

## 1 Message Types

Messages can be divided into two categories. The first are standardized SBP messages which are the messages described in this document. The second category is for messages which are specific to a particular hardware platform and are implementation defined. These messages are defined to have message types in the range 0x0000 – 0x00FF.

Message	Name	Size	Description
0xFF00	STARTUP	4	System start-up message
0xFFFF	HEARTBEAT	4	System heartbeat message
0x0100	GPS_TIME	11	GPS Time
0x0206	DOPS	14	Dilution of Precision
0x0200	POS_ECEF	32	Position in ECEF
0x0201	POS_LLH	34	Geodetic Position
0x0202	BASELINE_ECEF	20	Baseline in ECEF
0x0203	BASELINE_NED	22	Baseline in NED
0x0204	VEL_ECEF	20	Velocity in ECEF
0x0205	VEL_NED	22	Velocity in NED

Table 1.0.1: Summary of message types

## 1.1 STARTUP (0xFF00)

The system start-up message is sent once on system start-up. It is intended to be used to notify the host or other attached devices that the system has started and is now ready to respond to commands or configuration requests.

Offset	Size	Format	Units	Name	Description
0	4	u32		reserved	Reserved
	4				

Table 1.1.1: STARTUP 0xFF00 message structure

## 1.2 HEARTBEAT (0xFFFF)

The heartbeat message is sent periodically to inform the host or other attached devices that the system is running. It is intended to be used to monitor for system malfunctions and also contains status flags that indicate to the host the status of the system and if it is operating correctly.

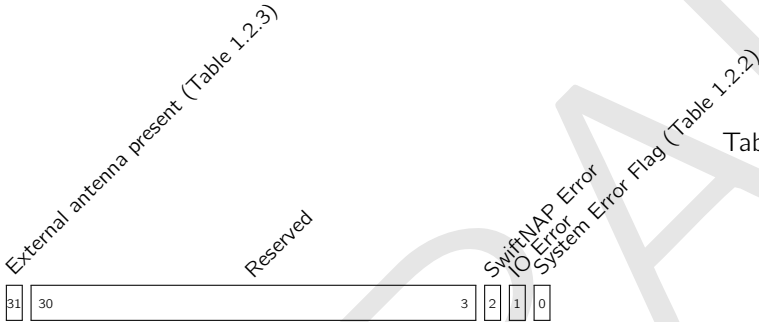
The system error flag is used to indicate that an error has occurred in the system. To determine the source of the error the remaining error flags should be inspected.

Offset	Size	Format	Units	Name	Description
0	4	u32		flags	Status flags, <i>See Field 1.2.1</i>
	4				

Table 1.2.1: HEARTBEAT 0xFFFF message structure

Value	Description
0	System Healthy
1	An error has occurred

Table 1.2.2: System Error Flag values (flags[0])



Field 1.2.1: Status flags (flags)

Value	Description
0	No external antenna detected
1	External antenna is present

Table 1.2.3: External antenna present values (flags[31])

### 1.3 GPS\_TIME (0x0100)

GPS Time.

Offset	Size	Format	Units	Name	Description
0	2	u16	weeks	wn	GPS week number
2	4	u32	ms	tow	GPS Time of Week rounded to the nearest ms
6	4	s32	ns	ns	Nanosecond remainder of rounded tow
10	1	u8		flags	Status flags (reserved)
11					

Table 1.3.1: GPS\_TIME 0x0100 message structure

## 1.4 DOPS (0x0206)

Dilution of Precision.

Offset	Size	Format	Units	Name	Description
0	4	u32	ms	tow	GPS Time of Week
4	2	u16	0.01	gdop	Geometric Dilution of Precision
6	2	u16	0.01	pdop	Position Dilution of Precision
8	2	u16	0.01	tdop	Time Dilution of Precision
10	2	u16	0.01	hdop	Horizontal Dilution of Precision
12	2	u16	0.01	vdop	Vertical Dilution of Precision
14					

Table 1.4.1: DOPS 0x0206 message structure

## 1.5 POS\_ECEF (0x0200)

Position solution in absolute Earth Centered Earth Fixed (ECEF) coordinates.

Offset	Size	Format	Units	Name	Description
0	4	u32	ms	<code>tow</code>	GPS Time of Week
4	8	double	m	<code>x</code>	ECEF X coordinate
12	8	double	m	<code>y</code>	ECEF Y coordinate
20	8	double	m	<code>z</code>	ECEF Z coordinate
28	2	u16	mm	<code>accuracy</code>	Position accuracy estimate
30	1	u8		<code>n_sats</code>	Number of satellites used in solution
31	1	u8		<code>flags</code>	Status flags, <i>See Field 1.5.1</i>
32					

Table 1.5.1: POS\_ECEF 0x0200 message structure



Field 1.5.1: Status flags (`flags`)

Value	Description
0	Single Point Positioning (SPP)
1	RTK

Table 1.5.2: Fix mode values (`flags[0:2]`)

## 1.6 POS\_LLH (0x0201)

Geodetic position solution.

Offset	Size	Format	Units	Name	Description
0	4	u32	ms	tow	GPS Time of Week
4	8	double	deg	lat	Latitude
12	8	double	deg	lon	Longitude
20	8	double	m	height	Height
28	2	u16	mm	h_accuracy	Horizontal position accuracy estimate
30	2	u16	mm	v_accuracy	Vertical position accuracy estimate
32	1	u8		n_sats	Number of satellites used in solution
33	1	u8		flags	Status flags, <i>See Field 1.6.1</i>
34					

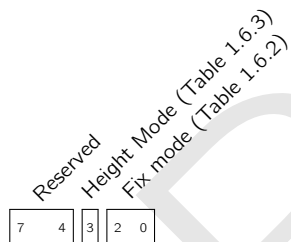
Table 1.6.1: POS\_LLH 0x0201 message structure

Value	Description
0	Single Point Positioning (SPP)
1	RTK

Table 1.6.2: Fix mode values (flags[0:2])

Value	Description
0	Height above Ellipsoid
1	Height above mean sea level

Table 1.6.3: Height Mode values (flags[3])



Field 1.6.1: Status flags (flags)

## 1.7 BASELINE\_ECEF (0x0202)

Baseline in Earth Centered Earth Fixed (ECEF) coordinates.

Offset	Size	Format	Units	Name	Description
0	4	u32	ms	tow	GPS Time of Week
4	4	s32	mm	x	Baseline ECEF X coordinate
8	4	s32	mm	y	Baseline ECEF Y coordinate
12	4	s32	mm	z	Baseline ECEF Z coordinate
16	2	u16	mm	accuracy	Position accuracy estimate
18	1	u8		n_sats	Number of satellites used in solution
19	1	u8		flags	Status flags, <i>See Field 1.7.1</i>
20					

Table 1.7.1: BASELINE\_ECEF 0x0202 message structure



Field 1.7.1: Status flags (flags)

Value	Description
0	Float
1	Fixed RTK

Table 1.7.2: Fix mode values (flags[0:2])

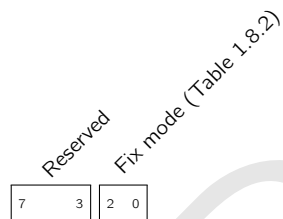


## 1.8 BASELINE\_NED (0x0203)

Baseline in local North East Down (NED) coordinates.

Offset	Size	Format	Units	Name	Description
0	4	u32	ms	tow	GPS Time of Week
4	4	s32	mm	n	Baseline North coordinate
8	4	s32	mm	e	Baseline East coordinate
12	4	s32	mm	d	Baseline Down coordinate
16	2	u16	mm	h_accuracy	Horizontal position accuracy estimate
18	2	u16	mm	v_accuracy	Vertical position accuracy estimate
20	1	u8		n_sats	Number of satellites used in solution
21	1	u8		flags	Status flags, <i>See Field 1.8.1</i>
22					

Table 1.8.1: BASELINE\_NED 0x0203 message structure



Field 1.8.1: Status flags (flags)

Value	Description
0	Float
1	Fixed RTK

Table 1.8.2: Fix mode values (flags[0:2])

## 1.9 VEL\_ECEF (0x0204)

Velocity in Earth Centered Earth Fixed (ECEF) coordinates.

Offset	Size	Format	Units	Name	Description
0	4	u32	ms	tow	GPS Time of Week
4	4	s32	mm/s	x	Velocity ECEF X coordinate
8	4	s32	mm/s	y	Velocity ECEF Y coordinate
12	4	s32	mm/s	z	Velocity ECEF Z coordinate
16	2	u16	mm/s	accuracy	Velocity accuracy estimate
18	1	u8		n_sats	Number of satellites used in solution
19	1	u8		flags	Status flags (reserved)
20					

Table 1.9.1: VEL\_ECEF 0x0204 message structure

## 1.10 VEL\_NED (0x0205)

Velocity in local North East Down (NED) coordinates.

Offset	Size	Format	Units	Name	Description
0	4	u32	ms	<code>tow</code>	GPS Time of Week
4	4	s32	mm/s	<code>n</code>	Velocity North coordinate
8	4	s32	mm/s	<code>e</code>	Velocity East coordinate
12	4	s32	mm/s	<code>d</code>	Velocity Down coordinate
16	2	u16	mm/s	<code>h_accuracy</code>	Horizontal velocity accuracy estimate
18	2	u16	mm/s	<code>v_accuracy</code>	Vertical velocity accuracy estimate
20	1	u8		<code>n_sats</code>	Number of satellites used in solution
21	1	u8		<code>flags</code>	Status flags (reserved)
22					

Table 1.10.1: VEL\_NED 0x0205 message structure