SwiftNav Binary Protocol

Protocol Specification v1.0

1 Message Structure

The Swift Binary Protocol is a fast, simple and minimal binary protocol for sending payloads to, from and between Swift-Nav devices. It is primarily used to send the binary representation of C structs with minimal overhead across serial links.

As of Version 1.0, the message consists of a 6 byte binary header section, a variable-sized payload field, and a 2 byte binary CRC value. SBP uses the CCITT CRC16 (XMODEM implementation) for error detection. It has no error correction and makes no delivery guarantees.

Name	Size	Description
`Preamble`	1	Denotes the start of frame transmission. Always 0x55.
`Message Type`	2	Identifies the payload contents.
`Sender`	2	A unique identifier of the sending hardware. Set to the 2 least significant bytes of the Piksi serial number.
`Length`	1	Length in bytes of the `Payload` field.
`Payload`	N	Binary data of the message.
`CRC`	2	Cyclic Redundancy Check of the packet's binary data from the Message Type up to the end of Payload (does not include the Preamble).
	$N+8$	

Table 1.0.1: Swift Binary Protocol message structure

2 Message Types

Messages are grouped into logical collections of packages.

Package	Message	Name	Size	Description
Acquisition	0x0015	MSG_ACQ_RESULT	13	Satellite acquisition result.
Bootload	0x00B0	MSG_BOOTLOADER_HANDSHAKE	1	Bootloading handshake (Host ¡=¿ Piksi).
	0x00B1	MSG_BOOTLOADER_JUMP_TO_APP	1	Bootloader jump to application (Host =¿ Piksi)
	0x00DD	MSG_NAP_DEVICE_DNA	8	Send FPGA device DNA over UART (Host ¡=¿ Piksi).
Flash	0x00E0	MSG_FLASH_DONE	1	Flash response message (Piksi =¿ Host).
	0x00E1	MSG_FLASH_READ	5	Read STM or M25 flash address (Host ¡=¿ Piksi).
	0x00E2	MSG_FLASH_ERASE	2	Erase sector of Piksi flash memory (Host =¿ Piksi).
	0x00E3	MSG_STM_FLASH_LOCK_SECTOR	1	Lock sector of STM flash memory (Host =¿ Piksi).
	0x00E4	MSG_STM_FLASH_UNLOCK_SECTOR	1	Unlock sector of STM flash memory (Host =¿ Piksi)
	0x00F3	MSG_M25_FLASH_WRITE_STATUS	1	Write M25 flash status register (Host =¿ Piksi).
Navigation	0x0100	MSG_GPS_TIME	11	GPS Time
	0x0206	MSG_DOPS	14	Dilution of Precision
	0x0200	MSG_POS_ECEF	32	Single-point position in ECEF
	0x0201	MSG_POS_LLH	34	Geodetic Position
	0x0202	MSG_BASELINE_ECEF	20	Baseline Position in ECEF
	0x0203	MSG_BASELINE_NED	22	Baseline in NED
	0x0204	MSG_VEL_ECEF	20	Velocity in ECEF
	0x0205	MSG_VEL_NED	22	Velocity in NED
Observation	0x0045	MSG_OBS	$13N + 20$	GPS satellite observations.
	0x0044	MSG_BASE_POS	24	Base station position.
Piksi	0x00B2	MSG_RESET	0	Reset the device (Host =¿ Piksi).
	0x0023	MSG_INIT_BASE	0	Initialize IAR from known baseline (Host =¿ Piksi).
	0x0018	MSG_UART_STATE	58	State of the UART channels.
Settings	0x00A1	MSG_SETTINGS_SAVE	0	Save settings to flash (Host =¿ Piksi)
System	0xFF00	MSG_STARTUP	4	System start-up message
	0xFFFF	MSG_HEARTBEAT	4	System heartbeat message
Tracking	0x0016	MSG_TRACKING_STATE	$6N + 6$	Satellite tracking channel states.
	0x001A	MSG_EPHEMERIS	175	WGS84 satellite orbit ephemeris parameters

Table 2.0.2: Summary of message types

3 MSG_ACQ_RESULT 0x0015

This message describes the results from an attempted GPS signal acquisition search for a satellite PRN over a code phase/carrier frequency range. It contains the parameters of the point in the acquisition search space with the best signal-to-noise (SNR) ratio.

Offset	Size	Format	Units	Name	Description
0	4	float		`snr`	SNR of best point.
4	4	float	chips	`cp`	Code phase of best point.
8	4	float	hz	`cf`	Carrier frequency of best point.
12	1	u8		`prn`	PRN identifier of the satellite signal for which acquisition was attempted.
	13				

Table 3.0.3: MSG_ACQ_RESULT 0x0015 message structure

4 MSG_BOOTLOADER_HANDSHAKE 0x00B0

The bootloader continually sends a handshake message to the host for a short period of time, and then jumps to the firmware if it doesn't receive a handshake from the host. If the host replies with a handshake the bootloader doesn't jump to the firmware and nwaits for flash programming messages, and the host has to send a MSG_BOOTLOADER_JUMP_TO_APP when it's done programming. On old versions of the bootloader (¡=v0.1), hardcoded u8=0. On new versions, return the git describe string for the bootloader build.

Offset	Size	Format	Units	Name	Description
0	1	u8		`handshake`	Handshake value
	1				

Table 4.0.4: MSG_BOOTLOADER_HANDSHAKE 0x00B0 message structure

5 MSG_BOOTLOADER_JUMP_TO_APP 0x00B1

The host initiates the bootloader to jump to the application.

Offset	Size	Format	Units	Name	Description
0	1	u8		`jump`	Ignored by the Piksi.
	1				

Table 5.0.5: MSG_BOOTLOADER_JUMP_TO_APP 0x00B1 message structure

6 MSG_NAP_DEVICE_DNA 0x00DD

The device DNA message from the host reads the unique device DNA from the Swift Navigation Acceleration Peripheral (SwiftNAP), a Spartan 6 FPGA. By convention, the host message buffer is empty; the Piksi returns the device DNA in a MSG_NAP_DEVICE_DNA message.

Offset	Size	Format	Units	Name	Description
0	8	u8[8]		`dna`	57-bit SwiftNAP FPGA Device DNA
	8				

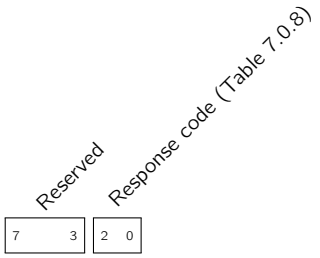
Table 6.0.6: MSG_NAP_DEVICE_DNA 0x00DD message structure

7 MSG_FLASH_DONE 0x00E0

This message defines success or failure codes for a variety of flash memory requests from the host to the Piksi. Flash read and write messages, such as MSG_FLASH_READ or MSG_FLASH_WRITE, may return this message on failure.

Offset	Size	Format	Units	Name	Description
0	1	u8		`response`	Response flags
	1				

Table 7.0.7: MSG_FLASH_DONE 0x00E0 message structure



Field 7.0.1: Response flags (`response`)

Value	Description
0	FLASH_OK

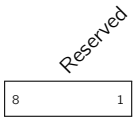
Table 7.0.8: Response code values (`response[0:2]`)

8 MSG_FLASH_READ 0x00E1

The flash read message reads a set of addresses of either the STM or M25 onboard flash. The Piksi replies with a MSG_FLASH_READ message containing either the read data on success or a MSG_FLASH_DONE message containing the return code FLASH_INVALID_LEN (2) if the maximum read size is exceeded or FLASH_INVALID_ADDR (3) if the address is outside of the allowed range.

Offset	Size	Format	Units	Name	Description
0	1	u8		`target`	Target flags
1	3	u8[3]	bytes	`addr_start`	Starting address offset to read from
4	1	u8	bytes	`addr_len`	Length of set of addresses to read, counting up from starting address.
	5				

Table 8.0.9: MSG_FLASH_READ 0x00E1 message structure



Field 8.0.2: Target flags (`target`)

9 MSG_FLASH_ERASE 0x00E2

The flash erase message from the host erases a sector of either the STM or M25 onboard flash memory. The Piksi will reply with a MSG_FLASH_DONE message containing the return code - FLASH_OK (0) on success or FLASH_INVALID_FLASH (1) if the flash specified is invalid.

Offset	Size	Format	Units	Name	Description
0	1	u8		`target`	Target flags
1	1	u8		`sector_num`	Flash sector number to erase (0-11 for the STM, 0-15 for the M25).
	2				

Table 9.0.10: MSG_FLASH_ERASE 0x00E2 message structure

Field 9.0.3: Target flags (`target`)

10 MSG_STM_FLASH_LOCK_SECTOR 0x00E3

The flash lock message locks a sector of the STM flash memory. The Piksi replies with a MSG_FLASH_DONE message.

Offset	Size	Format	Units	Name	Description
0	1	u8[1]		`sector`	Flash sector number to lock.
	1				

Table 10.0.11: MSG_STM_FLASH_LOCK_SECTOR 0x00E3 message structure

11 MSG_STM_FLASH_UNLOCK_SECTOR 0x00E4

The flash unlock message unlocks a sector of the STM flash memory. The Piksi replies with a MSG_FLASH_DONE message.

Offset	Size	Format	Units	Name	Description
0	1	u8[1]		`sector`	Flash sector number to unlock.
	1				

Table 11.0.12: MSG_STM_FLASH_UNLOCK_SECTOR 0x00E4 message structure

12 MSG_M25_FLASH_WRITE_STATUS 0x00F3

The flash status message writes to the 8-bit M25 flash status register. The Piksi replies with a MSG_FLASH_DONE message.

Offset	Size	Format	Units	Name	Description
0	1	u8[1]		`status`	Byte to write to the M25 flash status register.
	1				

Table 12.0.13: MSG_M25_FLASH_WRITE_STATUS 0x00F3 message structure

13 MSG_GPS_TIME 0x0100

This message reports the 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 13.0.14: MSG_GPS_TIME 0x0100 message structure

14 MSG_DOPS 0x0206

This dilution of precision (DOP) message describes the effect of navigation satellite geometry on positional measurement 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 14.0.15: MSG_DOPS 0x0206 message structure

15 MSG_POS_ECEF 0x0200

The single-point position solution message reports absolute Earth Centered Earth Fixed (ECEF) coordinates and the status (single point absolute vs RTK) of the position solution. If the rover receiver knows surveyed position of the base station and has an RTK solution, this reports a pseudo-absolute position solution using the base station position and the rover's RTK baseline vector.

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

Table 15.0.16: MSG_POS_ECEF 0x0200 message structure

Field 15.0.4: Status flags (`flags`)

Value	Description
0	Single Point Positioning (SPP)

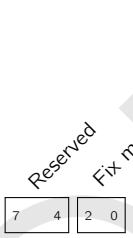
Table 15.0.17: Fix mode values (`flags[0:2]`)

16 MSG_POS_LLH 0x0201

This single-point position solution message reports the absolute geodetic coordinates and the status (single point absolute vs RTK) of the position solution. If the rover receiver knows the surveyed position of the base station and has an RTK solution, this reports a pseudo-absolute position solution using the base station position and the rover's RTK baseline vector.

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
	34				

Table 16.0.18: MSG_POS_LLH 0x0201 message structure



Field 16.0.5: Status flags (`flags`)

Value	Description
0	Single Point Positioning (SPP)

Table 16.0.19: Fix mode values (`flags[0:2]`)

17 MSG_BASELINE_ECEF 0x0202

This message reports the baseline position solution 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
	20				

Table 17.0.20: MSG_BASELINE_ECEF 0x0202 message structure

Field 17.0.6: Status flags (`flags`)

Value	Description
0	Float RTK

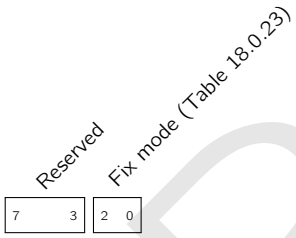
Table 17.0.21: Fix mode values (`flags[0:2]`)

18 MSG_BASELINE_NED 0x0203

This message reports the baseline position solution in 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
	22				

Table 18.0.22: MSG_BASELINE_NED 0x0203 message structure



Field 18.0.7: Status flags (`flags`)

Value	Description
0	Float RTK

Table 18.0.23: Fix mode values (`flags[0:2]`)

19 MSG_VEL_ECEF 0x0204

This message reports the 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 19.0.24: MSG_VEL_ECEF 0x0204 message structure

20 MSG_VEL_NED 0x0205

This message reports the velocity 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/s	`n`	Velocity North coordinate
8	4	s32	mm/s	`e`	Velocity East coordinate
12	4	s32	mm/s	`d`	Velocity Down coordinate
16	2	u16	mm/s	`h_accuracy`	Horizontal velocity accuracy estimate
18	2	u16	mm/s	`v_accuracy`	Vertical velocity accuracy estimate
20	1	u8		`n_sats`	Number of satellites used in solution
21	1	u8		`flags`	Status flags (reserved)
	22				

Table 20.0.25: MSG_VEL_NED 0x0205 message structure

21 MSG_OBS 0x0045

The GPS observations message reports all the pseudo range and carrier phase observations for the satellites being tracked by the Piksi.

Offset	Size	Format	Units	Name	Description
0	4	u32	ms	`header.t.tow`	Milliseconds since start of GPS week
4	2	u16	week	`header.t.wn`	GPS week number
6	1	u8		`header.n_obs`	Total number of observations. First nibble is the size of the sequence (n), second nibble is the zero-indexed counter (ith packet of n)
$13N + 7$	4	u32	cm	`obs[*N*].P`	Pseudorange observation.
$13N + 11$	4	s32	cycles	`obs[*N*].L.i`	Carrier phase whole cycles.
$13N + 15$	1	u8	cycles / 255	`obs[*N*].L.f`	Carrier phase fractional part.
$13N + 16$	1	u8	dB Hz	`obs[*N*].cn0`	Carrier-to-Noise density
$13N + 17$	2	u16		`obs[*N*].lock`	Lock indicator. This value changes whenever a satellite signal has lost and regained lock, indicating that the carrier phase ambiguity may have changed. There is no significance to the value of the lock indicator.
$13N + 19$	1	u8		`obs[*N*].prn`	PRN identifier of the satellite signal
	$13N + 20$				

Table 21.0.26: MSG_OBS 0x0045 message structure

22 MSG_BASE_POS 0x0044

This may be the position as reported by the base station itself or the position obtained from doing a single point solution using the base station observations.

Offset	Size	Format	Units	Name	Description
0	8	double	deg	`lat`	Latitude
8	8	double	deg	`lon`	Longitude
16	8	double	m	`height`	Height
	24				

Table 22.0.27: MSG_BASE_POS 0x0044 message structure

23 MSG_RESET 0x00B2

This message from the host resets the Piksi back into the bootloader. It ensures that all outstanding memory accesses including buffered writes are completed before reset begins.

Offset	Size	Format	Units	Name	Description
	0				

Table 23.0.28: MSG_RESET 0x00B2 message structure

24 MSG_INIT_BASE 0x0023

This message initializes the Integer Ambiguity Resolution (IAR) process on the Piksi to use an assumed baseline position between the base station and rover receivers. Warns via MsgPrint if there aren't a shared minimum number (4) of satellite observations between the two.

Offset	Size	Format	Units	Name	Description
	0				

Table 24.0.29: MSG_INIT_BASE 0x0023 message structure

25 MSG_UART_STATE 0x0018

The UART message reports data latency and throughput of the UART channels providing SBP I/O. On the default Piksi configuration, UARTs A and B are used for telemetry radios, but can also be be host access ports for embedded hosts, or other interfaces in future.

Offset	Size	Format	Units	Name	Description
0	4	float	kB/s	uart_a.tx_throughput	UART transmit throughput.
4	4	float	kB/s	uart_a.rx_throughput	UART receive throughput.
8	2	u16		uart_a.crc_error_count	UART CRC error count.
10	2	u16		uart_a.io_error_count	UART IO error count.
12	1	u8	Utilization /255	uart_a.tx_buffer_level	UART transmit buffer percentage utilization. Ranges from 0 - 255 and needs to be renormalized to 100.
13	1	u8	Utilization /255	uart_a.rx_buffer_level	UART receive buffer percentage utilization. Ranges from 0 - 255 and needs to be renormalized to 100.
14	4	float	kB/s	uart_b.tx_throughput	UART transmit throughput.
18	4	float	kB/s	uart_b.rx_throughput	UART receive throughput.
22	2	u16		uart_b.crc_error_count	UART CRC error count.
24	2	u16		uart_b.io_error_count	UART IO error count.
26	1	u8	Utilization /255	uart_b.tx_buffer_level	UART transmit buffer percentage utilization. Ranges from 0 - 255 and needs to be renormalized to 100.
27	1	u8	Utilization /255	uart_b.rx_buffer_level	UART receive buffer percentage utilization. Ranges from 0 - 255 and needs to be renormalized to 100.
28	4	float	kB/s	uart_ftdi.tx_throughput	UART transmit throughput.
32	4	float	kB/s	uart_ftdi.rx_throughput	UART receive throughput.
36	2	u16		uart_ftdi.crc_error_count	UART CRC error count.
38	2	u16		uart_ftdi.io_error_count	UART IO error count.
40	1	u8	Utilization /255	uart_ftdi.tx_buffer_level	UART transmit buffer percentage utilization. Ranges from 0 - 255 and needs to be renormalized to 100.
41	1	u8	Utilization /255	uart_ftdi.rx_buffer_level	UART receive buffer percentage utilization. Ranges from 0 - 255 and needs to be renormalized to 100.
42	4	s32	ms	latency.avg	Average latency.
46	4	s32	ms	latency.lmin	Minimum latency.
50	4	s32	ms	latency.lmax	Maximum latency.
54	4	s32	ms	latency.current	Smoothed estimate of the current latency.
	58				

Table 25.0.30: MSG_UART_STATE 0x0018 message structure

26 MSG_SETTINGS_SAVE 0x00A1

The save settings message persists the Piksi's current settings configuration to its onboard flash memory file system.

Offset	Size	Format	Units	Name	Description
	0				

Table 26.0.31: MSG_SETTINGS_SAVE 0x00A1 message structure

27 MSG_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 27.0.32: MSG_STARTUP 0xFF00 message structure

28 MSG_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
	4				

Table 28.0.33: MSG_HEARTBEAT 0xFFFF message structure

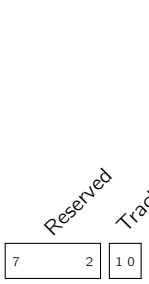
Field 28.0.8: Status flags (`flags`)

29 MSG_TRACKING_STATE 0x0016

The tracking message returns a variable-length array of tracking channel states. It reports status and code/carrier phase signal power measurements for all tracked satellites.

Offset	Size	Format	Units	Name	Description
$6N+0$	1	u8		`states[*N*].state`	Status of tracking channel.
$6N+1$	1	u8		`states[*N*].prn`	PRN being tracked.
$6N+2$	4	float	dB Hz	`states[*N*].cn0`	Carrier-to-noise density
	$6N+6$				

Table 29.0.34: MSG_TRACKING_STATE 0x0016 message structure



Field 29.0.9: Status of tracking channel. (`states[*N*].state`)

Value	Description
0	Disabled

Table 29.0.35: Tracking mode. values (`states[*N*].state[0:1]`)

30 MSG_EPHEMERIS 0x001A

The ephemeris message returns a set of satellite orbit parameters that is used to calculate GPS satellite position, velocity, and clock offset (WGS84). Please see the Navstar GPS Space Segment/Navigation user interfaces (ICD-GPS-200, Table 20-III) for more details (http://www.navcen.uscg.gov/pubs/gps/icd200/icd2

Offset	Size	Format	Units	Name	Description
0	8	double	s	tgd	Group delay differential between L1 and L2 (?)
8	8	double	m	crs	Amplitude of the sine harmonic correction term to the orbit radius
16	8	double	m	crc	Amplitude of the cosine harmonic correction term to the orbit radius
24	8	double	rad	cuc	Amplitude of the cosine harmonic correction term to the argument of latitude
32	8	double	rad	cus	Amplitude of the sine harmonic correction term to the argument of latitude
40	8	double	rad	cic	Amplitude of the cosine harmonic correction term to the angle of inclination
48	8	double	rad	cis	Amplitude of the sine harmonic correction term to the angle of inclination
56	8	double	rad/s	dn	Mean motion difference
64	8	double	radians	m0	Mean anomaly at reference time
72	8	double		ecc	Eccentricity of satellite orbit
80	8	double	m^(1/2)	sqrta	Square root of the semi-major axis of orbit
88	8	double	rad	omega0	Longitude of ascending node of orbit plane at weekly epoch
96	8	double	rad/s	omegadot	Rate of right ascension
104	8	double	rad	w	Argument of perigee
112	8	double	rad	inc	Inclination
120	8	double	rad/s	inc_dot	Inclination first derivative
128	8	double	s	af0	Polynomial clock correction coefficient (clock bias)
136	8	double	s/s	af1	Polynomial clock correction coefficient (clock drift)
144	8	double	s/s^2	af2	Polynomial clock correction coefficient (rate of clock drift)
152	8	double	s	toe_tow	Time of week
160	2	u16	week	toe_wn	Week number
162	8	double	s	toc_tow	Clock reference time of week
170	2	u16	week	toc_wn	Clock reference week number
172	1	u8		valid	Is valid?
173	1	u8		healthy	Satellite is healthy?
174	1	u8		prn	PRN being tracked
	175				

Table 30.0.36: MSG_EPHEMERIS 0x001A message structure