT-NMEA_ID_ZDA_UART1	0x209100d9	U1	-	-	0
CFG-MSGOUT-NMEA_ID_ZDA_UART2	0x209100da	U1	-	-	0
CFG-MSGOUT-NMEA_ID_ZDA_USB	0x209100db	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_POLYP_UART2	0x209100ee	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYP_USB	0x209100ef	U1	-	-	0

Message Output Configuration (CFG-MSGOUT-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
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_POLYS_UART2	0x209100f3	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYS_USB	0x209100f4	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
CFG-MSGOUT-PUBX_ID_POLYT_UART2	0x209100f8	U1	-	-	0
CFG-MSGOUT-PUBX_ID_POLYT_USB	0x209100f9	U1	-	-	0
CFG-MSGOUT-UBX_ESF_ALG_I2C	0x2091010f	U1	-	-	0
CFG-MSGOUT-UBX_ESF_ALG_SPI	0x20910113	U1	-	-	0
CFG-MSGOUT-UBX_ESF_ALG_UART1	0x20910110	U1	-	-	0
CFG-MSGOUT-UBX_ESF_ALG_UART2	0x20910111	U1	-	-	0
CFG-MSGOUT-UBX_ESF_ALG_USB	0x20910112	U1	-	-	0
CFG-MSGOUT-UBX_ESF_INS_I2C	0x20910114	U1	-	-	0
CFG-MSGOUT-UBX_ESF_INS_SPI	0x20910118	U1	-	-	0
CFG-MSGOUT-UBX_ESF_INS_UART1	0x20910115	U1	-	-	0
CFG-MSGOUT-UBX_ESF_INS_UART2	0x20910116	U1	-	-	0
CFG-MSGOUT-UBX_ESF_INS_USB	0x20910117	U1	-	-	0
CFG-MSGOUT-UBX_ESF_MEAS_I2C	0x20910277	U1	-	-	0
CFG-MSGOUT-UBX_ESF_MEAS_SPI	0x2091027b	U1	-	-	0
CFG-MSGOUT-UBX_ESF_MEAS_UART1	0x20910278	U1	-	-	0
CFG-MSGOUT-UBX_ESF_MEAS_UART2	0x20910279	U1	-	-	0
CFG-MSGOUT-UBX_ESF_MEAS_USB	0x2091027a	U1	-	-	0
CFG-MSGOUT-UBX_ESF_RAW_I2C	0x2091029f	U1	-	-	0
CFG-MSGOUT-UBX_ESF_RAW_SPI	0x209102a3	U1	-	-	0
CFG-MSGOUT-UBX_ESF_RAW_UART1	0x209102a0	U1	-	-	0
CFG-MSGOUT-UBX_ESF_RAW_UART2	0x209102a1	U1	-	-	0
CFG-MSGOUT-UBX_ESF_RAW_USB	0x209102a2	U1	-	-	0
CFG-MSGOUT-UBX_ESF_STATUS_I2C	0x20910105	U1	-	-	0
CFG-MSGOUT-UBX_ESF_STATUS_SPI	0x20910109	U1	-	-	0
CFG-MSGOUT-UBX_ESF_STATUS_UART1	0x20910106	U1	-	-	0
CFG-MSGOUT-UBX_ESF_STATUS_UART2	0x20910107	U1	-	-	0
CFG-MSGOUT-UBX_ESF_STATUS_USB	0x20910108	U1	-	-	0
CFG-MSGOUT-UBX_HNR_ATT_I2C	0x20910377	U1	-	-	0
CFG-MSGOUT-UBX_HNR_ATT_SPI	0x2091037b	U1	-	-	0
CFG-MSGOUT-UBX_HNR_ATT_UART1	0x20910378	U1	-	-	0
CFG-MSGOUT-UBX_HNR_ATT_UART2	0x20910379	U1	-	-	0
CFG-MSGOUT-UBX_HNR_ATT_USB	0x2091037a	U1	-	-	0
CFG-MSGOUT-UBX_HNR_INS_I2C	0x20910372	U1	-	-	0
CFG-MSGOUT-UBX_HNR_INS_SPI	0x20910376	U1	-	-	0
CFG-MSGOUT-UBX_HNR_INS_UART1	0x20910373	U1	-	-	0
CFG-MSGOUT-UBX_HNR_INS_UART2	0x20910374	U1	-	-	0

Message Output Configuration (CFG-MSGOUT-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-MSGOUT-UBX_HNR_INS_USB	0x20910375	U1	-	-	0
CFG-MSGOUT-UBX_HNR_PVT_I2C	0x2091028b	U1	-	-	0
CFG-MSGOUT-UBX_HNR_PVT_SPI	0x2091028f	U1	-	-	0
CFG-MSGOUT-UBX_HNR_PVT_UART1	0x2091028c	U1	-	-	0
CFG-MSGOUT-UBX_HNR_PVT_UART2	0x2091028d	U1	-	-	0
CFG-MSGOUT-UBX_HNR_PVT_USB	0x2091028e	U1	-	-	0
CFG-MSGOUT-UBX_LOG_INFO_I2C	0x20910259	U1	-	-	0
CFG-MSGOUT-UBX_LOG_INFO_SPI	0x2091025d	U1	-	-	0
CFG-MSGOUT-UBX_LOG_INFO_UART1	0x2091025a	U1	-	-	0
CFG-MSGOUT-UBX_LOG_INFO_UART2	0x2091025b	U1	-	-	0
CFG-MSGOUT-UBX_LOG_INFO_USB	0x2091025c	U1	-	-	0
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_COMMS_UART2	0x20910351	U1	-	-	0
CFG-MSGOUT-UBX_MON_COMMS_USB	0x20910352	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW2_I2C	0x209101b9	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW2_SPI	0x209101bd	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW2_UART1	0x209101ba	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW2_UART2	0x209101bb	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW2_USB	0x209101bc	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_HW3_UART2	0x20910356	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW3_USB	0x20910357	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_HW_UART2	0x209101b6	U1	-	-	0
CFG-MSGOUT-UBX_MON_HW_USB	0x209101b7	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_IO_UART2	0x209101a7	U1	-	-	0
CFG-MSGOUT-UBX_MON_IO_USB	0x209101a8	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_MSGPP_UART2	0x20910198	U1	-	-	0
CFG-MSGOUT-UBX_MON_MSGPP_USB	0x20910199	U1	-	-	0
CFG-MSGOUT-UBX_MON_PT2_I2C	0x20910209	U1	-	-	0
CFG-MSGOUT-UBX_MON_PT2_SPI	0x2091020d	U1	-	-	0
CFG-MSGOUT-UBX_MON_PT2_UART1	0x2091020a	U1	-	-	0

Message Output Configuration (CFG-MSGOUT-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-MSGOUT-UBX_MON_PT2_UART2	0x2091020b	U1	-	-	0
CFG-MSGOUT-UBX_MON_PT2_USB	0x2091020c	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_RF_UART2	0x2091035b	U1	-	-	0
CFG-MSGOUT-UBX_MON_RF_USB	0x2091035c	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_RXBUF_UART2	0x209101a2	U1	-	-	0
CFG-MSGOUT-UBX_MON_RXBUF_USB	0x209101a3	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_RXR_UART2	0x20910189	U1	-	-	0
CFG-MSGOUT-UBX_MON_RXR_USB	0x2091018a	U1	-	-	0
CFG-MSGOUT-UBX_MON_TEMP_I2C	0x20910331	U1	-	-	0
CFG-MSGOUT-UBX_MON_TEMP_SPI	0x20910335	U1	-	-	0
CFG-MSGOUT-UBX_MON_TEMP_UART1	0x20910332	U1	-	-	0
CFG-MSGOUT-UBX_MON_TEMP_UART2	0x20910333	U1	-	-	0
CFG-MSGOUT-UBX_MON_TEMP_USB	0x20910334	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_MON_TXBUF_UART2	0x2091019d	U1	-	-	0
CFG-MSGOUT-UBX_MON_TXBUF_USB	0x2091019e	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ATT_I2C	0x2091001f	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ATT_SPI	0x20910023	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ATT_UART1	0x20910020	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ATT_UART2	0x20910021	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ATT_USB	0x20910022	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_CLOCK_UART2	0x20910067	U1	-	-	0
CFG-MSGOUT-UBX_NAV_CLOCK_USB	0x20910068	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_COV_UART2	0x20910085	U1	-	-	0
CFG-MSGOUT-UBX_NAV_COV_USB	0x20910086	U1	-	-	0
CFG-MSGOUT-UBX_NAV_DOP_I2C	0x20910038	U1	-	-	0
CFG-MSGOUT-UBX_NAV_DOP_SPI	0x2091003c	U1	-	-	0



Message Output Configuration (CFG-MSGOUT-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-MSGOUT-UBX_NAV_DOP_UART1	0x20910039	U1	-	-	0
CFG-MSGOUT-UBX_NAV_DOP_UART2	0x2091003a	U1	-	-	0
CFG-MSGOUT-UBX_NAV_DOP_USB	0x2091003b	U1	-	-	0
CFG-MSGOUT-UBX_NAV_EELL_I2C	0x20910313	U1	-	-	0
CFG-MSGOUT-UBX_NAV_EELL_SPI	0x20910317	U1	-	-	0
CFG-MSGOUT-UBX_NAV_EELL_UART1	0x20910314	U1	-	-	0
CFG-MSGOUT-UBX_NAV_EELL_UART2	0x20910315	U1	-	-	0
CFG-MSGOUT-UBX_NAV_EELL_USB	0x20910316	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_EOE_UART2	0x20910161	U1	-	-	0
CFG-MSGOUT-UBX_NAV_EOE_USB	0x20910162	U1	-	-	0
CFG-MSGOUT-UBX_NAV_GEOFENCE_I2C	0x209100a1	U1	-	-	0
CFG-MSGOUT-UBX_NAV_GEOFENCE_SPI	0x209100a5	U1	-	-	0
CFG-MSGOUT-UBX_NAV_GEOFENCE_UART1	0x209100a2	U1	-	-	0
CFG-MSGOUT-UBX_NAV_GEOFENCE_UART2	0x209100a3	U1	-	-	0
CFG-MSGOUT-UBX_NAV_GEOFENCE_USB	0x209100a4	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HNR_I2C	0x20910286	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HNR_SPI	0x2091028a	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HNR_UART1	0x20910287	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HNR_UART2	0x20910288	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HNR_USB	0x20910289	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HPPOSECEF_I2C	0x2091002e	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HPPOSECEF_SPI	0x20910032	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HPPOSECEF_UART1	0x2091002f	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HPPOSECEF_UART2	0x20910030	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HPPOSECEF_USB	0x20910031	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HPPOSLH_I2C	0x20910033	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HPPOSLH_SPI	0x20910037	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HPPOSLH_UART1	0x20910034	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HPPOSLH_UART2	0x20910035	U1	-	-	0
CFG-MSGOUT-UBX_NAV_HPPOSLH_USB	0x20910036	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ODO_I2C	0x2091007e	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ODO_SPI	0x20910082	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ODO_UART1	0x2091007f	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ODO_UART2	0x20910080	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ODO_USB	0x20910081	U1	-	-	0



Message Output Configuration (CFG-MSGOUT-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
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_ORB_UART2	0x20910012	U1	-	-	0
CFG-MSGOUT-UBX_NAV_ORB_USB	0x20910013	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_POSECEF_UART2	0x20910026	U1	-	-	0
CFG-MSGOUT-UBX_NAV_POSECEF_USB	0x20910027	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_POSLLH_UART2	0x2091002b	U1	-	-	0
CFG-MSGOUT-UBX_NAV_POSLLH_USB	0x2091002c	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_PVT_UART2	0x20910008	U1	-	-	0
CFG-MSGOUT-UBX_NAV_PVT_USB	0x20910009	U1	-	-	0
CFG-MSGOUT-UBX_NAV_RELPOSNED_I2C	0x2091008d	U1	-	-	0
CFG-MSGOUT-UBX_NAV_RELPOSNED_SPI	0x20910091	U1	-	-	0
CFG-MSGOUT-UBX_NAV_RELPOSNED_UART1	0x2091008e	U1	-	-	0
CFG-MSGOUT-UBX_NAV_RELPOSNED_UART2	0x2091008f	U1	-	-	0
CFG-MSGOUT-UBX_NAV_RELPOSNED_USB	0x20910090	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
CFG-MSGOUT-UBX_NAV_SAT_UART2	0x20910017	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SAT_USB	0x20910018	U1	-	-	0
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_SBAS_UART2	0x2091006c	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SBAS_USB	0x2091006d	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_SIG_UART2	0x20910347	U1	-	-	0
CFG-MSGOUT-UBX_NAV_SIG_USB	0x20910348	U1	-	-	0
CFG-MSGOUT-UBX_NAV_STATUS_I2C	0x2091001a	U1	-	-	0
CFG-MSGOUT-UBX_NAV_STATUS_SPI	0x2091001e	U1	-	-	0

Message Output Configuration (CFG-MSGOUT-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-MSGOUT-UBX_NAV_STATUS_UART1	0x2091001b	U1	-	-	0
CFG-MSGOUT-UBX_NAV_STATUS_UART2	0x2091001c	U1	-	-	0
CFG-MSGOUT-UBX_NAV_STATUS_USB	0x2091001d	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_TIMEBDS_UART2	0x20910053	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEBDS_USB	0x20910054	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_TIMEGAL_UART2	0x20910058	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGAL_USB	0x20910059	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_TIMEGLO_UART2	0x2091004e	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGLO_USB	0x2091004f	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_TIMEGPS_UART2	0x20910049	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEGPS_USB	0x2091004a	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_TIMELS_UART2	0x20910062	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMELS_USB	0x20910063	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_TIMEUTC_UART2	0x2091005d	U1	-	-	0
CFG-MSGOUT-UBX_NAV_TIMEUTC_USB	0x2091005e	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_VELECEF_UART2	0x2091003f	U1	-	-	0
CFG-MSGOUT-UBX_NAV_VELECEF_USB	0x20910040	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_NAV_VELNED_UART2	0x20910044	U1	-	-	0
CFG-MSGOUT-UBX_NAV_VELNED_USB	0x20910045	U1	-	-	0
CFG-MSGOUT-UBX_RXM_MEASX_I2C	0x20910204	U1	-	-	0

Message Output Configuration (CFG-MSGOUT-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-MSGOUT-UBX_RXM_MEASX_SPI	0x20910208	U1	-	-	0
CFG-MSGOUT-UBX_RXM_MEASX_UART1	0x20910205	U1	-	-	0
CFG-MSGOUT-UBX_RXM_MEASX_UART2	0x20910206	U1	-	-	0
CFG-MSGOUT-UBX_RXM_MEASX_USB	0x20910207	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_RAWX_UART2	0x209102a6	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RAWX_USB	0x209102a7	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_RLM_UART2	0x20910260	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RLM_USB	0x20910261	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RTC5_I2C	0x20910155	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RTC5_SPI	0x20910159	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RTC5_UART1	0x20910156	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RTC5_UART2	0x20910157	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RTC5_USB	0x20910158	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RTCM_I2C	0x20910268	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RTCM_SPI	0x2091026c	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RTCM_UART1	0x20910269	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RTCM_UART2	0x2091026a	U1	-	-	0
CFG-MSGOUT-UBX_RXM_RTCM_USB	0x2091026b	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_RXM_SFRBX_UART2	0x20910233	U1	-	-	0
CFG-MSGOUT-UBX_RXM_SFRBX_USB	0x20910234	U1	-	-	0
CFG-MSGOUT-UBX_SEC_ECSIGN_I2C	0x2091034a	U1	-	-	0
CFG-MSGOUT-UBX_SEC_ECSIGN_SPI	0x2091034e	U1	-	-	0
CFG-MSGOUT-UBX_SEC_ECSIGN_UART1	0x2091034b	U1	-	-	0
CFG-MSGOUT-UBX_SEC_ECSIGN_UART2	0x2091034c	U1	-	-	0
CFG-MSGOUT-UBX_SEC_ECSIGN_USB	0x2091034d	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_TM2_UART2	0x2091017a	U1	-	-	0
CFG-MSGOUT-UBX_TIM_TM2_USB	0x2091017b	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_TP_UART2	0x2091017f	U1	-	-	0
CFG-MSGOUT-UBX_TIM_TP_USB	0x20910180	U1	-	-	0

## Message Output Configuration (CFG-MSGOUT-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
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
CFG-MSGOUT-UBX_TIM_VRFY_UART2	0x20910094	U1	-	-	0
CFG-MSGOUT-UBX_TIM_VRFY_USB	0x20910095	U1	-	-	0

## High Precision Navigation Configuration (CFG-NAVHPG-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-NAVHPG-DGNSSMODE	0x20140011	E1	-	-	3 (RTK_FIXED)

## Standard Precision Navigation Configuration (CFG-NAVSPG-\*) 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-WKNROLLOVER	0x30110017	U2	-	-	2014
CFG-NAVSPG-USE_PPP	0x10110019	L	-	-	0 (false)
CFG-NAVSPG-UTCSTANDARD	0x2011001c	E1	-	-	0 (AUTO)
CFG-NAVSPG-DYNMODEL	0x20110021	E1	-	-	4 (AUTOMOT)
CFG-NAVSPG-ACKAIDING	0x10110025	L	-	-	0 (false)
CFG-NAVSPG-USE_USRDATA	0x10110061	L	-	-	0 (false)
CFG-NAVSPG-USRDATA_MAJA	0x50110062	R8	-	m	6378137
CFG-NAVSPG-USRDATA_FLAT	0x50110063	R8	-	-	298. 25722356300002502
CFG-NAVSPG-USRDATA_DX	0x40110064	R4	-	m	0
CFG-NAVSPG-USRDATA_DY	0x40110065	R4	-	m	0
CFG-NAVSPG-USRDATA_DZ	0x40110066	R4	-	m	0
CFG-NAVSPG-USRDATA_ROT_X	0x40110067	R4	-	arcsec	0
CFG-NAVSPG-USRDATA_ROT_Y	0x40110068	R4	-	arcsec	0
CFG-NAVSPG-USRDATA_ROT_Z	0x40110069	R4	-	arcsec	0
CFG-NAVSPG-USRDATA_SCALE	0x4011006a	R4	-	ppm	0
CFG-NAVSPG-INFIL_MINSVS	0x201100a1	U1	-	-	5
CFG-NAVSPG-INFIL_MAXSVS	0x201100a2	U1	-	-	32
CFG-NAVSPG-INFIL_MINCNO	0x201100a3	U1	-	dBHz	20
CFG-NAVSPG-INFIL_MINELEV	0x201100a4	I1	-	deg	10
CFG-NAVSPG-INFIL_NCNOTHS	0x201100aa	U1	-	-	0
CFG-NAVSPG-INFIL_CNOTHS	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

## Standard Precision Navigation Configuration (CFG-NAVSPG-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
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^2	10000
CFG-NAVSPG-CONSTR_DGNSSTO	0x201100c4	U1	-	s	60

## NMEA Protocol Configuration (CFG-NMEA-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-NMEA-PROTVER	0x20930001	E1	-	-	41 (V41)
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_QZSS	0x10930015	L	-	-	0 (false)
CFG-NMEA-FILT_GLO	0x10930016	L	-	-	0 (false)
CFG-NMEA-FILT_BDS	0x10930017	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)
CFG-NMEA-OUT_FROZENCOD	0x10930026	L	-	-	0 (false)
CFG-NMEA-MAINTALKERID	0x20930031	E1	-	-	0 (AUTO)
CFG-NMEA-GSVTALKERID	0x20930032	E1	-	-	0 (GNSS)
CFG-NMEA-BDSTALKERID	0x30930033	U2	-	-	0

## Odometer and Low-Speed Course Over Ground Filter Configuration (CFG-ODO-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-ODO-USE_ODO	0x10220001	L	-	-	0 (false)
CFG-ODO-USE_COG	0x10220002	L	-	-	0 (false)
CFG-ODO-OUTLPVEL	0x10220003	L	-	-	0 (false)
CFG-ODO-OUTLPCOG	0x10220004	L	-	-	0 (false)
CFG-ODO-PROFILE	0x20220005	E1	-	-	0 (RUN)
CFG-ODO-COGMAXSPEED	0x20220021	U1	-	m/s	10
CFG-ODO-COGMAXPOSACC	0x20220022	U1	-	-	50
CFG-ODO-VELLPGAIN	0x20220031	U1	-	-	153
CFG-ODO-COGLPGAIN	0x20220032	U1	-	-	76

### Navigation and Measurement Rate Configuration (CFG-RATE-\*) 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)

### Remote Inventory (CFG-RINV-\*) 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

### SBAS Configuration (CFG-SBAS-\*) 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-USE_RANGING</a>	0x10360003	L	-	-	1 (true)
<a href="#">CFG-SBAS-USE_DIFFCORR</a>	0x10360004	L	-	-	1 (true)
<a href="#">CFG-SBAS-USE_INTEGRITY</a>	0x10360005	L	-	-	0 (false)
<a href="#">CFG-SBAS-PRNSCANMASK</a>	0x50360006	X8	-	-	0x00000000000007a389 (ALL   PRN120   PRN123   PRN127   PRN128   PRN129   PRN133   PRN135   PRN136   PRN137   PRN138)

### Security configuration (CFG-SEC-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
<a href="#">CFG-SEC-ECCFGSESSIONID0</a>	0x50f60006	U8	-	-	0
<a href="#">CFG-SEC-ECCFGSESSIONID1</a>	0x50f60007	U8	-	-	0
<a href="#">CFG-SEC-ECCFGSESSIONID2</a>	0x50f60008	U8	-	-	0

### Sensor Fusion (SF) Core Config (CFG-SFCORE-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
<a href="#">CFG-SFCORE-USE_SF</a>	0x10080001	L	-	-	1 (true)
<a href="#">CFG-SFCORE-IMU2CRP_LA_X</a>	0x30080002	I2	-	cm	0
<a href="#">CFG-SFCORE-IMU2CRP_LA_Y</a>	0x30080003	I2	-	cm	0

## Sensor Fusion (SF) Core Config (CFG-SFCORE-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-SFCORE-IMU2CRP_LA_Z	0x30080004	I2	-	cm	0
CFG-SFCORE-SEN_TTAG_FACT	0x40080006	U4	1e-6	-	1000
CFG-SFCORE-SEN_TTAG_MAX	0x40080007	U4	-	-	4294967295
CFG-SFCORE-OUTFIL_PACC	0x3008000f	U2	0.01	m/s	10000
CFG-SFCORE-SIGATTENCOMPmode	0x20080010	E1	-	-	0 (DIS)
CFG-SFCORE-HNR_RATE	0x2008001a	U1	-	Hz	0

## Sensor Fusion (SF) Inertial Measurement Unit (IMU) Configuration (CFG-SFIMU-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-SFIMU-GYRO_TC_UPDATE_PERIOD	0x30060007	U2	-	s	1200
CFG-SFIMU-GYRO_RMSTHDL	0x20060008	U1	2 <sup>-8</sup>	deg/s	128
CFG-SFIMU-GYRO_FREQUENCY	0x20060009	U1	-	Hz	0
CFG-SFIMU-GYRO_LATENCY	0x3006000a	U2	-	ms	0
CFG-SFIMU-GYRO_ACCURACY	0x3006000b	U2	1e-3	deg/s	0
CFG-SFIMU-ACCEL_RMSTHDL	0x20060015	U1	2 <sup>-6</sup>	m/s <sup>2</sup>	32
CFG-SFIMU-ACCEL_FREQUENCY	0x20060016	U1	-	Hz	0
CFG-SFIMU-ACCEL_LATENCY	0x30060017	U2	-	ms	0
CFG-SFIMU-ACCEL_ACCURACY	0x30060018	U2	1e-4	m/s <sup>2</sup>	0
CFG-SFIMU-IMU_I2C_SCL_PIO	0x2006001e	U1	-	-	11
CFG-SFIMU-IMU_I2C_SDA_PIO	0x2006001f	U1	-	-	12
CFG-SFIMU-IMU2ANT_LA_X	0x30060020	I2	-	cm	0
CFG-SFIMU-IMU2ANT_LA_Y	0x30060021	I2	-	cm	0
CFG-SFIMU-IMU2ANT_LA_Z	0x30060022	I2	-	cm	0
CFG-SFIMU-AUTO_MNTALG_ENA	0x10060027	L	-	-	0 (false)
CFG-SFIMU-IMU_MNTALG_YAW	0x4006002d	U4	1e-2	deg	0
CFG-SFIMU-IMU_MNTALG_PITCH	0x3006002e	I2	1e-2	deg	0
CFG-SFIMU-IMU_MNTALG_ROLL	0x3006002f	I2	1e-2	deg	0

## Sensor Fusion (SF) Odometer Configuration (CFG-SFODO-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-SFODO-COMBINE_TICKS	0x10070001	L	-	-	0 (false)
CFG-SFODO-USE_SPEED	0x10070003	L	-	-	0 (false)
CFG-SFODO-DIS_AUTOCOUNTMAX	0x10070004	L	-	-	0 (false)
CFG-SFODO-DIS_AUTODIRPINPOL	0x10070005	L	-	-	0 (false)
CFG-SFODO-DIS_AUTOSPEED	0x10070006	L	-	-	0 (false)
CFG-SFODO-FACTOR	0x40070007	U4	1e-6	-	0
CFG-SFODO-QUANT_ERROR	0x40070008	U4	1e-6	m (or m/s)	0
CFG-SFODO-COUNT_MAX	0x40070009	U4	-	-	1
CFG-SFODO-LATENCY	0x3007000a	U2	-	ms	0
CFG-SFODO-FREQUENCY	0x2007000b	U1	-	Hz	10



## Sensor Fusion (SF) Odometer Configuration (CFG-SFODO-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-SFODO-CNT_BOTH_EDGES	0x1007000d	L	-	-	0 (false)
CFG-SFODO-SPEED_BAND	0x3007000e	U2	-	cm/s	0
CFG-SFODO-USE_WT_PIN	0x1007000f	L	-	-	1 (true)
CFG-SFODO-DIR_PINPOL	0x10070010	L	-	-	0 (false)
CFG-SFODO-DIS_AUTOSW	0x10070011	L	-	-	0 (false)
CFG-SFODO-IMU2VRP_LA_X	0x30070012	I2	-	cm	0
CFG-SFODO-IMU2VRP_LA_Y	0x30070013	I2	-	cm	0
CFG-SFODO-IMU2VRP_LA_Z	0x30070014	I2	-	cm	0

## Satellite Systems (GNSS) Signal Configuration (CFG-SIGNAL-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-SIGNAL-GPS_ENA	0x1031001f	L	-	-	1 (true)
CFG-SIGNAL-GPS_L1CA_ENA	0x10310001	L	-	-	1 (true)
CFG-SIGNAL-GPS_L2C_ENA	0x10310003	L	-	-	1 (true)
CFG-SIGNAL-SBAS_ENA	0x10310020	L	-	-	1 (true)
CFG-SIGNAL-SBAS_L1CA_ENA	0x10310005	L	-	-	0 (false)
CFG-SIGNAL-GAL_ENA	0x10310021	L	-	-	1 (true)
CFG-SIGNAL-GAL_E1_ENA	0x10310007	L	-	-	1 (true)
CFG-SIGNAL-GAL_E5B_ENA	0x1031000a	L	-	-	1 (true)
CFG-SIGNAL-BDS_ENA	0x10310022	L	-	-	1 (true)
CFG-SIGNAL-BDS_B1_ENA	0x1031000d	L	-	-	1 (true)
CFG-SIGNAL-BDS_B2_ENA	0x1031000e	L	-	-	0 (false)
CFG-SIGNAL-QZSS_ENA	0x10310024	L	-	-	1 (true)
CFG-SIGNAL-QZSS_L1CA_ENA	0x10310012	L	-	-	1 (true)
CFG-SIGNAL-QZSS_L1S_ENA	0x10310014	L	-	-	0 (false)
CFG-SIGNAL-QZSS_L2C_ENA	0x10310015	L	-	-	1 (true)
CFG-SIGNAL-GLO_ENA	0x10310025	L	-	-	1 (true)
CFG-SIGNAL-GLO_L1_ENA	0x10310018	L	-	-	1 (true)
CFG-SIGNAL-GLO_L2_ENA	0x1031001a	L	-	-	1 (true)

## Configuration of the SPI Interface (CFG-SPI-\*) 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)

## Input Protocol Configuration of the SPI Interface (CFG-SPIINPROT-\*) 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)



## Input Protocol Configuration of the SPI Interface (CFG-SPIINPROT-\*) Configuration Defaults continued

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-SPIINPROT-RTCM3X	0x10790004	L	-	-	1 (true)

## Output Protocol Configuration of the SPI Interface (CFG-SPIOUTPROT-\*) 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)

## Timepulse Configuration (CFG-TP-\*) 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	0. 0000 0000 1	s	50
CFG-TP-PERIOD_TP1	0x40050002	U4	0. 0000 01	s	1000000
CFG-TP-PERIOD_LOCK_TP1	0x40050003	U4	0. 0000 01	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	0. 0000 01	s	0
CFG-TP-LEN_LOCK_TP1	0x40050005	U4	0. 0000 01	s	100000
CFG-TP-DUTY_TP1	0x5005002a	R8	-	%	0
CFG-TP-DUTY_LOCK_TP1	0x5005002b	R8	-	%	10
CFG-TP-USER_DELAY_TP1	0x40050006	I4	0. 0000 0000 1	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	-	-	0 (UTC)

### Tx-Ready Configuration (CFG-TXREADY-\*) 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)

### Configuration of the UART1 Interface (CFG-UART1-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-UART1-BAUDRATE	0x40520001	U4	-	-	38400
CFG-UART1-STOPBITS	0x20520002	E1	-	-	1 (ONE)
CFG-UART1-DATABITS	0x20520003	E1	-	-	0 (EIGHT)
CFG-UART1-PARITY	0x20520004	E1	-	-	0 (NONE)
CFG-UART1-ENABLED	0x10520005	L	-	-	1 (true)
CFG-UART1-REMAP	0x10520006	L	-	-	0 (false)

### Input Protocol Configuration of the UART1 Interface (CFG-UART1INPROT-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-UART1INPROT-UBX	0x10730001	L	-	-	1 (true)
CFG-UART1INPROT-NMEA	0x10730002	L	-	-	1 (true)
CFG-UART1INPROT-RTCM3X	0x10730004	L	-	-	1 (true)

### Output Protocol Configuration of the UART1 Interface (CFG-UART1OUTPROT-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-UART1OUTPROT-UBX	0x10740001	L	-	-	1 (true)
CFG-UART1OUTPROT-NMEA	0x10740002	L	-	-	1 (true)

### Configuration of the UART2 Interface (CFG-UART2-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-UART2-BAUDRATE	0x40530001	U4	-	-	38400
CFG-UART2-STOPBITS	0x20530002	E1	-	-	1 (ONE)
CFG-UART2-DATABITS	0x20530003	E1	-	-	0 (EIGHT)
CFG-UART2-PARITY	0x20530004	E1	-	-	0 (NONE)
CFG-UART2-ENABLED	0x10530005	L	-	-	1 (true)
CFG-UART2-REMAP	0x10530006	L	-	-	0 (false)

### Input Protocol Configuration of the UART2 Interface (CFG-UART2INPROT-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-UART2INPROT-UBX	0x10750001	L	-	-	0 (false)
CFG-UART2INPROT-NMEA	0x10750002	L	-	-	0 (false)
CFG-UART2INPROT-RTCM3X	0x10750004	L	-	-	1 (true)

### Output Protocol Configuration of the UART2 Interface (CFG-UART2OUTPROT-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-UART2OUTPROT-UBX	0x10760001	L	-	-	0 (false)
CFG-UART2OUTPROT-NMEA	0x10760002	L	-	-	0 (false)

### Configuration of the USB Interface (CFG-USB-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-USB-ENABLED	0x10650001	L	-	-	1 (true)
CFG-USB-SELFPOW	0x10650002	L	-	-	1 (true)
CFG-USB-VENDOR_ID	0x3065000a	U2	-	-	5446
CFG-USB-PRODUCT_ID	0x3065000b	U2	-	-	425
CFG-USB-POWER	0x3065000c	U2	-	mA	0
CFG-USB-VENDOR_STR0	0x5065000d	X8	-	-	0x4120786f6c622d75 ("u-blox A")
CFG-USB-VENDOR_STR1	0x5065000e	X8	-	-	0x2e777777202d2047 ("G - www.")
CFG-USB-VENDOR_STR2	0x5065000f	X8	-	-	0x632e786f6c622d75 ("u-blox.c")
CFG-USB-VENDOR_STR3	0x50650010	X8	-	-	0x00000000000006d6f ("om\0\0\0\0\0")
CFG-USB-PRODUCT_STR0	0x50650011	X8	-	-	0x4720786f6c622d75 ("u-blox G")
CFG-USB-PRODUCT_STR1	0x50650012	X8	-	-	0x656365722053534e ("NSS rece")
CFG-USB-PRODUCT_STR2	0x50650013	X8	-	-	0x0000000072657669 ("iver\0\0\0\0")
CFG-USB-PRODUCT_STR3	0x50650014	X8	-	-	0x0000000000000000
CFG-USB-SERIAL_NO_STR0	0x50650015	X8	-	-	0x0000000000000000
CFG-USB-SERIAL_NO_STR1	0x50650016	X8	-	-	0x0000000000000000
CFG-USB-SERIAL_NO_STR2	0x50650017	X8	-	-	0x0000000000000000
CFG-USB-SERIAL_NO_STR3	0x50650018	X8	-	-	0x0000000000000000

### Input Protocol Configuration of the USB Interface (CFG-USBINPROT-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-USBINPROT-UBX	0x10770001	L	-	-	1 (true)
CFG-USBINPROT-NMEA	0x10770002	L	-	-	1 (true)
CFG-USBINPROT-RTCM3X	0x10770004	L	-	-	1 (true)

### Output Protocol Configuration of the USB Interface (CFG-USBOUTPROT-\*) Configuration Defaults

Configuration Item	Key ID	Type	Scale	Unit	Default Value
CFG-USBOUTPROT-UBX	0x10780001	L	-	-	1 (true)
CFG-USBOUTPROT-NMEA	0x10780002	L	-	-	1 (true)

## Related Documents

### Overview

As part of our commitment to customer support, u-blox maintains an extensive volume of technical documentation for our products. In addition to product-specific data sheets and integration manuals, general documents are also available. These include:

- GPS Compendium, Docu. No [GPS-X-02007](#)
- GPS Antennas - RF Design Considerations for u-blox GPS Receivers, Docu. No [GPS-X-08014](#)

Our website [www.u-blox.com](http://www.u-blox.com) is a valuable resource for general and product specific documentation.

### Related Documents for ZED-F9K

- u-blox ZED-F9K, Data Sheet, Docu. No UBX-17061422
- u-blox ZED-F9K, Integration Manual, Docu. No UBX-18047567

## Revision History

Revision	Date	Name	Status / Comments
R01	19-Feb-2019	pmcm	initial version

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