No.: UG017
Level: Public
Version: 2022.11

INTERFACE PROTOCOL

INTRODUCTION

This Interface Protocol is applicable to all series of bynav products. This manual is a general version, please refer to it according to the model and configuration of the actual purchased product.

Date	Version	Revision Description	Reviewed by
20210126	1.0	Revised edition	Ljh, zwb
20210201	1.1	1. Add RTCM messages, 2. Add the ephemeris and observation data, 3. Added Description in logs, 4. Mark setinsaxis as deprecated (not deleted), 5. Delete the LAND_PLUS and marine_plus types in setinsprofile, 6. Mark pashr as *, 7. Mark enuavr as *	Ljh
20210205	1.2	Update the ephemeris, add canconfig, ccomconfig, j1939config messages	Ljh
20210205	1.3	1. Add headingoffset 2. Add the value range (Ecutoff, SNRCUTOFF is updated yet) 3. Modify inscalstatus 4. Unified the naming of ASCII and Binary Format	Ljh
20210208	1.4	Add the value range of ECUTOFF and SNRCUTOFF	Ljh
20210220	1.5	1. Delete SETINSAXIS 2. Mark * in Pashr message, only	Ljh

		supported by GNSS/INS receivers 3. Add Message ID to adapt to binary messages 4. Mak * in Corrimu message, only by GNSS/INS receivers 5. Add heading2a	
20210222	1.6	1. Modify the Description of ENUAVR, and INSCONFIG 2. Add flashdnaa	Ljh, zwb
20210225	1.7	Add frequencyout disable	zwb
20210303	1.8	Modify short header format Add data type	Ljh
20210311	1.9	Modify effective method of some commands	Ljh
20210317	1.10	Modify workfreqs	Zwb
20210318	1.11	Add psrvel, velsmooth, bestutm	Ljh
20210324	1.12	Modify obsercation Binary offset	Ljh

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1 OVERVIEW

Bynav messages are divided into two parts: commands and logs.

The commands are divided into general commands, GNSS commands and GNSS/INS commands.

The logs are classified into NMEA messages, BYNAV messages, RTCM messages, ephemeris and observation data, configuration query messages and other format messages.

For BYNAV messages, the message type is indicated by the character appended to the end of the message name. ‘A’ indicates the message is ASCII and ‘B’ indicates binary. When issuing binary commands, the output message type is dependent on the bit format in the message’s binary header

2 FORMAT

2.1 ASCII Format

ASCII messages are readable by both the user and a computer. The structures of all ASCII messages follow the general conventions as noted here:

1.The lead code identifier for each record is “#, $ or %” .

2.Each log or command is of variable length depending on amount of data and format.

3.All data fields are delimited by a comma ',' with two exceptions:

a)The first exception is the last header field which is followed by a ';' to denote the start of the data message.

b)The second exception is the last data field, which is followed by a * to indicate end of message data.

4.Each log ends with a hexadecimal number preceded by an asterisk and followed by a line termination using the carriage return and line feed characters. For example: *1234ABCD[CR][LF]. This value is a 32-bit CRC of all bytes in the log, excluding the '#' identifier and the asterisk preceding the eight CRC digits.

5.An ASCII string is one field and is surrounded by double quotation marks. For example: "ASCII string". If separators are surrounded by quotation marks then the string is still one field and the separator will be ignored (example, "xxx,xxx" is one field). Double quotation marks within a string are not allowed.

6.If the receiver detects an error parsing an input message, it returns an error response message.

2.1.1 NMEA

The general format of NMEA messages is given below:

$--< message ID >,<Header>,<Header>,.....,<Header>*< checksum><CR><LF>

Please refer to Table 2-1 and Table 2-1 for more information about NMEA format and reserved characters.

Table 2-1 Standard NMEA Format Description

ID	ID Description

$/!	Log header (ASCII HEX24).
--	Constellation: BD - Beidou GP - GPS GN - Compatible
Message ID	To identify message type and function. With 3 capital letters. This protocol defines 3 types of messages: parameter, query and special.
,	Field separator (ASCII HEX 2C).
Data field	Each message can contain multiple data fields separated by the field separator “,” . Generally only printable ASCII characters except reserved characters (Table 1-2) are allowed in data fields. Users should only use the commas to determine the field boundaries and not depend on column positions.
*	Checksum delimiter
Checksum	The NMEA checksum is an XOR of all the bytes (including delimiters such as ',' but excluding the * and $) in the message. The hexadecimal numbers of the first 4 bits and the last 4 bits are respectively expressed in ASCII code (0 ~ 9, A ~ F), with the highest order being the first.
<CR><LF>	Terminator (ASCII character HEX0D0A).

Note: a message can transfer up to 1024 bytes in length and up to 1021 bytes between "$" and < CR><LF > (excluding the checksum delimiter "*" and checksum).

Table 2-1 Reserved Characters

Characters	Hexadecimal	Decimal	Description
<CR>	OD	13	Carriage return-terminator

<LF>	OA	10	Line feed
$	24	36	Parameter message delimiter begins
*	2A	42	Checksum delimiter
,	2C	44	Data field delimiter
\	5C	92	Reserved
^	5E	94	Encoding delimiter expressed in hexadecimal
~	7E	126	Reserved
<del>	7F	127	Reserved

2.1.2 BYNAV ASCII

The bynav ASCII defined the general format of the messages, which includes the below elements:

Structure:

header; data field..., data field..., data field... *xxxxxxxx[CR][LF]

2.1.2.1 Standard ASCII Structure

Example 1:

#BESTPOSA,COM3,0,0.0,FINESTEERING,1975,393343.000,00000000,0000,113;

Description:

ID	Example	Description
0	#BESTPOSA	Header
1	COM3	Port number
2	0	Message sequence, 0 means only one message
3	0.0	CPU IDLE TIME(%)
4	FINESTEERING	Fixed as FINESTEERING
5	1975	GPS Week from 1980.1.6 to now (GPS time)

6	393343.000	Milliseconds from 00:00:00 of this Sunday to now (GPS time)
7	00000000	Fixed as 0
8	0000	Reserved
9	113	Software version

Example2:

#HEADINGA,COM3,0,0,FINESTEERING,1975,394129.000,00000000,0000,113;

Example2 Description:

ID	Example	Description
0	#HEADINGA	Header
1	COM3	Port number
2	0	Message sequence, 0 means only one message
3	0.0	CPU IDLE TIME (%)
4	FINESTEERING	Fixed as FINESTEERING
5	1975	GPS Week from 1980.1.6 to now (GPS time)
6	393343.000	Milliseconds from 00:00:00 of this Sunday to now (GPS time)
7	00000000	Fixed as 0
8	0000	Reserved
9	113	Software version

ASCII Header Structure:

header;data field...,data field...,data field...*xxxxxxxx[CR][LF]

The description of ASCII Header structure is as follow:

Table 2- 3 ASCII Header Structure Description

ID	Field	Type	Description	Optional Input ID
1	Sync	Char	Sync character. The ASCII message is always preceded by '#'	N
2	Message	Char	The ASCII name of the log or command	N
3	Port	Char	The name of the port from which the log was generated.The string is made up of the port name followed by an _x where x is a number from 1 to 31 denoting the virtual address of the port. If no virtual address is indicated, it is assumed to be address 0	Y
4	Sequence#	Long	Used for multiple related logs. It is a number that counts down from N-1 to 0, where 0 means it is the last one of the set. Most logs only come out one at a time in which case this number is 0	N
5	%Idle Time	Float	The minimum percentage of time the processor is idle, calculated once per second	Y
6	Time Status	Enum	The value indicates the quality of the GPS reference time. Unknow or Fine, the former indicates that the receiver has not yet calculated the accurate GPS time.	Y
7	Week	Ulong	GPS reference week number	Y
8	Seconds	GPSec	Seconds from the beginning of the GPS reference week; accurate to the millisecond level	Y
9	Receiver Status	Ulong	An eight digit hexadecimal number representing the status of various hardware and software components of thereceiver	Y
10	Reserved	Ulong	Reserved	Y
11	Receiver s/w Version	Ulong	A value (0 - 65535) representing the receiver software build number	Y
12	;	Char	Terminator	N

2.1.2.2 Abbreviated ASCII Structure

2.1.2.2 Abbreviated ASCII Header structure:

short header;data field...,data field...,data field...*xxxxxxxx[CR][LF]

The description of Abbreviated ASCII Header structure is as follow:

Table 2- 4 Abbreviated ASCII Header Structure Description

ID	Field	Type	Description
1	%	Char	Short ASCII always start with “%”
2	Message	Char	Short ASCII name
3	Week	Ushort	GNSS week
4	Seconds	GPSec	GNSS time to ms
5	;	Char	Terminator

2.2 Binary Format

Binary messages are strictly machine-readable format. They are ideal for applications where the amount of data transmitted is fairly high. Due to the inherent compactness of binary as opposed to ASCII data, messages are much smaller, which allows a larger amount of data to be transmitted and received.

2.2.1 Standard Binary Structure

The structure of standard binary messages follows the general conventions indicated here:

1, Basic format:

Header: 3 Sync bytes plus 25-bytes of header information. The header length is variable

as fields may be appended in the future. Always check the header length.

Data: variable

CRC: 4 bytes

2, The 3 Sync bytes will always be:

Table 2- 5 Binary Format Sync Byte

Byte	Hex	Decimal
First	AA	170
Second	44	68

3, The CRC is a 32-bit CRC (see CRC algorithm) performed on all data including the header.

4, The standard binary message header structure is shown as below:

Table1- 6 Standard Binary Header Structure

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	Sync	Hexadecimal 0xAA	Char	1	0
2	Sync	Hexadecimal 0x44	Char	1	1
3	Protocol type	bit 0-3=reserved, by default 0 bit 4=message format	Char	1	2

		0=reserved 1=binary bit 5-6= reserved, by default 0 bit 7-8= binary 01= reserved 10=standard binary 11=short binary 00=reserved (here should be 0x12)			
4	Header length	Header length	UChar	1	3
5	Message ID	Message ID	Ushort	2	4
6	Message Type	bit 0-4= Measurement source bit 5-6=Format 00=Binary 01=ASCII 10=Abbreviated ASCII, NMEA 11=Reserved bit 7=Response bit 0= Original Message 1= Response Message	Char	1	6
7	Port Address	See below table: Table1- 7	UChar	1	7
8	Message Length	The length in bytes of the body of the	Ushort	2	8

		message, not including the header nor the CRC			
9	Sequence	Used for multiple related logs. It is a number that counts down from N-1 to 0 where N is the number of related logs and 0 means it is the last one of the set. Most logs only come out one at a time in which case this number is 0	Ushort	2	10
10	Idle Time	Time the processor is idle, calculated once per second.	Uchar	1	12
11	Time Status	Unknow or Fine, the former indicates that the receiver has not yet calculated the accurate GPS time.	Enum	1	13
12	Week	GNSS week number	Ushort	2	14
13	ms	Milliseconds from the beginning of the GNSS reference week	GPSec	4	16
14	Receiver Status	An 8-digit hexadecimal number used to represent the status of hardware	Ulong	4	20

		and software.			
15	Reserved	Reserved	Ushort	2	24
16	Receiver S/W Version	A value (0 - 65535) representing the receiver software build number	Ushort	2	26

Table1- 7 Detailed Port Identifier

ID	Port	Hexadecimal	Decimal	Description
	NO_PORTS	0	0	
	COM1	1	1	COM1 port
	COM2	2	2	COM2 port
	COM3	3	3	COM3 port
	THISPORT	4	4	Current port
	FILE	5	5	Port to log file
	ALL_PORTS	6	6	All ports
	ETH1			Ethernet
	IMU			IMU
	ICOM1			ICOM1 port
	ICOM2			ICOM2 port
	ICOM3			ICOM3 port
	ICOM4			ICOM4 port
	NCOM1			NCOM1 port
	NCOM2			NCOM2 port
	NCOM3			NCOM3 port
	CCOM1			CCOM1 port

	CCOM2			CCOM2 port
	CCOM3			CCOM3 port
	MCOM1			MCOM1 port
	MCOM2			MCOM2 port
	MCOM3			MCOM3 port
	MCOM4			MCOM4 port

2.2.2 Short Binary Structure

The structure of short binary messages follows the general conventions indicated here:

1, Basic format:

Header: 3 Sync bytes plus 9-bytes of header information.

Data: variable

CRC: 4 bytes

2, The 3 sync bytes will always be:

Table 2- 8 Binary Format Sync Byte

Byte	**Hex**	**Decimal**
First	AA	170
Second	44	68

3, The CRC is a 32-bit CRC (see 32-bit CRC algorithm) performed on all data including the header.

4, The short binary message header structure is shown as below:

Table1- 9 Short Binary Header Structure

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	Sync	Hexadecimal 0xAA	Char	1	0
2	Sync	Hexadecimal 0x44	Char	1	1
3	Protocol type	bit 0-3=reserved, by default 0 bit 4=message format 0=reserved 1=binary bit 5-6= reserved, by default 0 bit 7-8= binary 01= reserved 10=standard binary 11=short binary 00=reserved (here should be 0x12)	Char	1	2
4	Message length	Message length, not including header or CRC	Uchar	1	3
5	Message ID	Message ID number	Ushort	2	4
6	Week number	GNSS week number	Ushort	2	6
7	Week seconds	Milliseconds from the beginning of the GNSS week	GPSec	4	8

2.3 Field Type

Table 2- 10 Field type

Type	Binary Bytes	Description
Int	4	Integer
Float	4	Single precision float （±3.4E38）
Double	8	Double precision float（±1.7E308）
Long	4	Long integer（-2147483648~+2147483647）
Ulong	4	Unsigned long（+0~+4294967295）
Short	2	Short integer（-32768~+32767）
Char	1	Character
UChar	1	Unsigned character（+0~+255）
Enum	4	Enum
String	n	String
Hex	n	Hexadecimal
HexUlong	4	Hexadecimal unsigned long（+0~+4294967295）
GPSec	4	For binary, output in ms, long integer For ASCII, output in s, float

3 COMMANDS

3.1 General Commands

3.1.1 AUTH

Add authorization, take effect after saveconfig and reboot.

Format:

AUTH Switch [AUTHSTR]

Example:

AUTH ADD E40F99631670CA4F205EB67FE0D2B048

Description:

ID	Example	Format	Description
1	AUTH	AUTH	Header
2	ADD	Switch	ADD, add authorization
			REMOVE, remove authorization
3	E40F99631670CA4F205EB67FE0D2B048	AUTHSTR	authorization string, leave blank when removing auth

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.2 CANCONFIG

Configure CAN ports

Format:

CANCONFIG PORT SWITCH [SPEED]

Example:

CANCONFIG CAN2 ON 500K

Description:

ID	Example	Format		Description
1	CANCONFIG	CANCONFIG		Header
2	CAN2	PORT	CAN1	Currently only support CAN2
			CAN2	
3	ON	SWITCH	ON	Switch on
			OFF	Switch off
4	500K	[SPEED]		Physical CAN port speed (bits per second) (default = 500K)

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.3 CCOMCONFIG

Configure the CAN COM port. Bind a CAN communication port to a J1939 node (see 3.1.10), and specify the CAN protocol, PGN, priority and address for the CCOM port.

Format:

CCOMCONFIG PORT NODE PROTOCOL [PGN [PRIORITY [ADDRESS]]]

Example:

CCOMCONFIG CCOM1 NODE1 CAN10 0 6 18

Description:

ID	Example	Format	Description
1	CCOMCONFIG	CCOMCONFIG	Header
2	CCOM1	[PORT]	Port name, can be CCOM1, CCOM2, CCOM3, CCOM4

3	NODE1	[NODE]	The J1939 node to use. This binds a CCOM port to the CAN NAME/address associated with the node.
4	CAN10	[PROTOCOL]	Protocol name, currently support CAN10 and J1939
5	0	[PGN]	PGN (Any valid PGN as defined by the J1939 protocol. All messages transmitted over this CCOM port will contain this PGN value. Only messages with this PGN will be received on this CCOM port.)
6	6	[PRIORITY]	Priority (Default CAN message priority for transmitted messages. Priority 0 is the highest priority)
5	18	[ADDRESS]	Address

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.4 DMICONFIG

To configure the protocols and ports of DMI lever arms or check current DMI configurations when no parameter is following.

Format:

DMICONFIG DMINum Switch [Protocol] [Port]

Example:

DMICONFIG DMI1 ENABLE EXT_VEL_XXX_FRONT_LEFT CCOM1

DMICONFIG DMI2 ENABLE EXT_VEL_XXX_FRONT_RIGHT CCOM1

DMICONFIG DMI3 ENABLE EXT_VEL_XXX_REAR_LEFT CCOM1

DMICONFIG DMI4 ENABLE EXT_VEL_XXX_REAR_RIGHT CCOM1

Description:

ID	Format	Example	Description
1	DMICONFIG	DMICONFIG	Header

2	DMINum	DMI1	DMI number, DMI1~4 are respectively referred to wheels of the front-left /front-right /rear-left /rear-right
3	Switch	ENABLE	Enable the protocol and port
		DISABLE	Disable the DMI lever arm
4	Protocol	EXT_VEL_XXX_FRONT_LEFT	Protocol name, please confirm XXX in the name with us
5	PORT	CCOM1	Ports, CCOM1~ CCOM4 are available

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.5 DNSCONFIG

Configure Ethernet DNS servers

Format:

DNSCONFIG NumDNSServers IP

Example:

DNSCONFIG 1 192.168.1.5

Description:

ID	Example	Format	Description
1	DNSCONFIG	DNSCONFIG	Header
2	1	NumDNSServers	0: DNS server quantity, no IP address needed when set as 0
			1: 1 DNS server
3	192.168.1.5	IP	Main DNS server address

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.6 DUALANTENNAPOWER

Configure dual-antenna mode, take effect after savconfig and reboot. When the parameter is not set, it is used to query the current configuration.

Format:

DUALANTENNAPOWER [Switch]

Example:

DUALANTENNAPOWER OFF

Description:

ID	Example	Format	Description
1	DUALANTENNAPOWER	DUALANTENNAPOWER	Header
2	OFF	Switch	ON: dual-antenna on
			OFF: dual-antenna off
			Blank: query dual antenna status

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.7 FREQUENCYOUT

Configure pulse signal output

Format:

FREQUENCYOUT Switch [PluseWidth Period Edge Instance]

Example:

FREQUENCYOUT ENABLE 20000000 100000000 POSITIVE 1

FREQUENCYOUT DISABLE 1

Description:

ID	Example	Format	Description
1	FREQUENCYOUT	FREQUENCYOUT	Header
2	ENABLE	Switch	DISABLE: disable pulse signal output, leave the rest field blank
			ENABLE: enable pulse signal output
3	20000000	PluseWidth	Pulse width, in 10 ns, duty cycle = pulse width / period, pulse width cannot be larger than period
4	100000000	Period	Period, unit in 10ns, 1Hz to 20MHz
5	POSITIVE	Edge	POSITIVE: Valid in rising edge output
			NEGATIVE: Valid in falling edge output
6	1	Instance	0: EVENT_OUT (this signal is not drawn for X1)
			1: PPS

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.8 ICOMCONFIG

Configure the Ethernet transport/application layer. (Note: there must be a space between Protocol and Endpoint)

Format:

ICOMCONFIG Port Protocol Endpoint

Example:

ICOMCONFIG ICOM1 TCP :2000

Description:

ID	Example	Format	Description
1	ICOMCONFIG	ICOMCONFIG	Header
2	ICOM1	Port	Port name: ICOM1/2/3/4
3	TCP	Protocol	DISABLED: disable ethernet service
			TCP: use TCP
			UDP: use UDP
4	2000	Endpoint	Host: endpoint, if host is blank, act as a server, if not blank, X1 will act as a client to connect actively to the configured address (There must be a blank space between Protocol and Endpoint)

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.9 INTERFACEMODE

Configure the serial port input and output format.

Format:

INTERFACEMODE x1 U1 U2

Example:

INTERFACEMODE COM1 BYNAV BYNAV

Description:

ID	Example	Format	Description	
1	INTERFACEMODE	INTERFACEMODE	Header	
2	COM1	x1	Serial port number, can be COM1, COM2, COM3	
3	BYNAV	U1	INPUT FORMAT	AUTO: identify automatically (BYNAV+RTCM)
				BYNAV: NMEA0183
				RTCM: RTCM
				LOG: bynav debugging info
				FPGA: FPGA raw data, large
4	BYNAV	U2	OUTPUT FORMAT	AUTO: Can output NMEA0183and RTCM when used as base; same as BYNAV when used as rover
				BYNAV: NMEA0183
				RTCM: RTCM
				LOG: bynav debugging info
				FPGA: FPGA raw data

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.10 IPCONFIG

Configure Ethernet static or dynamic TCP/IP parameters.

Format:

IPCONFIG [InterfaceName] AddressMode [IPAddress [Netmask [Gateway]]]

Example:

IPCONFIG ETHA STATIC 192.168.74.10 255.255.255.0 192.168.74.1

Description:

ID	Example	Format	Description
1	IPCONFIG	IPCONFIG	Header
2	ETHA	InterfaceName	Ethernet name (by default ETHA)
3	STATIC	AddressMode	DHCP: use dynamic IP address
			STATIC: use static IP address
4	192.168.74.10	IPAddress	IP address (be dafault 192.168.8.151)
5	255.255.255.0	Netmask	Netmask (by default 255.255.0.0)
6	192.168.74.1	Gateway	Gateway (by default 192.168.8.1)

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.11 J1939CONFIG

Configure CAN J1939 parameters (name etc.)

Format:

J1939CONFIG NODE PORT [CAN_ADDR]

Example:

J1939CONFIG NODE1 CAN1 AA

Description:

ID	Example	Format		Description
1	J1939CONFIG	J1939CONFIG		Header
2	NODE1	NODE		Node name: The J1939 node to use. This binds a CCOM port to the CAN NAME/address associated with the node.
3	CAN1	PORT	CAN1	Port: currently only support CAN2
			CAN2	

4	0	[CAN_ADDR]	CAN address, by default 0x0

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.12 LOG

Output the requested messages from the receiver.

Format:

LOG [port] message ONNEW

LOG [port] message ONCHANGED

LOG [port] message ONTIME period [offset [hold]]

LOG [port] message ONNEXT

LOG [port] message ONCE

LOG [port] message ONMARK

Example:

LOG COM1 GPGGA ONTIME 1 0.5 hold

ID	Example	Format	Description	
1	LOG	LOG	Header	
2	COM1	[port]	Port name	
3	GPGGA	message	Message ID	
4	ONTIME	TRIGGER	ONNEW	outputs when the message is updated (not

				necessarily changed)
			ONCHANGED	Output when the message is changed
			ONTIME	Output on a time interval
			ONNEXT	Output only the next message
			ONCE	Output only the current message (default).
			ONMARK	Output when a pulse is detected on the mark 1
5	1	period	Log period in seconds (for ONTIME trigger). If the value is lower than the minimum measurement period, it will be rejected.	
6	0.5	[offset]	Smaller than period, only valid when triiger is ONTIME. The output time is period+offset.	
7	hold	[hold]	hold: unlog command cannot stop the output; nohold: unlog command can stop th output	

3.1.13 NTRIPCONFIG

Configure NTRIP parameters.

Format

NTRIPCONFIG [PORT] [TYPE] [PROTOCOL] [ENDPOINT] [MOUNTPONIT] [USER NAME] [PASSWORD] [BINDINTERFACE]

Example:

NTRIPCONFIG NCOM1 CLIENT V1 192.168.1.88:8888 NTRIP BYNAV BYNAV ALL

Description

ID	Example	Format	Description

1	NTRIPCONFIG	NTRIPCONFIG	Header
2	NCOM1	PORT	NTRIP port (NCOM1/NCOM2)
3	CLIENT	DISABLED	NTRIP connection mode (ntrip server is not tested yet, not for customer use)
		SERVER	
		CLIENT	
4	V1	PROTOCOL	NTRIP protocol type (V1/V2), by default V1
5	192.168.1.88:8888	ENDPOINT	NTRIP IP and endpoint
6	NTRIP	MOUNTPOINT	NTRIP Mount point
7	BYNAV	USER NAME	Username
8	BYNAV	PASSWORD	Password
9	ALL	BINDINTERFACE	Bingding the port, fixed as ALL

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.14 OUTPUTSOURCE

Set the output source of the solution results, take effect after saveconfig and reboot.

When the parameter is not set, it is used to query the current configuration.

The following messages affected by OUTPUTSOURCE:

BESTGNSSPOS, BESTPOS, BESTXYZ, HEADING, GGA, GSV, RMC, ZDA, DOP, ORI, AVR, VTG, FPD, HPD, NTR, TRA, ATR, HDT, GST, PSATHPR, PTNLAVR, PTNLPJK, KSXT

Format:

OUTPUTSOURCE [RAW/KF/INS/ARTK]

Example:

OUTPUTSOURCE RAW

Description:

ID	Example	Format	Description
1	OUTPUTSOURCE	OUTPUTSOURCE	Header
2	RAW	[RAW/KF/INS/ARTK]	RAW: raw RTK solution results
			KF: RTK solution results after Kalman Filter
			INS: INS solution results* (only GNSS/INS products
			ARTK: solution results in surveying mode

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.15 QUALITYCHECK

Quality check engine. It is to enable another positioning engine to verify the current RTK results, when under blockage and RTK initialization, it helps to avoid wrong fix or too early fixed solution, but at the same time it will lead to additional computational burden, so the heading QC is not recommended to be enabled for GNSS/INS products. The command takes effect after savconfig and reboot. When the parameter is not set, it is used to query the current configuration.

Format:

QUALITYCHECK [POS/ORI] [Switch]

Example:

QUALITYCHECK POS ON

Description:

ID	Example	Format	Description
1	QUALITYCHECK	QUALITYCHECK	Header
2	POS	POS/ORI	POS: positioning QC
			ORI: heading QC
3	ON	Switch	ON: enable
			OFF: disable

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.16 REBOOT

Reboot the program.

Format:

REBOOT

Example:

REBOOT

Description:

ID	Example	Format	Description
1	REBOOT	REBOOT	Reboot

3.1.17 RESET

Reset command to reload the last saved configuration.

Format:

RESET

Example:

RESET

Description:

ID	Example	Format	Description
1	RESET	RESET	Header

3.1.18 SAVECONFIG

Save current configuration to FLASH

Format:

SAVECONFIG

Example:

SAVECONFIG

Description:

ID	Example	Format	Description
1	SAVECONFIG	SAVECONFIG	Header

3.1.19 SERIALCONFIG

Set serial port baudrate.

Format:

SERIALCONFIG x1 x2

Example:

SERIALCONFIG COM1 19200

Description:

ID	Example	Format	Description
1	SERIALCONFIG	SERIALCONFIG	Header
2	COM1	x1	Serial port, can be COM1, COM2, COM3
3	19200	x2	Baudrate, support 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 576000, 921600

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.20 SET

Set receiver working parameters. Take effect after saveconfig and reboot.

The [OPTION] can be:

OBSFREQ: observation frequency, min. 2Hz (the PVT frequency consists with the observation frequency, no need to set PVTFREQ)

FPGARAWFREQ: FPGA raw data output frequency, min.1Hz

PJKPARA: PJK parameters

SHIFTDATUM: the coordinates shift parameters, X, Y, Z

Format:

SET [OPTION] [PARA]

Example:

SET OBSFREQ 2

SET FPGARAWFREQ 10

SET SHIFTDATUM 0 0 0

Description:

ID	Example	Format	Description
1	SET	SET	Header
2	OBSFREQ	OBSFREQ	observation frequency, min. 2Hz (the PVT frequency consists with the observation frequency, no need to set PVTFREQ)
	FPGARAWFREQ	FPGARAWFREQ	FPGA raw data output frequency, min.1Hz
	SHIFTDATUM	SHIFTDATUM	the coordinates shift parameters, X, Y, Z
	PJKPARA	PJKPARA	PJK parameters
3	2	obsfreq	observation frequency, min. 2Hz
	10	fpgarawfreq	FPGA raw data output frequency, min.1Hz
	0 0 0	X Y Z	the coordinates shift parameters, X, Y, Z
	6378245 298.3 0 0 0 500000 0.99923 EHT	xxxx.xx xx.xx x.xxx x.xxx x.x x.x [x.x XXX]	PJK parameters, refer to 0

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.21 SETBASELINE

Set the baseline constraint length, take effect after savconfig and reboot. When the parameter is not set, it is used to query the current configuration.

Format:

SETBASELINE [SWITCH] [baseline length m] [margin m]

Example:

SETBASELINE ON 1 0.03

Description:

ID	Example	Format	Description
1	SETBASELINE	SETBASELINE	Header
2	ON	SWITCH	ON: baseline constraint on
			OFF: baseline constraint off
3	1	[baseline length m]	Baseline length m (support 0.1-100, configure according to actual length)
4	0.3	[margin m]	Margin m

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.1.22 TRANS

Configure serial port data transmission, only in uppercase.

Format:

TRANS Switch [Port1] [Port2]

Example:

TRANS ON COM1 COM2
TRANS OFF

Description:

ID	Format	Example	Description
1	TRANS	TRANS	Header
2	Switch	ON	Enable pass-through
		OFF	Disable pass-through
3	x1	COM1	Serial port, can be COM1, COM2, COM3
4	x2	COM2	Serial port, can be COM1, COM2, COM3

3.1.23 UNLOG

Disable output of messages.

Format:

UNLOG [Port] Log
UNLOGALL [Port]

Example:

UNLOG COM3 GPGGA

Description:

ID	Format	Example	Description
1	UNLOG	UNLOG	Header, to disable a specific output of a assigned port or the port in use when no port parameter added
	UNLOGALL	UNLOGALL	Header, to disable all output of a assigned port or all ports when no port parameter added

2	Port	COM3	Serial number, can be COM1, COM2, COM3, ICOM1, ICOM2, ICOM3, ICOM4, CCOM1, CCOM2, NCOM1, NCOM2
3	Log	GPGGA	Message

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2 GNSS COMMANDS

3.2.1 ECUTOFF

Set satellite elevation cut-off (°), take effect after saveconfig and reboot. When the parameter is not set, it is used to query current configuration.

Format:

ECUTOFF [Elevation Threshold°]

Example:

ECUTOFF 5

Description:

ID	Example	Format	Description
1	ECUTOFF	ECUTOFF	Header
2	5	[Elevation cut-off angle°]	Elevation cut-off angle °, range 0-90 °, by default 5°

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.2 FIX

Set base station coordinates, take effect after saveconfig and reboot.

Format:

FIX [AUTO/POSITION/NONE]

AUTO: use the last positioning results as the base coordinates

POSITION: use a specified value (lat, lon, hgt) as the base coordinates, when the value is 0, it is considered the same as FIX NONE

NONE: clear the base station coordinates, after that it will take the first position results as the base station coordinates.

Example:

FIX AUTO

FIX POSITION 28.234042909 112.888089727 91.0662

FIX NONE

Description:

ID	Example	Format	Description
1	FIX	FIX	Header
2	AUTO	AUTO	Use the last positioning results as the base coordinates
	POSITION	POSITION	Use a specified value (lat, lon, hgt) as the base coordinates, when the value is 0, it is considered the same as FIX NONE

	NONE	NONE	Clear the base station coordinates, after that it will take the first position results as the base station coordinates
3	28.234042909	【B】	Latitude
4	112.888089727	【L】	Longitude
5	91.0662	【H】	Height

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.3 FRESET

Clear the configuration or reset to default factory configuration.

Format:

FRESET [OPTION]

Example:

FRESET STANDARD

Description:

ID	Example	Format	Description
1	FRESET	FRESET	Header
2	STANDARD	STANDARD	Clear all ephemeris, almanac and GLONASS bias correction parameters.
	EPHALM	EPHALM	Clear all ephemeris and almanac
	GPSALMANAC	GPSALMANAC	Clear GPS almanac
	GPSEPHEM	GPSEPHEM	Clear GPS ephemeris
	GLOALMANAC	GLOALMANAC	Clear GLONASS almanac
	GLOEPHEM	GLOEPHEM	Clear GLONASS ephemeris
	QZSSALMANC	QZSSALMANC	Clear QZSS almanac

	QZSSEPHEMERIS	QZSSEPHEMERIS	Clear QZSS ephemeris
	BDSALMANAC	BDSALMANAC	Clear BDS almanac
	BDSEPHEMERIS	BDSEPHEMERIS	Clear BDS ephemeris
	IONUTC	IONUTC	Clear ionospheric parameters
	GLOIFB	GLOIFB	Clear GLONASS bias correction parameters
	BATCHTEST	BATCHTEST	Reset to default configuration of batch test

3.2.4 GPSREFWEEK

Configure GPS reference week, take effect after saveconfig and reboot. When the parameter is not set, it is used to query the current configuration.

Format:

GPSREFWEEK [WEEKNUM]

Example:

GPSREFWEEK 2553

Description:

ID	Example	Format	Description
1	GPSREFWEEK	GPSREFWEEK	Header
2	2553	[WEEKNUM]	GPS reference week number

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.5 HEADINGOFFSET

Add heading and pitch offset value.

The unmodified heading value represents the angle between the True North and the line vector (point from ANT1 to ANT2) in a clockwise direction. In some cases, it may not be possible to place the two antennas in the desired location, for instance, to match the travelling forward direction of the vehicle.

Format:

HEADINGOFFSET headingoffsetindeg [pitchoffsetindeg]

Example:

HEADINGOFFSET 0 0

Description:

ID	Example	Format	Description
1	HEADINGOFFSET	HEADINGOFFSET	Header
2	0	headingoffsetindeg	Heading offset value°, -180.0 - 180.0
3	0	[pitchoffsetindeg]	Pitch offset value°, -90.0 - 90.0

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.6 NMEATALKER

Set NMEA talker ID like GPGGA/GPRMC/GPZDA, take effect after saveconfig and reboot.

Format:

NMEATALKER [AUTO/GP//BD]

Example:

NMEATALKER AUTO

Description:

ID	Example	Format	Description
1	NMEATALKER	NMEATALKER	Header
2	AUTO	AUTO	Only GPS: GP; only BDS: BD; multi-system:GN
		GP	Set as GP
		BD	Set as BD

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.7 PJKPARA

Configure PJK parameters.

Format:

SET PJKPARA xxxx.xx xx.xx x.xxx x.x x.x [x.x XXX]

Example:

SET PJKPARA 6378245 298.3 0 0 0 500000 0.99923 EHT

Description:

ID	Example	Format	Description
1	SET PJKPARA	SET PJKPARA	Header
2	6378245	xxxx.xx	Semi-major axis of ellipsoid (m)
3	298.3	xx.xx	Reciprocal flattening
4	0	x.xxx	Origin latitude (°)
5	0	x.xxx	Central meridian (°)
6	0	x.x	North offset (m)

7	500000	x.x	East offset (m)
8	0.99923	x.x	Scale Factor
9	EHT	XXX	EHT: Ellipsoid hgt; GHT: Geodetic hgt

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.8 RTKTIMEOUT

Set maximum age (s) of RTK data, take effect after saveconfig and reboot. When the parameter is not set, it is used to query current configuration.

Format:

RTKTIMEOUT [DIFFAGE]

Example:

RTKTIMEOUT 35

Description:

ID	Example	Format	Description
1	RTKTIMEOUT	RTKTIMEOUT	Header
2	35	[DIFFAGE]	Differential age(s), default 30, recommended <60, support 0-500

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.9 RTKTYPE

Configure receiver work mode, rover station: ROVER, base station: BASE. When the

parameter is not set, it is used to query current configuration.

Format:

RTKTYPE [ROVER/BASE]

Example:

RTKTYPE ROVER

Description:

ID	Example	Format	Description
1	RTKTYPE	RTKTYPE	Header
2	ROVER	[ROVER/BASE]	rover station: ROVER, base station: BASE

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.10 SAVEEPHDATA

Save current ephemeris.

Format:

SAVEEPHDATA

Example:

SAVEEPHDATA

Description:

ID	Example	Format	Description
1	SAVEEPHDATA	SAVEEPHDATA	Header

3.2.11 SETGLOIFB

In case that the base station that does not broadcast 1230 (GLO bias correction data), users can add the GLO bias correction by this command to make the GLO system in the base station available. Otherwise, the GLO observations in the base station will not be able to fix the ambiguity.

Notes:

- The first following 4 parameters are given by the base station manufacturer, used to set the RTCM1230 CPB value.
- At most one space is allowed in the device name, and it must be replaced by '~'.
- The 60 parameters at the back are used to set the correction value of each K value.

Format:

SETGLOIFB [DEVICE_NAME] x1 x2 x3 x4 [x5……x60]

Example:

SETGLOIFB TRIMBLE 16.348 16.348 16.348 16.348

SETGLOIFB TRIMBLE .....

Description:

ID	Example	Format	Description

1	SETGLOIFB	SETGLOIFB	Header
2	TRIMBLE	TRIMBLE	Device name
3	16.348 16.348 16.348 16.348 16.348	x1 x2 x3 x4 [x5.....x60]	The first following 4 parameters are given by the base station manufacturer, used to set the RTCM1230 CPB value. The 60 parameters at the back are used to set the correction value of each K value.

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.12 SNRCUTOFF

Set the SNR threshold (dB) of the satellites used in the solution, take effect after savconfig and reboot.

Format:

SNRCUTOFF [SNR]

Example:

SNRCUTOFF 40

Description:

ID	Example	Format	Description
1	SNRCUTOFF	SNRCUTOFF	Header
2	40	[SNR]	SNR threshold (dB), 0-50dB, by default 20dB

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.13 VELSMOOTH

Velocity smooth window configuration, output the average speed of the GNSS velocity window, can be used to smooth GNSS velocity. Take affect after SAVECONFIG and REBOOT. When the parameter is not set, it is used to query the current configuration.

Format:

VELSMOOTH [PERIOD]

3.2.14 WORKFREQS

Set work frequency, take effect after savconfig and reboot. When the SYSTEM is not indicated, the command will configure it to full-system, at this moment, you need to type down all frequencies that you need at one time. When the parameter is not set, it is used to query the current configuration.

Format:

WORKFREQS [FREQ] [SYSTEM]

Example:

WORKFREQS B1IB2IB2AL1L2CL2PG1G2E1E5BI5: set work frequency

WORKFREQS L1L2 GPS: set primary antenna GPS dual band

WORKFREQS L1L2 GPS MASTER: set primary antenna GPS dual band

WORKFREQS ALL ALL: set full-frequency full-system

WORKFREQS NONE QZSS: disable QZSS system

WORKFREQS: query current work frequency

Description:

ID	Example	Format	Description
1	WORKFREQS	WORKFREQS	Header
2	L1L2	[FREQ]/[ALL]	Frequency, options can be: A specifc freq: like L2, L2C, B1I etc. (to check what freq is available, enter LOG AUTHORIZATION ONCE) NONE: disable all freq. ALL: enable all freq.
3	GPS	[SYSTEM] /[ALL]	System, options can be: GPS, GLONASS, GALILEO, BEIDOU, BEIDOU2, BEIDOU3, QZSS, IRNSS, ALL.
4	MASTER	SOURCE	MASTER: primary antenna SLAVE: secondary antenna Note: if this field is blank, by default is primary antenna

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.2.15 DGPSTXID

Set base station ID. When the parameter is not set, it is used to query current configuration.

Format:

DGPSTXID RTCMV3 [Station ID]

Example:

DGPSTXID RTCMV3: query base station ID

DGPSTXID RTCMV3 1001: set base station id to 1001

Description:

ID	Example	Format	Description
1	DGPSTXID RTCMV3	DGPSTXID RTCMV3	Header
2	1001	xxxx	Base station ID

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.3 GNSS/INS COMMANDS

3.3.1 INSCALIBRATE*

Initialize the INS calibration

Format:

INSCALIBRATE Offset Trigger [SDThreshold]

Example:

INSCALIBRATE RBV NEW 0.5

Description:

ID	Example	Format	Description
1	INSCALIBRATE	INSCALIBRATE	Header
2	RBV	Offset	Rotation from IMU body frame to Vehicle frame
3	NEW	Trigger	NEW: Overwrite the last calibration value with the new calibration value
			STOP: Stop calibration and use the estimated value
			RESET: Reset the calibration process, restore the last factory value (usually 0 0 0) or user input value
4	0.5	SDThreshold	Standard deviation (by default RBV: 0.5°)

3.3.2 RAWIMUOUT*

To configure output of IMU raw data under the condition of no GNSS signal received.

格式：

RAWIMUOUT [Switch]

示例：

RAWIMUOUT ON

说明：

ID	格式	示例	描述
1	RAWIMUOUT	RAWIMUOUT	Header
2	Switch	ON	Enable output of IMU raw data
		OFF	disable output of IMU raw data

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.3.3 SETALIGNMENTVEL*

Set the minimum carrier traveling speed required for alignment.

Format:

SETALIGNMENTVEL V

Example:

SETALIGNMENTVEL 5.0

Description:

ID	Example	Format	Description
1	SETALIGNMENTVEL	SETALIGNMENTVEL	Header
2	5.0	V	Minimum alignment velocity, default 2m/s, inferior limit 1m/s

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.3.4 SETINSPROFILE*

Set INS profile.

Format:

SETINSPROFILE Profile

Example:

SETINSPROFILE LAND

Description:

ID	Example	Format	ASCII	Binary	Description
1	SETINSPROFILE	SETINSPROFILE	SETINSPROFILE	--	Header
2	LAND	Profile	Default	0	Basic model
			LAND	1	Land vehicle model
			MARINE	2	Marine model
			FIXEDWING_ BASIC	3	Fixed wing model (not supported)
			Reserved	4	Reserved
			VTOL_BASIC	5	VTOL model (not supported)
			RAIL_BASIC	6	Rail model (not supported)

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.3.5 SETINSROTATION*

Set the rotation parameter from the IMU Body Frame to other frames.

Format:

SETINSROTATION INSRotation X Y Z [XSD YSD ZSD]

Example:

ETINSROTATION RBV 1.0 2.0 3.0 0.05 0.05 0.05

Description:

ID	Example	Format	Description
1	SETINSROTATION	SETINSROTATION	Header
2	RBV	INSRotation	RBV: Rotation parameter from IMU Body Frame to Vehicle Frame
			USER: Rotation parameter from IMU Body

			Frame to User Output Frame
3	1.0	X	X rotation offset from IMU origin (°), -90 ~ +90
4	2.0	Y	Y rotation offset from IMU origin (°), -180 ~ +180
5	3.0	Z	Z rotation offset from IMU origin (°), -180 ~ +180
6	0.05	XSD	Optional, the standard deviation of rotation offset of X axis (°), by default 0.0, 0~45
7	0.05	YSD	Optional, the standard deviation of rotation offset of Y axis (°), by default 0.0, 0~45
8	0.05	ZSD	Optional, the standard deviation of rotation offset of Z axis (°), by default 0.0, 0~45

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.3.6 SETINSTRANSLATION*

Set Lever Arm from IMU body frame to other frames.

Format:

SETINSTRANSLATION INSTranslation X Y Z XSD YSD ZSD VEHICLE

Example:

SETINSTRANSLATION ANT1 1.0 2.0 3.0 0.05 0.05 0.05 VEHICLE

Description:

ID	Example	Format	Description
1	SETINSTRANSLATION	SETINSTRANSLATION	Header
2	ANT1	INSTranslation	ANT1: lever arm from IMU body frame to ANT1(primary)
			ANT2: lever arm from IMU body frame to ANT2(secondary)
			USER: lever arm from IMU body frame to User output frame, that is to change

			navigation center to a user-defined point
3	1.0	X	Lever arm of X axis (m), -100~ + 100
4	2.0	Y	Lever arm of Y axis (m), -100~ + 100
5	3.0	Z	Lever arm of Z axis (m), -100~ + 100
6	0.05	XSD	Optional, standard deviation of the X-axis lever arm (m), 0~10
7	0.05	YSD	Optional, standard deviation of the Y-axis lever arm (m), 0~10
8	0.05	ZSD	Optional, standard deviation of the Z-axis lever arm (m), 0~10
9	VEHICLE	InputFrame	VEHICLE: Vehicle frame as input frame
			IMUBODY: IMU Body Frame as input frame

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.3.7 SETINSTYPE*

Set IMU type, generally there's no need to configure, the receiver can identify the IMU type automatically. When the parameter is not set, it is used to query the current configuration.

Format:

SETINSTYPE [IMUTYPE]

Example:

SETINSTYPE X1-3

Description:

ID	Example	Format	Description
1	SETINSTYPE	SETINSTYPE	Header

2	X1-3	[IMUTYPE]	IMU model

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

3.3.8 SETINSUPDATE*

Enable or disable INS filter updates, should be only used by advanced users of GNSS/INS.

Format:

SETINSUPDATE INSUpdate Trigger

Example:

SETINSUPDATE ZUPT DISABLE

Description:

ID	Example	Format	Description
1	SETINSUPDATE	SETINSUPDATE	Header
2	ZUPT	INSUpdate	POS: position
			ZUPT: Zero Velocity Updates
			ADR: Carrier phase updates
			ALIGN: Dual-antenna heading updates
			DMI: Distance measuring device updates
3	DISABLE	Trigger	DISABLE: Disable
			ENABLE: Enable

Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH.

4 LOGS

Messages marked with* only support GNSS/INS.

4.1 NMEA Format

4.1.1 ATR

Output navigation information like positioning and heading.

Recommended

LOG GPATR ONTIME 1

ASCII Example

$GPATR,062743.00,4,0.000,-0.002,0.000,0.006,4,37.19,-76.84*7F

Description

ID	Example	Format	Description
1	GPATR	$--ATR	Header
2	062743.00	hhmmss.ss	UTC time
3	4	a0	Positioning status, see note ①.
4	0.000	x1	Baseline length (m)
5	-0.002	x2	North distance (m)
6	0.000	x3	East distance (m)
7	0.006	x4	Up distance (m)
8	4	a1	Heading status, see note ①.

9	37.19	x5	Yaw (°)
10	-76.84	x6	Pitch (°)
11		-	Reserved
12	7F	hh	Check sum

Note ①: 0- no solution;1- single point solution; 2- pseudorange differential; 4- fixed solution; 5- floating point solution.

4.1.2 BYINS

This log contains position, attitudes and velocity related data from both GNSS and INS, also, time data is included.

推荐

LOG Port BYINS ONNEW

ASCII 示例

$BYINS,SN101133140136,021938.17,94796.165,28.232455223,112.874930648,71.093,10.127,-0.040,1.424,0.002,0.003,-0.001,-0.247,0.019,9.817,0.016,0.084,0.158,-0.010,-0.006,-0.010,6,4,54,1000000,0,0.000,0,0.003,0.010,0.001,112.8749301,28.2324561,69.22,1,000000,0.003,0.002,-0.001*57

说明

ID	Format	Example	Description
1	$BYINS	$BYINS	Header
2	SNxxx	SN101133140136	Device's serial number consisting of SN and 12 numbers. See note①
3	hhmmss.ss	021938.17	UTC time. See note②
4	x.x	94796.165	Seconds from the beginning of this Sunday.
5	x.x	28.232455223	INS latitude, unit: degree

6	x.x	112.874930648	INS longitude, unit: degree
7	x.x	71.093	INS ellipsoidal height, unit: meter
8	x.x	10.127	Azimuth, unit: degree
9	x.x	-0.040	Pitch, unit: degree
10	x.x	1.424	Roll, unit: degree
11	x.x	0.002	Forward velocity, unit: m/s
12	x.x	0.003	Right-hand velocity, unit: m/s
13	x.x	-0.001	Up velocity, unit: m/s
14	x.x	-0.247	Raw right-hand acceleration, unit: m/s^2
15	x.x	0.019	Raw forward acceleration, unit: m/s^2
16	x.x	9.817	Raw up acceleration, unit: m/s^2
17	x.x	0.016	Raw right-hand angular velocity，a positive sign is for counter clockwise rotation, unit: °/s
18	x.x	0.084	Raw forward angular velocity，a positive sign is for counter clockwise rotation, unit: °/s
19	x.x	0.158	Raw up angular velocity，a positive sign is for counter clockwise rotation, unit: °/s
20	x.x	-0.010	Corrected right-hand angular velocity，a positive sign is for counter clockwise rotation, unit: °/s
21	x.x	-0.006	Corrected forward angular velocity，a positive sign is for counter clockwise rotation, unit: °/s
22	x.x	-0.010	Corrected up angular velocity，a positive sign is for counter clockwise rotation, unit: °/s
23	x	6	INS position status. See note③
24	x	4	GNSS heading status. See note④
25	xx	54	Satellites number of master antenna
26	x.x	1000000	Delay of correction data
27	x.x	0	Reserved
28	x.x	0.000	Reserved
29	x.x	0	Reserved
30	x.x	0.003	North acceleration, unit: m/s^2
31	x.x	0.010	East acceleration, unit: m/s^2

32	x.x	0.001	Down acceleration，unit: m/s^2
33	x.x	112.8749301	GNSS longitude, unit: degree
34	x.x	28.2324561	GNSS latitude, unit: degree
35	x.x	69.22	GNSS ellipsoidal height, unit: meter
36	x	1	GNSS position status. See note⑤
37	xxxxxx	000000	Warning. See note⑥
38	x.x	0.003	East velocity, unit: m/s
39	x.x	0.002	North velocity, unit: m/s
40	x.x	-0.001	Up velocity, unit: m/s
41	*hh	*57	Check sum of all characters between $ and *
42	<CR><LF>		Sentence terminator (ASCII only)

Note①: This field will never be empty regardless of position status.
Note②: This field will be empty with no solution.
Note③: 0-No solution or invalid; 1-Single; 2-DGPS; 4-Fix; 5-Float; 6-Valid INS solution.
Note④: 0-Invalid; 1-Single; 2-DGPS; 4-Fix; 5-Float.
Note⑤: 0-No solution or invalid; 1-Single; 2-DGPS; 4-Fix; 5-Float.
Note⑥: Every digit refers to ABCDEF respectively。A=0，Functional IMU；A=1，Dysfunctional gyro；A=2，Dysfunctional accelerometer；A=3，Dysfunctional gyro and accelerometer；B=0，valid GNSS；B=1，No GNSS signal；B=2，No data output；D=0，Valid navigation status；D=1，invalid data output；C, E and F are reserved。

4.1.3 DOP

Output DOP value.

Recommended

LOG GPDOP ONTIME 1

ASCII Example

$GPDOP,022518.00,1.03,0.61,0.83,0.61,1.19*70

Description

ID	Example	Format	Description
1	$GPDOP	$--DOP	Header
2	022518.00	HHMMSS.SS	UTC time
3	1.03	xx.xx	PDOP: Position Dilution of Precision
4	0.61	xx.xx	HDOP: Horizontal Dilution of Precision
5	0.83	xx.xx	VDOP: Vertical Dilution of Precision
6	0.61	xx.xx	TDOP: Time Dilution of Precision
7	1.19	xx.xx	GDOP: Geometric Dilution of Precision
8	70	Hh	Check sum

4.1.4 FPD

Output position and attitude information.

Recommended

LOG GPFPD ONTIME 1

ASCII Example

$GPFPD,1975,355908.00,296.248, - 71.075,1.579,28.233170896,112.877141017,61.053, - 0.157,0.020,-0.021, 3.898,30,30,1*4F

Description

ID	Example	Format	Description
1	$GPFPD	$--FPD	Header
2	1975	Xxxx	The number of GPS Weeks from January 6, 1980

			to the current week (GPS time)
3	3555908.00	ssssss.ss	The number of seconds from 00:00:00 of this Sunday to the current time (GPS time)
4	296.248	xx.xx	Yaw 0° ~ 360°
5	-71.075	xx.xx	Pitch -90° ~ 90°
6	1.579	xx.xx	Roll -180° ~ 180°
7	28.233170896	xxx.xx	Latitude -90° ~ 90°
8	112.877141017	xxx.xx	Longitude -180° ~ 180°
9	61.053	xxx.xx	Height (m)
10	-0.157	xx.xx	East velocity (m/s)
11	0.020	xx.xx	North velocity (m/s)
12	-0.021	xx.xx	Up velocity (m/s)
13	3.898	xx.xx	Baseline length (m)
14	30	Xx	Number of Satellites for antenna 1
15	30	Xx	Number of satellites for antenna 2
16	1	a	Solution status, see note ①
17	4F	Hh	Check sum

Note ①: 0: Initialization; 1: GPS position, velocity and heading are valid; 2: GPS position and velocity are valid; 3: Pure inertial mode; 11: GPS differential, velocity and heading are valid; 12: GPS differential is valid.

4.1.5 GGA

Output the receiver time, position and other information.

Recommended

LOG GPGGA ONTIME 1

ASCII Example

$GPGGA,062134.00,2813.9908005,N,11252.6285300,E,1,28,0.5,83.684,M,-17.038,M,0.000,0000*60

Description

ID	Example	Format	Description
1	$GPGGA	$--GGA	Header
2	062134.00	hhmmss.ss	UTC time
3	2813.9908005	ddff.ff	Latitude, see note ①
4	N	a	Latitude direction (N = North, S=South)
5	11252.6285300	dddff.ff	Longitude, see note ②
6	E	a	Longitude direction (E = East, W =West)
7	1	x	Solution status, see note ③
8	28	xx	Number of satellites in use.
9	0.5	x.x	HDOP: Horizontal Dilution of Precision
10	83.684	x.x	Antenna altitude above/below mean sea level
11	M	U	Antenna altitude (m)
12	-17.038	x.x	Undulation - the relationship between the geoid and the WGS84 ellipsoid "-" means the sea level is lower than CGS-2000 Ellipsoid
13	M	U	Undulation (m)

14	0.000	xxxx	Differential age (s), see note ④
15	0000	x.x	Differential base station ID, see note ⑤
16	60	hh	Check sum

Note ①: 28°13.9908005', the value range is 0 ~ 90, 2 digits are reserved before the decimal point, and the rest are degrees.
Note ②: 112°52.6285300', the range of values is 0 ~ 180, 2 digits are reserved before the decimal point, and the rest are degrees.
Note ③: 0: invalid solution; 1: single point solution; 2: pseudorange differential; 4: fixed solution; 5: floating point solution.
Note ④: Differential age: the time since the last differential signal was received.
Note ⑤: ID is 0 while in single point positioning and it will be the base station ID while in RTK mode.

4.1.6 GSA

This log contains operational mode, satellites in use and DOP related data of the receiver. There will be more than on message output when multiple GNSS involved.

This message is applied for firmware newer than 7.57, please refer to *NMEA 0183-Standard for Interfacing Marine Electronic Devices Version 4.10* if you use 7.57 firmware。

Recommended

LOG GPGSA ONTIME 1

ASCII Example

$GPGSA,M,3,87,70,,,,,,,,,,,1.2,0.8,0.9,1*2A

Description

ID	Format	Example	Description
1	$--GSA	$GPGSA	Header. See note①

2	a	M	A：Automatic 2D/3D M：Manual, forced to operate in 2D or 3D
3	x	3	1：No fix；2：2D；3：3D
4-15	xx	87,70,,,,,,,,,,	PRN numbers of satellites used in solution, 12 fields in total in each message. See note①
16	x.x	1.2	PDOP
17	x.x	0.8	HDOP
18	x.x	0.9	VDOP
19	h	1	GNSS ID. See note②
20	*hh	*2A	Check sum
21	[CR][LF]		Sentence terminator

Note①: Headers varies when different constellations are use in solution, for example, it will be GP when only GPS is used and it will be GN if multiple constellations involved in solution. Refer to *NMEA 0183-Standard for Interfacing Marine Electronic Devices Version 4.11* for more information about PRN.

Note②: 1-GPS(GP), 2-GLONASS(GL), 3-Galileo(GA), 4-BDS(GB), 5-QZSS(GQ), 6-IRNSS(GI), 7~F-Reserved。

4.1.7 GST

Output GPS pseudorange noise statistics, including standard deviation of three-dimensional coordinates.

Recommended

LOG GPGST ONTIME 1

ASCII Example

$GPGST,024603.00,3.2,6.6,4.7,47.3,5.8,5.6,22.0*58

Description

ID	Example	Format	Description

1	$GPGST	$--GST	Header
2	024603.00	hhmmss.ss	UTC time, (hours/minutes/seconds)
3	3.2	a.a	RMS value of the standard deviation of the pseudorange to the navigation process.
4	6.6	b.b	Standard deviation of semi-major axis of error ellipse (m)
5	4.7	c.c	Standard deviation of semi-minor axis of error ellipse (m)
6	47.3	d.d	Orientation of semi-major axis of error ellipse (degrees from true north)
7	5.8	e.e	Standard deviation of latitude error (m)
8	5.6	f.f	Standard deviation of longitude error (m)
9	22.0	g.g	Standard deviation of altitude error (m)
10	*58	*cc	Check sum

4.1.8 GSV

Output satellites status in view, including number of satellites in view, PNR numbers, elevation, Azimuth and signal-to-noise ratio (SNR) value.

Recommended

LOG GPGSV ONTIME 1

ASCII Example

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

Description

ID	Example	Format	Description
1	$GPGSV	$--GSV	Header
2	3	x.x	Total number of GSV messages
3	3	x.x	Current GSV message number
4	10	xx	Number of satellites in view
5	26	xxx	Satellite PRN number
6	82	x.x	Elevation, degrees, 90 maximum
7	187	x.x	Azimuth, degrees True, 000 to 359
8	47	x.x	Signal-to-noise ratio
.....	28,43,056,46	-	Next satellite PRN number, elev, azimuth, SNR--repeat from field 4 to 7
.....	,,,,,,,,		See note ①
n	77	hh	Check sum

Note ①: Each message transmits information of up to 4 satellites. If there are less than 4 satellites at the end, the actual number would be output, and the remaining fields shall be filled with ",,," respectively.(the number of commas in each message must be the same).

4.1.9 HDT

Output heading in degrees from True North.

Recommended

LOG GPHDT ONTIME 1

ASCII Example

$GPHDT,98.397404,T*39

Description

ID	Example	Format	Description
1	GPHDT	$--HDT	Header
2	98.397404	x.x	Heading in degree
3	T	T	Degrees True
4	39	hh	Check sum

4.1.10 HPD

Output GPS positioning and heading messages.

Recommended

LOG GPHPD ONTIME 1

ASCII Example

$GPHPD,1975,355985.00,296.248, - 71.075,292.096,28.233173291,112.877139847,61.040, -492.200,567.901,-28.918,-0.003,0.001,-0.006,-0.005,-0.003,-0.006,1.808,30,30,1*4F

Description

ID	Example	Format	Description
1	$GPHPD	$--HPD	Header

2	1975	xxxx	The number of GPS week from January 6, 1980 to current week (GPS time)
3	355985.00	xxxx.xx	The number of seconds from 00:00:00 of this Sunday to the current time (GPS time)
4	296.248	xx.xx	Yaw 0 ~ 360(°)
5	-71.075	xx.xx	Pitch -90 ~ 90(°)
6	292.096	xx.xx	The angle of the ground velocity from True North (0-359.99°)
7	28.233173291	xxx.xx	Latitude (°)
8	112.877139847	xxx.xx	Longitude (°)
9	61.040	xxx.xx	Height (m)
10	-492.200	xx.xx	East distance of rover station relative to base station (m)
11	567.901	xx.xx	North distance of rover station relative to base station (m)
12	-28.918	xx.xx	Up distance of rover station relative to base station (m)
13	-0.003	xx.xx	East velocity (m/s)
14	0.001	xx.xx	North velocity (m/s)
15	-0.006	xx.xx	Up velocity (m/s)
16	0.005	xx.xx	East velocity difference between two measurements (m/s)
17	-0.003	xx.xx	North velocity difference between the two

			measurements (m/s)
18	-0.006	xx.xx	Up velocity difference between two measurements (m/s)
19	1.808	xx.xx	Baseline length (m)
20	30	xx	Available Satellites from Secondary Antenna
21	30	xx	Available Satellites from Primary Antenna
22	1	a	Solution status, see Note ①
23	4F	HH	Check sum

Note ①: 0: invalid solution; 1: single point position; 2: pseudorange differential; 4: RTK fixed solution; 5: RTK floating point solution.

4.1.11 NTR

Output the distance between the rover station and the base station.

Recommended

LOG GPNTR ONTIME 1

ASCII Example

$GPNTR,024404.00,1,17253.242,+5210.449,-16447.587,-49.685,0004*40

Description

ID	Example	Format	Description
1	$GPNTR	$--NTR	Header

2	024404.00	hhmmss.ss	UTC time
3	1	a	Solution status, see note ①
4	17253.242	xxx.xxx	Oblique distance between the rover and the base (m)
5	+5210.449	xxx.xxx	Distance in X direction (m) "+" : north of the base "-" : south of the base
6	-16447.587	xxx.xxx	Distance in Y direction (m) "+" : east of the base "-" : west of the base
7	-49.685	xxx.xxx	Distance in H direction (m) "+" : above the base "-" : below the base
8	0004	xxx	Station ID
9	HH	hh	Check sum

Note ①: 0: invalid solution; 1: single point solution; 2: pseudorange differential; 4: fixed solution; 5: floating solution.

4.1.12 ORI

Output heading information.

Recommended

LOG GPORI ONTIME 1

ASCII Example

$GPORI,060723.00,2,3.25000000,30.450000,6.112233,3.2,8*HH

Description

ID	Example	Format	Description
1	$GPORI	$--ORI	Header
2	060723.00	hhmmss.ss	UTC time
3	1	x	Solution status, see note ①
4	3.25000000	x.x	Baseline length (m)
5	30.450000	x.x	Azimuth (°)
6	6.112233	x.x	Pitch (°)
7	Reserved	x.x	X of baseline vector (m)
8	Reserved	x.x	Y of baseline vector (m)
9	Reserved	x.x	Z of baseline vector (m)
10		HH	Check sum

Note ①: 0: invalid solution; 1: single point solution; 4: fixed solution; 5: floating point solution.

4.1.13 PASHR*

Output heading information

Recommended

LOG PASHR ONTIME 1

ASCII Example

$PASHR,024224.00,37.186,T,0.000,-76.837,0.000,0.000,0.500,0.200,2*10

Description

ID	Example	Format	Description
1	$PASHR	$PASHR	Header
2	024224.00	hhmmss.ss	UTC time
3	37.186	xxx.xx	Yaw (°)
4	T	T	True North Mark
5	0.000	xxx.xx	Roll (°)
6	-76.837	xxx.xx	Pitch (°)
7	0.000	heave	Elevation outliers (fixed as 0)
8	0.000	xx.xxx	Roll standard deviation
9	0.500	xx.xxx	Pitch standard deviation
10	0.200	xx.xxx	Yaw standard deviation
11	2	a	Solution status, see note①
12	10	hh	Check sum

Note①: 0-invalid solution; 1-single point solution; 2-RTK solution

4.1.14 PTNL AVR

Output yaw information.

Recommended

LOG PTNLAVR ONTIME 1

ASCII Example

$PTNL,AVR,032735.00,+37.1860,Yaw,-76.8374,Tilt,,,0.001,3,1.5,21*36

Description

ID	Example	Format	Description
1	$PTNL,AVR	$PTNL,AVR	Header
2	032735.00	hhmmss.ss	UTC time
3	+37.1860	xxx.xxx	Yaw (°)
4	Yaw	Yaw	Yaw mark
5	-76.8374	xx.xx	Pitch (°)
6	Tilt	Tilt	Pitch mark
7		-	Reserved
8		-	Reserved
9	0.001	xx.xx	Baseline length (m)
10	3	a	Solution status, see note ①
11	1.5	xx.xx	PDOP: Position Dilution of Precision
12	21	xx	Number of satellites used in solution
13	36	hh	Check sum

Note ①: 0: invalid solution; 1: single point solution; 2: RTK floating point solution; 3: RTK fixed solution; 4: pseudorange differential.

4.1.15 PTNL PJK

Output PJK coordinates, to facilitate the use of third-party software.

Recommended

LOG PTNLPJK ONTIME 1

Example

$PTNL,PJK,022832.00,111617,+3125709.515,N,+684258.136,E,1,30,0.526,EHT+63.147,M*7A

Description

ID	Example	Format	Description
1	$PTNL,PJK	$PTNL,PJK	Header
2	022832.00	hhmmss.ss	UTC time
3	111617	mmddyy	Date (mmddyyyy)
4	+3125709.515	xxxx.xxx	X axis, unit: m
5	N	-	X axis direction
6	+684258.136	xxxx.xxx	Y axis, unit: m
7	E	-	Y axis direction
8	1	a	Solution status, see note ①
9	30	xx	Number of satellites used in solution
10	0.526	xx.xx	HDOP
11	EHT+63.147	axxx.xx	Height: EHT-Earth Height; GHT-Height above sea level
12	M	U	Unit: m
13	7A	hh	Check sum

Note①: 0: invalid solution; 1: single point solution; 2: pseudorange differential; 3: fixed solution; 4: floating point solution

4.1.16 RMC

Output the simplest navigation data.

Recommended

LOG GPRMC ONTIME 1

ASCII Example

$GPRMC,020550.00,A,2813.9891299,N,11252.6278784,E,0.033,315.7,161117,0.0,E,A*30

Description

ID	Example	Format	Description
1	GPRMC	$--RMC	Header
2	020250.00	Hhmmss.ss	UTC time
3	A	x.x	Position status: A-valid data, V-invalid data
4	2813.9891299	ddff.ff	Latitude, see note ①
5	N	a	Latitude direction (N = North, S = South)
6	11252.6278784	dddff.ff	Longitude, see note ②
7	E	a	Longitude direction: (E = East, W = West)
8	0.033	x.x	Speed over ground, knots (N)
9	315.7	x.x	Track made good, degrees True, heading from True North
10	161117	ddmmyy	Date: dd/mm/yy
11	0.0	x.x	Magnetic variation (°)

12	E	a	Magnetic variation direction E/W
13	A	a	Positioning mode indicator,, see note ③.
14	30	hh	Check sum

Note ①: the value range is 0 ~ 90 degrees, 2 digits are reserved before the decimal point, and the rest are degrees.

Note ②: the range of values is 0 ~ 180 degrees, 2 digits are reserved before the decimal point, and the rest are degrees.

Note ③ : A=Autonomous; D=Differential; E=Estimated (dead reckoning) mode; M=Manual input; N=Data not valid

4.1.17 TRA

Output Yaw, Pitch and Roll.

Recommended

LOG GPTRA ONTIME 1

ASCII Example

$GPTRA,063027.30,101.78,071.19, -00.00, 4,10,0.00,0004*51

Description

ID	Example	Format	Description
1	$GPTRA	$--TRA	Header
2	063027.30	hhmmss.ss	UTC time

3	101.78	xxx.xx	Yaw (°)
4	071.19	xxx.xx	Pitch(°)
5	-00.00	xx.xx	Roll(°)
6	4	a	Solution status, see note①
7	10	xx	Number of satellites used in solution
8	0	xx.xx	Differential age (s)
9	0004	xxxx	Station ID
10	51	hh	Check sum

Note ①: 0: invalid solution; 1: single point solution; 2: pseudorange differential; 4: fixed solution; 5: floating point solution.

4.1.18 VTG

Track made good and the velocity relative to the ground.

Recommended

LOG GPVTG ONTIME 1

ASCII Example

$GPVTG,134.395,T,134.395,M,0.019,N,0.035,K,A*33

Description

ID	Example	Format	Description
1	$GPVTG	$--VTG	Header

2	134.395	xxx.xxx	Track made good, degrees True, 000 ~ 359(°)
3	T	U	Degrees True
4	134.395	xxx.xxx	Track made good, degrees Magnetic; 000 ~ 359 (°)
5	M	U	Magnetic track indicator
6	0.019	xxx.xxx	Speed over ground, 000~999 in knots (nautical miles per hour)
7	N	U	Nautical speed indicator (N = Knots)
8	0.035	xxx.xxx	Speed, kilometers/hour: 000~999
9	K	U	Speed indicator (K = km/hr)
10	A	U	Positioning mode indicator, see note ①.
11	33	hh	Check sum

Note ①: A-autonomous; D- differential; E- estimated mode; M- manual input; N-invalid data.

4.1.19 ZDA

Output UTC time, date and local time zone.

Recommended

LOG GPZDA ONTIME 1

ASCII Example

$GPZDA,004401.00,16,11,2017,8,0*6C

Description

ID	Example	Format	Description
1	GPZDA	$--ZDA	Header
2	004401.00	hhmmss.ss	UTC time
3	16	xx	Day
4	11	xx	Month
5	2017	xxxx	Year
6	8	xx	Local time zone, see note ①.
7	0	xx	Difference in local time zone, see note ①.
8	6C	hh	Check sum

Note ①: Since the board cannot automatically obtain the local time zone and local time difference, the local time zone is fixed as Eastern Eight Zone and the local time difference is fixed as zero.

4.2 Bynav Format

4.2.1 BESTPOS

Output best position.

Message ID: 42

Recommended

LOG BESTPOSA ONTIME 1

ASCII Example

#BESTPOSA,COM3,0,0.0,FINESTEERING,1975,393343.000,00000000,0000,113;SOL_COM

PUTED,SINGLE,28.23315179260,112.87713400113,79.7665, -17.0381,WGS84,1.2642,1.6209,2.1834,"0",0.000,0.022,28,27,27,27,0,00,30,13*DB49BF3D

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	BESTPOS header	Header, see Standard ASCII	-	H	0
2	sol stat	Solution status, see Table 4- 1 Solution Status	Enum	4	H
3	pos type	Position type, see Table 4- 2 Position Status	Enum	4	H+4
4	lat	Latitude (°)	Double	8	H+8
5	lon	Longitude (°)	Double	8	H+16
6	hgt	Height above mean sea level (m)	Double	8	H+24
7	Undulation	Undulation (m), the relationship Between the geoid and the ellipsoid of the chosen datum	Float	4	H+32
8	Datum ID	Datum ID number	Enum	4	H+36
9	Lat σ	Latitude standard deviation (m)	Float	4	H+40
10	Lon σ	Longitude standard deviation (m)	Float	4	H+44
11	Hgt σ	Height standard deviation (m)	Float	4	H+48
12	Stn ID	Base station ID, 0 for single point positioning.	Char	4	H+52
13	Diff_age	Differential age (s)	Float	4	H+56
14	Sol_age	Solution age (s)	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17	#solnL1SVs	Number of satellites with L1/E1/B1 signals used in solution	Uchar	1	H+66
18	#solnMultiSVs	Number of satellites with multi-frequency signals used in solution	Uchar	1	H+67
19	Reserved	Reserved	HEX	1	H+68

20	Ext sol stat	Extended solution status, see Table 4- 3 Extended Solution Status	Hex	1	H+69
21	Galileo and BDS sig mask	Galileo and BeiDou signal mask, see Table 4- 5 Galileo and BDS Signal-Used Mask	Hex	1	H+70
22	GPS and GLONASS sig mask	GPS and Glonass signal mask, see Table 4- 4 GPS and GLONASS Signal-Used Mask	Hex	1	H+71
23	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+72
24	[CR][LF]	Message terminator (ASCII only)	-	-	-

Table 4- 1 Solution Status

Binary	ASCII	Description
0	SOL_COMPUTED	Solution computed
1	INSUFFICIENT_OBS	Insufficient observations
2	NO_CONVERGENCE	No convergence
3	SINGULARITY	Singularity at parameters matrix
4	COV_TRACE	Covariance trace exceeds maximum (trace > 1000 m)
5	TEST_DIST	Test distance exceeded (maximum of 3 rejections if distance >10 km)
6	COLD_START	Not yet converged from cold start
7	V_H_LIMIT	Height or velocity limits exceeded
8	VARIANCE	Variance exceeds limits
9	RESIDUALS	Residuals are too large
10-12	Reserved	Reserved
13	INTEGRITY_WARNING	Large residuals make position unreliable
14-17	Reserved	Reserved

18	PENDING	When a **FIX position** command is entered, the receiver computes its own position and determines if the fixed position is valid Pending means that there are not enough satellites currently tracked to verify whether the FIX position input to the receiver is valid. Under normal circumstances, you should only see Pending for a few seconds before the GNSS receiver tracks its first few satellites. If your antenna is blocked (or not plugged in) and you have entered the FIX position command, you may see this status indefinitely.
19	INVALID_FIX	The fixed position, entered using the **FIX position** command, is not valid
20	UNABTHORIZED	Position type is unauthorized
21	Reserved	Reserved
22	INVALID_RATE	The selected logging rate is not supported for this solution type.

Table 4- 2 Position Status

Binary	ASCII	Description
0	NONE	No solution
1	FIXEDPOS	Position has been fixed by the **FIX position** command.
2	FIXEDHEIGHT	Position has been fixed by the **FIX height** or **FIX auto** command
3	Reserved	Reserved

4	FLOATCONV	Floating carrier phase ambiguity solution
5	WIDELANE	Wide lane ambiguity solution
6	NARROWLANE	Narrow lane ambiguity solution
7	Reserved	Reserved
8	DOPPLER_VELOCITY	Velocity computed using instantaneous Doppler
9-15	Reserved	Reserved
16	SINGLE	Single point solution
17	PSRDIFF	Pseudorange Differential
18	WAAS	SBAS solution
19	PROPAGATED	Propagated by a Kalman filter without new observations
20-31	Reserved	Reserved
32	L1_FLOAT	L1 float solution
33	IONOFREE_FLOAT	Ionosphere-free floating point
34	NARROW_FLOAT	RTK float solution with unresolved carrier phase ambiguities
35-47	Reserved	Reserved
48	L1_INT	Reserved
49	WIDE_INT	RTK Fixed solution with carrier phase ambiguities resolved to wide-lane integers
50	NARROW_INT	RTK Fixed solution with carrier phase ambiguities resolved to narrow-lane integers
51	RTK_DIRECT_INS	RTK status, where RTK is initialized directly through INS

52	INS_SBAS	INS position after antenna calibration
53	INS_PSRSP	INS Pseudorange single point (no DGPS)
54	INS_PSRDIFF	INS Pseudoring differential
55	INS_RTKFLOAT	INS RTK Float
56	INS_RTKFIXED	INS RTK Fixed
57-67	Reserved	Reserved
68	PPP_CONVERGING	Converging PPP solution (TerraStar-C)
69	PPP	Converged PPP solution (TerraStar-C)
70	OPERATIONAL	Solution accuracy is within UAL operational limit
71	WARNING	Solution accuracy is outside UAL operational limit but within warning limit
72	OUT_OF_BOUNDS	Solution accuracy is outside UAL limits
73	INS_PPP_Converging	Converging INS PPP solution (TerraStar-C)
74	INS_PPP	Converged INS PPP solution (TerraStar-C)
77	PPP_BASIC_CONVERGING	Converging PPP solution (TerraStar-L)
78	PPP_BASIC	Converged PPP solution (TerraStar-L)
79	INS_PPPP_BASIC_Converging	Converging INS PPP solution (TerraStar-L)
80	INS_PPPP_BASIC	Converged INS PPP solution (TerraStar-L)

Table 4- 3 Extended Solution Status

Bit	Net Mask	Description
0	0x01	RTK solution: an RTK solution has been verified PDP solution: solution is GLIDE Otherwise: Reserved

1-3	0x0E	Pseudorange Iono Correction 0 = Unknown or default Klobuchar model 1 = Klobuchar Broadcast 2 = SBAS Broadcast 3 = Multi-frequency Computed 4 = PSRDiff Correction 5 = Blended Iono Value
4	0x10	RTK ASSIST active
5	0x20	0 = No antenna warning 1 = Antenna information is missing
6-7	0xC0	Reserved

Table 4- 4 GPS and GLONASS Signal-Used Mask

Bit	Net Mask	Description
0	0x01	GPS L1 used in solution
1	0x02	GPS L2 used in solution
2	0x04	GPS L5 used in solution
3	0x08	Reserved
4	0x10	GLONASS L1 used in solution
5	0x20	GLONASS L2 used in solution
6	0x40	GLONASS L3 used in solution
7	0x80	Reserved

Table 4- 5 Galileo and BDS Signal-Used Mask

Bit	Net mask	Description

0	0x01	Galileo E1 used in Solution
1	0x02	Galileo E5A used in Solution
2	0x04	Galileo E5B used in Solution
3	0x08	Galileo ALTBOC used in Solution
4	0x10	BeiDou B1 used in Solution
5	0x20	BeiDou B2 used in Solution
6	0x40	BeiDou B3 used in Solution
7	0x80	Reserved

Table 4- 6 32-CRC check code (C)

```
#define CRC32_POLYNOMIAL 0xEDB88320L

/* --------------------------------------------------------------------------
Calculate a CRC value
value: Value
-------------------------------------------------------------------------- */
unsigned long CalcCRC32Value(int value) {
int i;
unsigned long ulCRC;
ulCRC = value;
for ( i = 8 ; i > 0; --i ) {
    if ( ulCRC & 1 )
        ulCRC = ( ulCRC >> 1 ) ^ CRC32_POLYNOMIAL;
    else
    ulCRC >>= 1;
}
return ulCRC;
}
/* --------------------------------------------------------------------------
Calculates the CRC-32 of a data block
ulCount: Number of bytes in the data block
ucBuff: Data block
-------------------------------------------------------------------------- */
unsigned long CalcBlockCRC32( unsigned long ulCount, unsigned char *ucBuff ) {
```

```
unsigned long ulTmp1;
unsigned long ulTmp2;
unsigned long ulCRC = 0;
while ( ulCount-- != 0 ) {
    ulTmp1 = ( ulCRC >> 8 ) & 0x00FFFFFFL;
    ulTmp2 = CalcCRC32Value( ((int) ulCRC ^ *ucBuff++ ) & 0xFF );
    ulCRC = ulTmp1 ^ ulTmp2;
}
return ulCRC;
}
```

4.2.2 BESTGNSSPOS

Output best GNSS position. (no-INS)

Message ID: 1429

Recommended

LOG Port BESTGNSSPOSA ONTIME 1

ASCII Example

#BESTGNSSPOSA,ICOM4,0,0.0,FINESTEERING,2109,367696.000,00000000,0000,82;SOL_COMP
UTED,NARROW_INT,28.23315515415,112.87713068512,82.5990,-17.0381,WGS84,0.0106,0.01
10,0.0250,"0",1.000,0.058,33,33,33,25,00,00,30,33*9ea908f7

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	BESTGNSSPOS header	Header, see Standard ASCII	-	H	0
2	Sol Type	Solution status, see Table 4- 2 status	Enum	4	H
3	Pos Type	Position type, see Table 4- 3	Enum	4	H+4
4	Lat	Latitude (°)	Double	8	H+8
5	Lon	Longitude (°)	Double	8	H+16
6	Hgt	Height above mean sea level (m)	Double	8	H+24
7	Undulation	Undulation (m), the relationship between the geoid and the ellipsoid of the chosen datum	Float	4	H+32
8	Datum ID	Datum ID number	Enum	4	H+36
9	Lat σ	Latitude standard deviation (m)	Float	4	H+40
10	Lon σ	Longitude standard deviation (m)	Float	4	H+44
11	Hgt σ	Height standard deviation (m)	Float	4	H+48
12	Stn ID	Base station ID	Char[4]	4	H+52
13	Diff_age	Differential age (s)	Float	4	H+56
14	Sol_age	Solution age (s)	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17	#solnL1SVs	Number of satellites with L1/E1/B1 signals used in solution	Uchar	1	H+66
18	#solnMultiSVs	Number of satellites with multi-frequency signals used in solution	Uchar	1	H+67
19	Reserved	Reserved	Uchar	1	H+68
20	Ext sol stat	Extended solution status, seeTable 4- 4	Hex	1	H+69
21	Galileo and BeiDou sig mask	Galileo and BeiDou signal mask, see Table 4-5	Hex	1	H+70
22	GPS and GLONASS	GPS and GLONASS signal mask, see	Hex	1	H+71

	sig mask	Table 4- 5 GPS-GLONASS mask			
23	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+72
24	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.3 BESTUTM

This log contains the best position data computed by the receiver in UTM coordinates

消息 ID：726

推荐

LOG BESTUTMA ONTIME 1

ASCII 示例

#BESTUTMA,COM1,0,73.0,FINESTEERING,1419,336209.000,02000040,eb16,2724;SOL_COMPUTED,NARROW_INT,11,U,5666936.4417,707279.3875,1063.8401,-16.2712,WGS84,0.0135,0.0084,0.0173,"AAAA",1.000,0.000,8,8,8,8,0,01,0,03*a6d06321

说明

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	BESTUTM header	Header, see 2.1.2.1Standard ASCII Structure	-	H	0
2	Sol Status	Solution status, see Table 4- 2 Solution Status	Enum	4	H
3	Pos Type	Position type, see Table 4- 3 Position Status	Enum	4	H+4
4	Z#	Longitudinal zone number	Ulong	4	H+8
5	Zletter	Latitudinal zone letter	Ulong	4	H+12
6	Northing	Northing (m) where the origin is defined as the equator in the orthern hemisphere and as a point 10000000 metres south of	Double	8	H+16

		the equator in the southern hemisphere (that is, a 'false northing' of 10000000 m)			
7	Easting	Easting (m) where the origin is 500000 m west of the central meridian of each longitudinal zone (that is, a 'false easting' of 500000 m)	Double	8	H+24
8	Hgt	Height above mean sea level (m)	Double	8	H+32
9	Undulation	Undulation - the relationship between the geoid and the ellipsoid (m) of the chosen datum	Float	4	H+40
10	Datum ID	Datum ID number, 61 (WGS84) is fixed	Enum	4	H+44
11	N σ	Northing standard deviation (m)	Float	4	H+48
12	E σ	Easting standard deviation (m)	Float	4	H+52
13	Hgt σ	Height standard deviation (m)	Float	4	H+56
14	Stn ID	Base station ID	Char[4]	4	H+60
15	Diff_age	Differential age in seconds	Float	4	H+64
16	Sol_age	Solution age in seconds	Float	4	H+68
17	#SV	Number of satellites tracked	Uchar	1	H+72
18	#SolnSV	Number of satellite used in solution	Uchar	1	H+73
19	#GGL1	Number of GPS plus GLONASS plus BDS L1/B1 used in solution	Uchar	1	H+74
20	#SolnMultiSV	Number of satellites with L1/E1/B1 signals used in solution	Uchar	1	H+75
21	Reserved	Reserved	Uchar	1	H+76
22	Ext Sol Stat	Extended solution status, seeTable 4- 4 Extended Solution Status	Hex	1	H+77
23	Galileo & BDS Sig Mask	Galileo and BeiDou signals used mask, see Table 4- 5 Galileo and BDS Signal-Used Mask	Hex	1	H+78
24	GPS & GLONASS	GPS and GLONASS signals used	Hex	1	H+79

	Sig Mask	mask, see Table 4- 4 GPS and GLONASS Signal-Used Mask			
25	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	H+80
26	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

4.2.4 BESTGNSSVEL

Output best GNSS velocity (non-INS). It also outputs a speed status indicator to indicate whether the corresponding data is valid. The velocity measurement sometimes has a latency associated with it. The time of validity is the time tag in the log minus the latency value.

Message ID: 1430

Recommended

LOG Port BESTGNSSVELA ONTIME 1

ASCII Example

#BESTGNSSVELA,ICOM4,0,0.0,FINESTEERING,2109,367811.000,00000000,0000,82;SOL_COMPUTED,NARROW_INT,0.000,1.000,0.0086,148.677046,0.0586,0.0*2b4e3d94

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	BESTGNSSVEL header	Header, see Standard ASCII	-	H	0
2	Sol Status	Solution status, see Table 4- 2 status	Enum	4	H

3	Vel Type	Position type, see Table 4- 3	Enum	4	H+4
4	Latency	Latency	Float	4	H+8
5	Diff_age	Differential age (s)	Float	4	H+12
6	Hor Spd	Horizontal speed over ground (m/s)	Double	8	H+16
7	Trk Gnd	Angle between traveling direction and True North (°)	Double	8	H+24
8	Vert Spd	Vertical speed (m/s), A positive value indicates an increase in altitude (rise), a negative value indicates a decrease in altitude (fall).	Double	8	H+32
9	Reserved	Reserved	Float	4	H+40
10	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+44
11	[CR][LF]	Message terminator (ASCII only)		-	-

4.2.5 CORRIMUDATA*

Output the RAWIMU data corrected for gravity, the earth's rotation and estimated sensor errors. The values in this log are incremental values, accumulated over the logging interval (sample) of CORRIMUDATA. The output frequency is not adjustable, only ONNEW is supported according to the IMU output frequency.

Message ID: 812

Recommended

LOG Port CORRIMUDATAA ONNEW

ASCII Example

#CORRIMUDATAA,ICOM4,0,0.0,FINESTEERING,2106,444279.000,00000000,0000,68;2106,444279.000000000,-0.000002203,-0.000002203,-0.000000670,0.000005145,0.000102724,-0.000006268*b0429fcb

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	CORRIMUDATA header	Header, see Standard ASCII	-	H	0
2	Week	GNSS week	ULong	4	H+
3	Seconds into Week	GNSS seconds from week start	Double	8	H+4
4	PitchRate	About X-axis rotation (rad/sample)	Double	8	H+12
5	RollRate	About Y-axis rotation (rad/sample)	Double	8	H+20
6	YawRate	About Z-axis rotation (rad/sample)	Double	8	H+28
7	LateralAcc	INS Lateral Acceleration (along X-axis) (m/s/sample)	Double	8	H+36
8	LongitudinalAcc	INS Longitudinal Acceleration (along Y-axis) (m/s/sample)	Double	8	H+44
9	VerticalAcc	INS Vertical Acceleration (along Z-axis) (m/s/sample)	Double	8	H+52
10	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+56
11	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.6 CORRIMUDATAS*

Provide the RAWIMU data corrected for gravity, the earth's rotation and estimated sensor errors. The values in this log are incremental values, accumulated over the logging interval (sample) of CORRIMUDATA. The output frequency is not adjustable, only ONNEW is supported according to the IMU output frequency. (This log is the short header version of the CORRIMUDATA)

Message ID: 813

Recommended

LOG Port CORRIMUDATASA ONNEW

ASCII Example

%CORRIMUDATASA,2106,444370.000;2106,444370.000000000,-0.000002805,-0.000002805,-0.000008220,-0.000000018,0.000042498,-0.000013335*a0a3d8d6

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	CORRIMUDATAS header	Header, see Standard ASCII	-	H	0
2	Week	GNSS week	ULong	4	H+
3	Seconds into Week	GNSS seconds from week start	Double	8	H+4

4	PitchRate	About X-axis rotation (rad/sample)	Double	8	H+12
5	RollRate	About Y-axis rotation (rad/sample)	Double	8	H+20
6	YawRate	About Z-axis rotation (rad/sample)	Double	8	H+28
7	LateralAcc	INS Lateral Acceleration (along X-axis) (m/s/sample)	Double	8	H+36
8	LongitudinalAcc	INS Longitudinal Acceleration (along Y-axis) (m/s/sample)	Double	8	H+44
9	VerticalAcc	INS Vertical Acceleration (along Z-axis) (m/s/sample)	Double	8	H+52
10	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+56
11	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.7 HEADING

Output the heading information, which is the angle between the True North and the line vector (point from ANT1 to ANT2) in a clockwise direction.

Message ID: 971

Recommended

LOG HEADINGA ONTIME 1

ASCII Example

#HEADINGA,COM3,0,0,FINESTEERING,1975,394129.000,00000000,0000,113;SOL_COMPUTED,NARROW_INT,1.328605294,296.248487535, -71.075350314,0,0.200,0.500,"0000",29,24,29,7,00,00,10,01*63131FA1

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	HEADING header	Header, see Standard ASCII	-	H	0
2	sol stat	Solution status, see Table 4- 2 status	Enum	4	H
3	pos type	Heading status, see Table 4- 3	Enum	4	H+4
4	length	Heading baseline length (m)	Float	4	H+8
5	heading	Heading 0 ~ 360(°)	Float	4	H+12
6	pitch	Pitch: -90 ~ +90(°)	Float	4	H+16
7	Reserved	Reserved	Float	4	H+20
8	hdg std dev	Heading standard deviation (°)	Float	4	H+24
9	ptch std dev	Pitch standard deviation (°)	Float	4	H+28
10	stn ID	Station ID, it will be zero if it's not differential.	Char[4]	4	H+32
11	#SVs	Number of satellites tracked	Uchar	1	H+36
12	#solnSVs	Number of satellites used in heading	Uchar	1	H+37
13	#obs	Number of satellites above the elevation of the heading antenna	Uchar	1	H+38
14	#multi	Number of L2 satellites above the elevation of the heading antenna	Uchar	1	H+39
15	sol source	Solution source, see Table 4- 8	Hex	1	H+40
16	ext sol stat	Extended solution status, seeTable 4- 4	Uchar	1	H+41
17	Galileo and Be	Galileo and BeiDou signal mask, see Table 4-5	Hex	1	H+42

	iDou sig mask				
18	GPS and GLONASS sig mask	GPS and GLONASS signal mask, see Table 4- 5 GPS-GLONASS mask	Hex	1	H+43
19	xxxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+44
20	[CR][LF]	Message terminator (ASCII only)	-	-	-

Table 4- 8 Solution Source

Bit	Mask	Description
0-1	0x03	Reserved
2-3	0x0C	Solution source: 0 = primary antenna 1 = secondary antenna
4-7	0xF0	Reserved

4.2.8 HEADING2

Output the heading information, which is the angle between the True North and the line vector (point from ANT1 to ANT2) in a clockwise direction.

Message ID: 1335

Recommended

LOG HEADING2A ONTIME 1

ASCII Example

#HEADING2A,COM1,0,39.5,FINESTEERING,1622,422892.200,02040000,f9bf,6521;SOL_COMPUTED,NARROW_INT,0.927607417,178.347869873,-1.3037414550.0,0.261901051,0.391376048,"R222","AAAA",18,17,17,16,0,01,0,33*7be836f6

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	HEADING header	Header, see Standard ASCII	-	H	0
2	sol stat	Solution status, see Table 4- 2 status	Enum	4	H
3	pos type	Heading status, see Table 4- 3	Enum	4	H+4
4	length	Heading baseline length (m)	Float	4	H+8
5	heading	Heading 0 ~ 360(°)	Float	4	H+12
6	pitch	Pitch: -90 ~ +90(°)	Float	4	H+16
7	Reserved	Reserved	Float	4	H+20
8	hdg std dev	Heading standard deviation (°)	Float	4	H+24
9	ptch std dev	Pitch standard deviation (°)	Float	4	H+28
10	rover stn ID	Rover station ID	Char[4]	4	H+32
11	Master stn ID	Base station ID it will be zero if it's not differential.	Char[4]	4	H+36
12	#SVs	Number of satellites tracked	Uchar	1	H+40
13	#solnSVs	Number of satellites used in heading	Uchar	1	H+41
14	#obs	Number of satellites above the elevation of the	Uchar	1	H+42

		heading antenna			
15	#multi	Number of L2 satellites above the elevation of the heading antenna	Uchar	1	H+43
16	sol source	Solution source, see Table 4- 8	Hex	1	H+44
17	ext sol stat	Extended solution status, seeTable 4- 4	Uchar	1	H+45
18	Galileo and Bei Dou sig mask	Galileo and BeiDou signal mask, see Table 4-5	Hex	1	H+46
19	GPS and GLONASS sig mask	GPS and GLONASS signal mask, see Table 4- 5 GPS-GLONASS mask	Hex	1	H+47
20	xxxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+48
21	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.9 INSATT*

Output attitude. By default, the output attitude is IMU body frame with respect to the local level frame (ENU), unless you have defined a User output frame.

Message ID: 263

Recommended

LOG Port INSATTA ONTIME 1

ASCII Example

#INSATTA,ICOM4,0,0.0,FINESTEERING,2106,444520.000,00000000,0000,68;2106,444520.0000

00000,179.817646100,-0.384419858,0.601726410,INS_ALIGNMENT_COMPLETE*127e6ba7

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSATT header	Header, see Standard ASCII	-	H	0
2	Week	GNSS week	Ulong	4	H
3	Seconds into Week	Seconds into Week	Double	8	H+4
4	Roll	Roll (°)	Double	8	H+12
5	Pitch	Pitch (°)	Double	8	H+20
6	Azimuth	Azimuth (°)	Double	8	H+28
7	Status	INS solution status, see Table 4- 9	Enum	4	H+36
8	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+40
9	[CR][LF]	Message terminator (ASCII only)	-	-	-

Table 4- 9 INS status

Binary	ASCII	Description
0	INS_INACTIVE	Alignment not activated
1	INS_ALIGNING	In coarse alignment
2	INS_HIGH_VARIANCE	High covariance Attitude estimation not converged
3	INS_SOLUTION_GOOD	Alignment completed, good results

6	INS_SOLUTION_ FREE	Poor satellite signals, results not available
7	INS_ALIGNMENT_COMPLETE	Coarse alignment completed
8	DETERMINING_ORIENTATION	INS is determining the IMU axis aligned with gravity.
9	WAITING_INITIALPOS	Waiting for position
10	WAITING_AZIMUTH	Waiting for Azimuth
11	INITIALIZING_BIASES	The INS filter is estimating initial biases during the first 10 seconds of stationary data.
12	MOTION_ DETECT	The INS filter has not completely aligned, but has detected motion.

4.2.10 INSCALSTATUS*

Output the calibration status and estimated value.

Message ID: 1961

Recommended

LOG INSCALSTATUSA ONTIME 1

ASCII Example

#INSCALSTATUSA,ICOM4,0,0.0,FINESTEERING,2106,445650.000,00000000,0000,68;RBV,0.0000,

0.0000,0.0000,45.0000,45.0000,45.0000,INS_CONVERGING,0*d1c62c20

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSCALSTATUS	Header, see Standard ASCII	-	H	0

	header				
2	Offset Type	Offset value, see Table 4- 10	Enum	4	H
3	X Axis Offset	Offset of X-axis of IMU Body frame (m/°)	Float	4	H+4
4	Y Axis Offset	Offset of Y-axis of IMU Body frame (m/°)	Float	4	H+8
5	Z Axis Offset	Offset of Z-axis of IMU Body frame (m/°)	Float	4	H+12
6	X Uncertainty	Uncertainty of Z-axis of IMU Body frame (m/°)	Float	4	H+16
7	Y Uncertainty	Uncertainty of Z-axis of IMU Body frame (m/°)	Float	4	H+20
8	Z Uncertainty	Uncertainty of Z-axis of IMU Body frame (m/°)	Float	4	H+24
9	Source Status	Data source, see Table 4- 11	Enum	4	H+28
10	Calibration Count	Calibration count	Ulong	4	H+32
11	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+36
12	[CR][LF]	Message terminator (ASCII only)	-	-	-

Table 4- 10 Offset Type

Binary	ASCII	Description
1	ANT1	IMU to antenna lever arm
8	ALIGN	Align offset
11	RBV	IMU body to vehicle offset

Table 4- 11 Data source

Binary	ASCII	Description
1	FROM_NVM	Offset values originate from saved parameters in NVM
2	CALIBRATING	Offset values originate from a currently running calibration process
3	CALIBRATED	Offset values originate from a completed calibration process
4	FROM_ COMMAND	Offset values originate from a user command
5	RESET	Offset values originate from a system reset
6	FROM_DUAL_ ANT	Offset values originate from a dual antenna Align solution
7	INS_ CONVERGING	Offset values originate from initial input values. Calibration process on hold until INS solution is converged.。
8	INSUFFICIENT_ SPEED	Offset values originate from a currently running calibration process. Further estimation on hold due to insufficient speed.
9	HIGH_ ROTATION	Offset values originate from a currently running calibration process. Further estimation on hold due to high vehicle rotations.

4.2.11 INSPOS*

Output position in the WGS84 coordinate system, the default output point is the navigation center of the enclosure. If a user-defined output point is set, the output origin is the user-defined point.

Message ID: 265

Recommended

LOG Port INSPOSA ONTIME 1

ASCII Example

#INSPOSA,ICOM4,0,0.0,FINESTEERING,2107,34578.000,00000000,03de,68;2107,34578.000000

000,28.23317171539,112.87712332635,81.4569,INS_ALIGNMENT_COMPLETE*3070d086

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSPOS header	Header, see Standard ASCII	-	H	0
2	Week	GNSS week	Ulong	4	H
3	Seconds into Week	Seconds Into Week	Double	8	H+4
4	Lat	Latitude (°)	Double	8	H+12
5	Lon	Longitude (°)	Double	8	H+20
6	Hgt	Ellipsoid height (m)	Double	8	H+28
7	Status	INS solution status, see Table 4- 9	Enum	4	H+36
8	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+40
9	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.12 INSPTNLPJKS*

Output IMU data after correction of gravity, earth rotation and sensor error, as well as the inertial navigation results and plane coordinates after projection. For details about the parameter settings of projection, please refer to 2.2 PJKPARA.

Message ID: 0 (binary not supported)

Recommended

LOG Port INSPTNLPJKSA ONTIME 1

ASCII Example

%INSPTNLPJKSA,2140,543667.190;2140,543667.190,INS_ALIGNMENT_COMPLETE,NARROW_INT,0.004055394,-0.003153181,-0.006703759,0.000486768,-0.000326828,-0.000478564,28.23255921255,112.87499481423,87.4105,3125639.183,684048.808,70.367,0.000496535,0.003006558,0.000241381,114.633280830,179.502194734,0.016271861*c0b7c8ec

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSPTNLPJKSA header	Header, see Standard ASCII	-	H	0
2	Week	GNSS week	Ulong	4	H
3	Seconds into Week	Seconds Into Week	Double	8	H+4
4	Pos Type	Position type, see Table 4- 3	Ulong	4	H+12
5	INS Status	INS solution status, see Table 4- 9	Ulong	4	H+16
6	Accl_X	X-axis acceleration variation(m/s/sample)	Double	8	H+20
7	Accl_Y	Y-axis acceleration variation (m/s/sample)	Double	8	H+28
8	Accl_Z	Z-axis acceleration variation (m/s/sample)	Double	8	H+36
9	PitchRate	X-axis angle variation (rad/sample)	Double	8	H+44

10	RollRate	Y-axis angle variation (rad/sample)	Double	8	H+52
11	YawRate	Z-axis angle variation (rad/sample)	Double	8	H+60
12	Lat	Latitude (°)	Double	8	H+68
13	Lon	Longitude (°)	Double	8	H+76
14	Hgt	Height above sea level (m)	Double	8	H+84
15	Pos_X	Position X (m)	Double	8	H+92
16	Pos_Y	Position Y (m)	Double	8	H+100
17	Height	geodetic height (m)	Double	8	H+108
18	North Velocity	North velocity (m/s)	Double	8	H+116
19	East Velocity	East velocity (m/s)	Double	8	H+124
20	Down Velocity	Down velocity (m/s)	Double	8	H+132
21	Heading	Heading (°)	Double	8	H+140
22	Pitch	Pitch (°)	Double	8	H+148
23	Roll	Roll (°)	Double	8	H+156
24	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+160
25	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.13 INSPVA*

Output position, velocity and attitude.

Message ID: 507

Recommended

LOG Port INSPVAA ONTIME 1

ASCIIExample

#INSPVAA,ICOM4,0,0.0,FINESTEERING,2107,34642.000,00000000,03de,68;2107,34642.000000000,28.23317128813,112.87712303748,81.5374,-0.0060,-0.0437,0.0013,179.714439972,-0.352008098,1.265366582,INS_ALIGNMENT_COMPLETE*3d5a8ba9

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSPVA header	Header, see Standard ASCII	-	H	0
2	Week	GNSS week	Ulong	4	H
3	Seconds into Week	Seconds Into Week	Double	8	H+4
4	Lat	Latitude (°)	Double	8	H+12
5	Lon	Longitude (°)	Double	8	H+20
6	Hgt	Ellipsoid height (m)	Double	8	H+28
7	North Velocity	North velocity (m/s)	Double	8	H+36
8	East Velocity	East velocity (m/s)	Double	8	H+44
9	Up Velocity	Up velocity (m/s)	Double	8	H+52
10	Roll	Roll (°)	Double	8	H+60
11	Pitch	Pitch (°)	Double	8	H+68
12	Azimuth	Azimuth (°)	Double	8	H+76
13	Status	INS solution status, see Table 4- 9	Enum	4	H+84
14	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+88

15	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.14 INSPVAS*

Output position, velocity and attitude. (This log is the short header version of the **INSPVA**)

Message ID: 508

Recommended

LOG Port INSPVASA ONTIME 1

ASCIIExample

%INSPVASA,2107,34875.000;2107,34875.000000000,28.23316391985,112.87713071260,82.8079,-0.0024,-0.0307,0.0003,179.757726111,-0.376524653,1.046861519,INS_ALIGNMENT_COMPLETE*7adc4cb9

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSPVAS header	Header, see Standard ASCII	-	H	0
2	Week	GNSS week	Ulong	4	H
3	Seconds into Week	Seconds into Week	Double	8	H+4
4	Lat	Latitude (°)	Double	8	H+12

5	Lon	Longitude (°)	Double	8	H+20
6	Hgt	Ellipsoid height (m)	Double	8	H+28
7	North Velocity	North velocity (m/s)	Double	8	H+36
8	East Velocity	East velocity (m/s)	Double	8	H+44
9	Up Velocity	Up velocity (m/s)	Double	8	H+52
10	Roll	Roll (°)	Double	8	H+60
11	Pitch	Pitch (°)	Double	8	H+68
12	Azimuth	Azimuth (°)	Double	8	H+76
13	Status	INS solution status, see Table 4- 9	Enum	4	H+84
14	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+88
15	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.15 INSPVAX*

Output the same position, velocity and attitude with INSPVA, as well as the standard deviation.

Message ID: 1465

Recommended

LOG Port INSPVAXA ONTIME 1

ASCIIExample

#INSPVAXA,ICOM4,0,0.0,FINESTEERING,2107,35489.000,00000000,03de,68;INS_ALIGNMENT_COMPLETE,INS_RTKFIXED,28.23316396165,112.87713086609,82.7966,-17.0382,0.0020,-0.0191,

0.0006,179.789714292,-0.387541550,1.405962922,0.0240,0.0168,0.0218,0.0047,0.0049,0.005

4,0.0553,0.0553,1.0818,00000000,0*fd6e3a89

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSPVAX header	Header, see Standard ASCII	-	H	0
2	INS Status	INS solution status, see Table 4- 9	Enum	4	H
3	Pos Type	Position type, see Table 4- 3	Enum	4	H+4
4	Lat	Latitude (°)	Double	8	H+8
5	Lon	Longitude (°)	Double	8	H+16
6	Hgt	Height above mean sea level (m)	Double	8	H+24
7	Undulation	Undulation (m)	Float	4	H+32
8	North Velocity	North velocity (m/s)	Double	8	H+36
9	East Velocity	East velocity (m/s)	Double	8	H+44
10	Up Velocity	Up velocity (m/s)	Double	8	H+52
11	Roll	Roll (°)	Double	8	H+60
12	Pitch	Pitch (°)	Double	8	H+68
13	Azimuth	Azimuth (°)	Double	8	H+76
14	Lat σ	Latitude standard deviation	Float	4	H+84
15	Long σ	Longitude standard deviation	Float	4	H+88
16	Height σ	Ellipsoid height standard deviation	Float	4	H+92
17	North Vel σ	North velocity standard deviation	Float	4	H+96

18	East Vel σ	East velocity standard deviation	Float	4	H+100
19	Up Vel σ	Up velocity standard deviation	Float	4	H+104
20	Roll σ	Roll standard deviation	Float	4	H+108
21	Pitch σ	Pitch standard deviation	Float	4	H+112
22	Azimuth σ	Azimuth standard deviation	Float	4	H+116
23	Ext sol stat	Extended solution status, see Table 4- 12	Hex	4	H+120
24	Time Since Update	Time Since Last Update (s)	Ushort	2	H+124
25	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+126
26	[CR][LF]	Message terminator (ASCII only)	-	-	-

Table 4- 12 INS extended solution status

Nibble	Bit	Mask	Description	Range values
N0	0	0x00000001	Position update	0 = Unused 1 = Used
	1	0x00000002	Phase update	0 = Unused 1 = Used
	2	0x00000004	Zero velocity update	0 = Unused 1 = Used
	3	0x00000008	Wheel sensor update	0 = Unused 1 = Used
N1	4	0x00000010	ALIGN (heading) update	0 = Unused 1 = Used
	5	0x00000020	External position update	0 = Unused 1 = Used
	6	0x00000040	INS solution convergence mark	0 = Unused 1 = Used
	7	0x00000080	Doppler update	0 = Unused 1 = Used
N2	8	0x00000100	Pseudorange update	0 = Unused 1 = Used
	9	0x00000200	Velocity update	0 = Unused 1 = Used
	10	0x00000400	Reserved	--
	11	0x00000800	Dead reckoning update	0 = Unused 1 = Used
N3	12	0x00001000	Phase wind up update	0 = Unused 1 = Used
	13	0x00002000	Course over ground update	0 = Unused 1 = Used
	14	0x00004000	External velocity update	0 = Unused 1 = Used
	15	0x00008000	External attitude update	0 = Unused 1 = Used
N4	16	0x00010000	External heading update	0 = Unused 1 = Used
	17	0x00020000	External height update	0 = Unused 1 = Used
	18	0x00040000	Reserved	--
	19	0x00080000	Reserved	--
N5	20	0x00100000	Rover position update	0 = Unused 1 = Used
	21	0x00200000	Rover position update	0 = Non-RTK update

			type	1 = RTK integer update
	22	0x00400000	Reserved	--
	23	0x00800000	Reserved	--
N6	24	0x01000000	Turn on biases estimated	0 = Static turn-on biases not estimated (starting from zero) 1 = Static turn-on biases estimated
	25	0x02000000	Alignment direction verified	0 = Not verified 1 = Verified
	26	0x04000000	Alignment Indication 1	0 = Not set, 1 = Set, see below Table 4- 13 Alignment Indication
	27	0x08000000	Alignment Indication 2	0 = Not set, 1 = Set, see below Table 4- 14 Alignment Indication
N7	28	0x10000000	Alignment Indication 3	0 = Not set, 1 = Set, see below Table 4- 15 Alignment Indication
	29	0x20000000	NVM Seed Indication 1	0 = Not set, 1 = Set, see Table 4- 17 NVM Seed Indicator Description
	30	0x40000000	NVM Seed Indication 2	0 = Not set, 1 = Set, see Table 4- 17 NVM Seed Indicator Description

	31	0x80000000	NVM Seed Indication 3	0 = Not set, 1 = Set, see Table 4- 17 NVM Seed Indicator Description

Table 4- 16 Alignment Indication

Bits 26-28 Values	Hex Values	Completed Alignment Type
000	0x00	Incomplete Alignment
001	0x01	Static
010	0x02	Kinematic
011	0x03	Dual Antenna
100	0x04	User Command
101	0x05	NVM Seed

Table 4- 17 NVM Seed Indicator Description

Bits 29-31 Values	Hex Values	Completed Alignment Type
000	0x00	NVM Seed Inactive
001	0x01	Seed stored in NVM is invalid
010	0x02	NVM Seed failed validation check
011	0x03	NVM Seed is pending validation (awaiting GNSS)
100	0x04	NVM Seed Injected (includes error model data)
101	0x05	NVM Seed data ignored due to a user-commanded filter reset or configuration change
110	0x06	NVM Seed error model data injected

4.2.16 INSSPD*

Output velocity in horizontal and vertical directions.

Message ID: 266

Recommended

LOG Port INSSPDA ONTIME 1

ASCIIExample

#INSSPDA,ICOM4,0,0.0,FINESTEERING,2107,37106.000,00000000,0000,68;2107,37106.0000

00000,5.233402789,0.014530860,-0.000531521,INS_ALIGNMENT_COMPLETE*4ac6a980

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSSPD header	Header, see Standard ASCII	-	H	0
2	Week	GNSS week	Ulong	4	H
3	Seconds into Week	Seconds into Week	Double	8	H+4
4	Trk Gnd	Actual direction of motion over ground (track over ground) with respect to True North (°)	Double	8	H+12
5	Horizontal Speed	Horizontal Speed (m/s)	Double	8	H+20

6	Vertical Speed	Vertical Speed (m/s)	Double	8	H+28
7	Status	INS solution status, see Table 4- 9	Enum	4	H+36
8	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+40
9	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.17 INSSTDEV*

Output the standard deviation of INS position, velocity and attitude.

Message ID: 2051

Recommended

LOG Port INSSTDEVA ONTIME 1

ASCIIExample

#INSSTDEVA,ICOM4,0,0.0,FINESTEERING,2107,37213.000,00000000,0000,68;0.0239,0.0168,0.0220,0.0068,0.0067,0.0057,0.0497,0.0497,1.0741,00000000,0,0,00bffbbf,0*c607c0d6

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSSTDEV header	Header, see Standard ASCII	-	H	0
2	Lat σ	Latitude standard deviation (m)	Float	4	H
3	Lon σ	Longitude standard deviation (m)	Float	4	H+4

4	Hgt σ	Height standard deviation (m)	Float	4	H+8
5	North Velocity σ	North velocity standard deviation (m/s)	Float	4	H+12
6	East Velocity σ	East velocity standard deviation (m/s)	Float	4	H+16
7	Up Velocity σ	Up velocity standard deviation (m/s)	Float	4	H+20
8	Roll σ	Roll standard deviation (°)	Float	4	H+24
9	Pitch σ	Pitch standard deviation (°)	Float	4	H+28
10	Azimuth σ	Azimuth standard deviation (°)	Float	4	H+32
11	Ext sol stat	Extended solution status, see Table 4- 12	Ulong	4	H+36
12	Time Since Update	Elapsed time since the last ZUPT or position update (seconds)	Ushort	2	H+40
13	Reserved	Reserved	Ushort	2	H+42
14	Reserved	Reserved	Ulong	4	H+44
15	Reserved	Reserved	Ulong	4	H+48
16	xxxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+52
17	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.18 INSVEL*

Output velocity in the Local Level frame (ENU).

Message ID: 267

Recommended

LOG Port INSVELA ONTIME 1

ASCIIExample

#INSVELA,ICOM4,0,0.0,FINESTEERING,2107,37289.000,00000000,0000,68;2107,37289.00000

0000,0.0099,-0.0082,-0.0014,INS_ALIGNMENT_COMPLETE*7c7a85fb

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSVEL header	Header, see Standard ASCII	-	H	0
2	Week	GNSS week	Ulong	4	H
3	Seconds into Week	Seconds Into Week	Double	8	H+4
4	North Velocity	North velocity (m/s)	Double	8	H+12
5	East Velocity	East velocity (m/s)	Double	8	H+20
6	Up Velocity	Up velocity (m/s)	Double	8	H+28
7	Status	INS solution status, see Table 4- 9	Enum	4	H+36
8	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+40
9	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.19 IONUTC

This log contains the Ionospheric Model parameters (ION) and the Universal Time Coordinated parameters (UTC).

Message ID: 8

Recommended

LOG IONUTCA ONTIME 1

ASCII Example

#IONUTCA,COM3,0,97.2,FINESTEERING,2223,283558.000,00000000,0000,769;1.3038516044

61670e-08,2.235174179077148e-08,-5.960464477539063e-08,-1.192092895507813e-07,1.

064960000000000e+05,1.310720000000000e+05,-6.553600000000000e+04,-2.621440000000000e+05,2223,405504,-2.7939677238464400e-09,-1.243449788e-14,2185,7,18,18,0*ed49f7a2

Description

ID	Format	Description	Binary Format	Binary Bytes	Binary Offset
1	IONUTC header	Header, see 2.1.2.1Standard ASCII Structure	-	H	0
2	a0	Alpha parameter constant term	Double	8	H
3	a1	Alpha parameter 1st order term	Double	8	H+8
4	a2	Alpha parameter 2nd order term	Double	8	H+16
5	a3	Alpha parameter 3rd order term	Double	8	H+24
6	b0	Beta parameter constant term	Double	8	H+32
7	b1	Beta parameter 1st order term	Double	8	H+40
8	b2	Beta parameter 2nd order term	Double	8	H+48
9	b3	Beta parameter 3rd order term	Double	8	H+56
10	utc wn	UTC reference week number	Ulong	4	H+64
11	tot	Reference time of UTC parameters	Ulong	4	H+68
12	A0	UTC constant term of polynomial	Double	8	H+72
13	A1	UTC 1st order term of polynomial	Double	8	H+80
14	wn lsf	Future week number	Ulong	4	H+88
15	dn	Day number (the range is 1 to 7 where Sunday = 1 and Saturday = 7)	Ulong	4	H+92
16	deltat ls	Delta time due to leap seconds	Long	4	H+96
17	deltat lsf	Future delta time due to leap seconds	Long	4	H+100
18	Reserved	Reserved	-	4	H+104
19	xxxx	32-bit CRC, see Table 4-6 32-CRC check code (C)	Hex	4	H+108
20	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.2.20 MARKTIME,MARK2TIME

Mark the EVENT_IN time.

MARKTIME: to mark IMU Data Ready time (invalid output);

MARK2TIME: to mark external trigger EVENT_IN time.

Message ID: 231 (MARKTIME) , 616 (MARK2TIME)

Recommended

LOG Port MARKTIMEA ONNEW

LOG Port MARK2TIMEA ONNEW

ASCIIExample

#MARK2TIMEA,ICOM4,0,0.0,FINESTEERING,2107,37368.803,00000000,0000,68;2107,37368.803115213,0.000000000e+00,0.000000000e+00,0.000000000,VALID*1a85cfb5

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	MARKTIME/ MARK2TIME header	Header, see Standard ASCII	-	H	0
2	Week	GPS reference week	Long	4	H
3	Seconds	Seconds of Week measured by the internal clock of the device	Double	8	H+4
4	Offset	Device clock offset (s), GPS time =GPS reference time - clock offset	Double	8	H+12
5	Offset std	Clock offset standard deviation	Double	8	H+20
6	UTC Offset	UTC time = GPS reference time - clock offset + UTC offset	Double	8	H+28
7	Status	Clock status, seeTable 4- 18 Clock Model Status	Enum	4	H+36
9	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Ulong	4	H+40
10	[CR][LF]	Message terminator (ASCII only)	-	-	-

Table 4- 18 Clock Model Status

Clock status(Binary)	Clock status (ASCII)	Description
0	VALID	The clock model is valid
1	CONVERGING	The clock model is near validity
2	ITERATING	The clock model is iterating towards validity
3	INVALID	The clock model is not valid

4.2.21 PSRVEL

In the PSRVEL log the actual speed and direction of the receiver antenna over ground is provided. The velocity measurements sometimes have a latency associated with them. The time of validity is the time tag in the log minus the latency value.

The velocity in the PSRVEL log is determined by the pseudo-range filter. Velocities from the pseudo-range filter are calculated from the Doppler.

The velocity status indicates varying degrees of velocity quality. To ensure healthy velocity, the velocity sol-status must also be checked. If the sol-status is non-zero, the velocity is likely invalid. It should be noted that the receiver does not determine the direction a vessel, craft, or vehicle is pointed (heading), but rather the direction of the motion of the GPS antenna relative to the ground.

The latency of the instantaneous Doppler velocity is always 0.15 s. The latency represents an estimate of the delay caused by the tracking loops under acceleration of approximately 1g. For most users, the latency can be assumed to be zero (instantaneous velocity).

Message ID: 100

Recommended

LOG Port PSRVELA ONTIME 1

ASCII Example

#PSRVELA,COM3,0,98.1,FINESTEERING,2149,348230.000,00000000,0000,757;SOL_COMPUTED,NARROW_INT,0.000,0.000,0.0012,60.835538,0.0057,0*a0039781

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	PSRVELA header	Header, see 2.1.2.1Standard ASCII Structure	-	H	0
2	Sol Status	Solution status, see Table 4- 2 Solution Status	Enum	4	H
3	Vel Type	Position type, see Table 4- 3 Position Status	Enum	4	H+4
4	Latency	A measure of the latency in the velocity time tag in seconds.	Float	4	H+8
5	Diff_age	Differential age in seconds	Float	4	H+12
6	Hor Spd	Horizontal speed over ground (m/s)	Double	8	H+16
7	Trk Gnd	Actual direction of motion over ground (track over ground) with respect to True North (0°~360°)	Double	8	H+24
8	Vert Spd	Vertical speed, in metres per second, where positive values indicate increasing altitude (up) and negative values indicate decreasing altitude (down)	Double	8	H+32
9	Reserved	Reserved	Float	4	H+40
10	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+44
11	[CR][LF]	Message terminator (ASCII only)		-	-

4.2.22 RAWIMU*

Provide the IMU raw observation data, and the reference origin is the enclosure navigation center. The output frequency is not adjustable, only supports ONNEW, in accordance with the IMU update rate.

Message ID: 268

Recommended

LOG Port RAWIMUA ONNEW

ASCIIExample

#RAWIMUA,ICOM4,0,0.0,FINESTEERING,2107,37454.000,00000000,0000,68;2107,37454.000000000,00000000,-2116037,15254,-3991,1707,2161,3258*ab408b44

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	RAWIMU header	Header, see Standard ASCII	-	H	0
2	Week	GNSS week	Ulong	4	H
3	Seconds into Week	Seconds Into Week	Double	8	H+4
4	IMU Status	IMU status	Hex Ulong	4	H+12
5	Z Accel	Z-axis acceleration variation*	Long	4	H+16
6	-Y Accel	-Y-axis acceleration variation*	Long	4	H+20

7	X Accel	X-axis acceleration variation*	Long	4	H+24
8	Z Gyro	Z-axis angle variation*	Long	4	H+28
9	-Y Gyro	-Y-axis angle variation*	Long	4	H+32
10	X Gyro	X-axis angle variation*	Long	4	H+36
11	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+40
12	[CR][LF]	Message terminator (ASCII only)	-	-	-

*unit: LSB (Least Significant Bit), conversion scale factor related with IMU model. SeeTable 4- 19 IMU raw data conversion factor.

Table 4- 19 IMU raw data conversion factor

Device	IMU	Conversion coefficient	Freq.	Scale factor
X1-3 /A1-3	Gyro	3.35276126861572e-05 °/s/LSB	100Hz	3.35276126861572e-07 °/LSB
	Accel	4.65661287307739e-06 m/s2/LSB		4.65661287307739e-08 m/s/LSB
X1-5 /A1-5	Gyro	3.0517578125e-05 °/s/LSB	125Hz	2.44140625e-07 °/LSB
	Accel	3.74094009399414e-06 m/s2/LSB		2.99275207519531e-08 m/s/LSB
X1-6 /A1-6	Gyro	2.88991928100586e-05 °/s/LSB	125Hz	2.31193542480469e-07 °/LSB
	Accel	7.48188018798828e-06 m/s2/LSB		5.98550415039063e-08 m/s/LSB

4.2.23 RAWIMUS*

Provide IMU raw observation data, and some additional information beside RAWIMU, and the reference origin is the enclosure navigation center. The output frequency is

not adjustable, only supports ONNEW, in accordance with the IMU update rate. (Note that the log header is the short version of RAWIMU.)

Message ID: 325

Recommended

LOG Port RAWIMUSA ONNEW

ASCII Example

%RAWIMUSA,2107,37564.000;2107,37564.000000000,00000000,-2111774,15617,-4719,2939,635,1057*03104a49

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	RAWIMUS header	Short header, see 2.1.2.2Abbreviated ASCII	-	H	0
2	Week	GNSS week	Ulong	4	H
3	Seconds into Week	Seconds Into Week	Double	8	H+4
4	IMU Status	IMU status, by default, 0	Hex Ulong	4	H+12
5	Z Accel	Z-axis acceleration variation*	Long	4	H+16
6	-Y Accel	-Y-axis acceleration variation*	Long	4	H+20
7	X Accel	X-axis acceleration variation*	Long	4	H+24

8	Z Gyro	Z-axis angle variation*	Long	4	H+28
9	-Y Gyro	-Y-axis angle variation*	Long	4	H+32
10	X Gyro	X-axis angle variation*	Long	4	H+36
11	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+40
12	[CR][LF]	Message terminator (ASCII only)	-	-	-

*unit: LSB (Least Significant Bit), conversion scale factor related with IMU model. See table 4 15 IMU raw data conversion factor.

4.2.24 RAWIMUSX*

Provide extended IMU raw observation data, and some additional information beside RAWIMU, and the reference origin is the enclosure navigation center. The output frequency is not adjustable, only supports ONNEW, in accordance with the IMU update rate. (Note that the log header is the short version of RAWIMUX)

Message ID: 1462

Recommended

LOG Port RAWIMUSXA ONNEW

ASCIIExample

%RAWIMUSXA,2107,37676.000;00,3,2107,37676.000000000,00000000,-2106390,13697,-5780,3624,1446,1426*6ae4f31b

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	RAWIMUSX header	Short header, see 2.1.2.2Abbreviated ASCII	-	H	0
2	Imu Info	IMU data: Bit 0: 1 means IMU error Bit1: 1 means IMU encrypted and cannot be used. Bit2-7: reserved	Hex	1	H
3	Imu Type	IMU type, seeTable 4- 20 IMU	Uchar	1	H+1
4	Week	GNSS week	UShort	2	H+2
5	Seconds into Week	Seconds Into Week	Double	8	H+4
6	IMU Status	IMU status, by default 0	Hex Ulong	4	H+12
7	Z Accel	Z-axis acceleration variation*	Long	4	H+16
8	-Y Accel	-Y-axis acceleration variation*	Long	4	H+20
9	X Accel	X-axis acceleration variation*	Long	4	H+24
10	Z Gyro	Z-axis angle variation*	Long	4	H+28
11	-Y Gyro	-Y-axis angle variation*	Long	4	H+32
12	X Gyro	X-axis angle variation*	Long	4	H+36
13	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+40
14	[CR][LF]	Message terminator (ASCII only)	-	-	-

Table 4- 20 IMU Type

Binary	ASCII	Model	IMU Type
3	3	X1-3/A1-3	ADIS 16505
4	4	X1-4/A1-4	TDK IIM-46234
5	5	X1-5/A1-5	EPSON_G354
6	6	X1-6/A1-6	EPSON_G365
7	7	X1-7/A1-7	EPSON_G370

*unit: LSB (Least Significant Bit), conversion scale factor related with IMU model. See table 4 15 IMU raw data conversion factor.

4.2.25 RAWIMUX*

Provide extended IMU raw observation data, and some additional information beside RAWIMU, and the reference origin is the enclosure navigation center. The output frequency is not adjustable, only supports ONNEW, in accordance with the IMU update rate.

Message ID: 1461

Recommended

LOG Port RAWIMUXA ONNEW

ASCIIExample

#RAWIMUXA,ICOM4,0,0.0,FINESTEERING,2107,37613.000,00000000,0000,68;00,3,2107,37613.000000000,00000000,-2106169,13714,-5559,3570,1638,1782*9d84ce36

Description

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	RAWIMUX header	Header, see Standard ASCII	-	H	0
2	Imu Info	IMU data: Bit 0: 1 means IMU error Bit1: 1 means IMU encrypted and cannot be used. Bit2-7: reserved	Hex	1	H
3	Imu Type	IMU type, seeTable 4- 20 IMU	Uchar	1	H+1
4	Week	GNSS week	UShort	2	H+2
5	Seconds into Week	Seconds Into Week	Double	8	H+4
6	IMU Status	IMU status, by default 0	Hex Ulong	4	H+12
7	Z Accel	Z-axis acceleration variation*	Long	4	H+16
8	-Y Accel	-Y-axis acceleration variation*	Long	4	H+20
9	X Accel	X-axis acceleration variation*	Long	4	H+24
10	Z Gyro	Z-axis angle variation*	Long	4	H+28
11	-Y Gyro	-Y-axis angle variation*	Long	4	H+32
12	X Gyro	X-axis angle variation*	Long	4	H+36
13	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+40

14	[CR][LF]	Message terminator (ASCII only)	-	-	-

*unit: LSB (Least Significant Bit), conversion scale factor related with IMU model. See table 4 15 IMU raw data conversion factor.

4.2.26 TRACKSTAT

The TRACKSTAT log contains an entry for each channel. If there are multiple signal channels for one satellite, then there will be multiple entries for that satellite.

For dual antenna receivers, a TRACKSTAT_1 log can be requested to get TRACKSTAT data from the second antenna.

For base station, a TRACKSTAT_2 log can be requested to get TRACKSTAT data from the base station.

To request an ASCII log enter TRACKSTATA_1 and for a binary log enter TRACKSTATB_1.

Message ID: 83

Recommended Input:

LOG TRACKSTATA ONTIME 1

ASCII Example:

#TRACKSTATA,COM1,0,49.5,FINESTEERING,1337,410139.000,02000000,457c,1984;SOL_COMPUTED,PSRDIFF,5.0,30,1,0,18109c04,21836080.582,-2241.711,50.087,1158.652,0.722,GOOD,0.973,1,0,11309c0b,21836083.168,-1746.788,42.616,1141.780,0.000,OBSL2,0.000,30,0,18109c24,24248449.644,-2588.133,45.237,939.380,-0.493,GOOD,0.519,30,0,11309c2b,24248452.842,-2016.730,38.934,939.370,0.000,OBSL2,0.000,...14,0,18109da4,24747286.206,-3236.906,46.650,1121.760,-0.609,GOOD,0.514,14,0,11309dab,24747288.764,-2522.270,35.557,1

116.380,0.000,OBSL2,0.000,0,0,0c0221c0,0.000,0.000,0.047,0.000,0.000,NA,0.000,0,0,0c02

21e0,0.000,0.000,0.047,0.000,0.000,NA,0.000*255a732e

Description

Field	Field Type	Description	Format	Binary Bytes	Binary Offset
1	TRACKSTAT header.	Log header. See Messages on page 30 for more information		H	0
2	sol status	Solution status (see Table 79: Solution Status on page 446)	Enum	4	H
3	pos type	Position type (see Table 80: Position or Velocity Type on page 447	Enum	4	H+4
4	cutoff	GPS tracking elevation cut-off angle	Float	4	H+8
5	#chans	Number of hardware channels with information to follow	Ulong	4	H+12
6	PRN/slot	Satellite PRN number of range measurement Refer to PRN Numbers on page 49	Short	2	H+16
7	glofreq	(GLONASS Frequency + 7) see GLONASS Slot and Frequency Numbers on page 48	Short	2	H+18
8	ch-tr-status	Channel tracking status (see Table 145: Channel Tracking Status on page 717)	Ulong	4	H+20
9	psr	Pseudorange (m) - if this field is zero but the channel tracking status in the previous field indicates that the card is phase locked and code locked the pseudorange has not been calculated yet	Double	8	H+24
10	Doppler	Doppler frequency (Hz)	Float	4	H+32
11	C/No	Carrier to noise density ratio (dB-Hz)	Float	4	H+36
12	locktime	Number of seconds of continuous tracking (no cycle slips)	Float	4	H+40
13	psr res	Pseudorange residual from pseudorange filter (m)	Float	4	H+44
14	reject	Range reject code from pseudorange filter (see Table 85: Observation	Enum	4	H+48

		Statuses on page 452)			
15	psr weight	Pseudorange filter weighting	Float	4	H+52
16...	Next PRN offset =H+16+(#chans x 40)				
17	xxxx	32-bit CRC (ASCII and Binary only)	Ulong	4	H+16 (#chans x 40)
18	[CR][LF]	Sentence terminator (ASCII only)			

4.3 Query configuration

4.3.1 AUTHORIZATION

Output authorization information.

Format:

LOG AUTHORIZATION ONCE

Example:

AuthStr: 3745523D74C21D0DB7410D0B071AB2C8;

AuthMode: C1-8D;

Authorization: Permanent License;

InsEnable: FALSE;

DualAntEnable: TRUE;

RawOutEnable: TRUE;

AssistEnable: FALSE;

OdoEnable: FALSE;

MaxInsFreq: 125;

MaxRTKFreq: 5;

FrqMask: B1IB2IB1CB2AB2BL1L1CL2CL2PG1G2E1E5BE5A;

NavSys: GPS GLONASS GALILEO BEIDOU QZSS;

Description:

ID	Example	Description
1	AuthStr: 3745523D74C21D0DB7410D0B071AB2C8;	AuthStr: authorization code
2	AuthMode: C1-8D;	AuthMode: receiver model
3	Authorization: Permanent License;	AuthWeek: Valid period (GPS WEEK)
4	InsEnable: FALSE;	InsEnable: INS status
5	DualAntEnable: TRUE;	DualAntEnable: dual antenna status
6	RawOutEnable: TRUE;	RawOutEnable: Raw data output
7	AssistEnable: FALSE;	AssistEnable: INS assistance (selfcheck, lever arm, RBV)
8	OdoEnable: FALSE;	OdoEnable: odometer status
9	MaxInsFreq: 125;	MaxInsFreq: Max. INS output freq.
10	MaxRTKFreq: 5;	MaxRTKFreq: Max. RTK output freq.
11	FrqMask:B1IB2IB1CB2AB2BL1L1CL2CL2PG1G2E1E5BE5A;	FrqMask: satellite frequency
12	NavSys: GPS GLONASS GALILEO BEIDOU QZSS;	NavSys: navigation system

4.3.2 BYCHECK

GNSS self-check.

Format:

LOG BYCHECKA ONTIME 5

Example:

#BYCHECKA,ICOM1,0,0.0,FINESTEERING,2106,129959.200,00000000,0000,65;1502,2106,129959.200,1,1,1,1,1,1,1,1,1,1*e120f355

Description:

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	BYCHECK header	Header, see Standard ASCII		H	0
2	Runtime	Receiver runtime, unit: s	Ulong	4	H
3	Week	GPS week	Ulong	4	H+4
4	Sow	Second of week	Double	4	H+8
5	Dual Frequency	Support dual frequency or not*	Ulong	4	H+12
6	Detection Voltage	Antenna power feed*	Ulong	4	H+16
7	Glo Frequency Diff	GLONASS bias corrected*	Ulong	4	H+20
8	Work Frequency	Work frequency match*	Ulong	4	H+24
9	Base Station Position	Base position received*	Ulong	4	H+38
10	Base Antenna Block	Base antenna blocked*	Ulong	4	H+32
11	Diff Link	Correction data link is stable*	Ulong	4	H+36
12	Dual Base	Multiple base*	Ulong	4	H+40
13	Board Temperature	Board Temperature *	Ulong	4	H+44

14	Rover Block	Rover antenna blocked*	Ulong	4	H+48
15	xxxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+52
16	[CR][LF]	Message terminator (ASCII only)			

*0: No, 1: Yes; 2: Unknow

4.3.3 BYCONFIG

Output system information.

Format:

LOG Port BYCONFIGA ONTIME 1

Example:

#BYCONFIG,ICOM1,0,0.0,FINESTEERING,2105,565387.000,00000000,0000,64;1606.277,0A0A473C44242E10B9EBEB718777B7A3,2105,55.412,rover*f275111e

Description:

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	BYCONFIG header	Header, see Standard ASCII	-	H	0
2	Runtime Seconds	System run time	Double	8	H
3	DNA	DNA	Uchar*32	1*16	H+8

4	Authorization Gpsweek	Authorization GPS week	Ulong	4	H+24
5	Temperature	System temperature	Double	8	H+28
6	Workmode	Work mode (1-rover, 2-base)	Ulong	4	H+36
7	xxxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+52
8	[CR][LF]	Message terminator (ASCII only)			

4.3.4 CCOMCONFIG

Output CAN configuration.

Format:

LOG CCOMCONFIG ONCE

Example:

```
CCOM1 NODE1   J1939   126720   7   FE   IN:NONE      OUT:NONE
CCOM2 NONE    NONE       0     0   0    IN:NONE      OUT:NONE
CCOM3 NONE    NONE       0     0   0    IN:NONE      OUT:NONE
CCOM4 NONE    NONE       0     0   0    IN:NONE      OUT:NONE
```

Description:

ID	Example	Format	Description
1	CCOM1	[PORT]	Port number, can be CCOM1, CCOM2, CCOM3, CCOM4
2	NODE1	[NODE]	Node
3	J1939	[PROTOCOL]	Protocol

4	126720	[PGN]	PGN
5	7	[PRIORITY]	Priority
6	FE	[ADDRESS]	Address
7	IN:NONE	[IN:FORMAT]	Input format: can be RTCM, BYNAV, NONE, FPGA, LOG, AUTO, refer INTERFACEMODE
8	OUT:NONE	[OUT:FORMAT]	Output format: can be RTCM, BYNAV, NONE, FPGA, LOG, AUTO, refer INTERFACEMODE

4.3.5 COMCONFIG

Output serial configuration.

Format:

LOG COMCONFIG

Example:

COM1 115200 N 8 1 IN:RTCM OUT:RTCM

COM2 460800 N 8 1 IN:BYNAV OUT:BYNAV

Description:

ID	Example	Format	Description
1	COM1	Port	Serial port number, can be COM1, COM2
2	115200	Baudrate	Baudrate
3	N	Parity	Parity: ‘N’- no parity; ‘O’- odd parity; ‘E’- even parity
4	8	Databit	Databit, can be 7, 8
5	1	Stopbit	Stopbit, can be 1, 2

6	IN:RTCM	IN:FORMAT	Input format: can be RTCM, BYNAV, NONE, FPGA, LOG, AUTO, refer INTERFACEMODE
7	OUT:RTCM	OUT:FORMAT	Output format: can be RTCM, BYNAV, NONE, FPGA, LOG, AUTO, refer INTERFACEMODE

4.3.6 FLASHDNA

Output the flash DNA.

Format:

LOG FLASHDNA ONCE

Example:

FlashDNA:0000000000EF6018D46888950B163E39;UniqueID:

0000000000EF6018D46888950B163E39; 0

Description:

ID	Example	Format	Description
1	FlashDNA	FlashDNA	Header
2	0000000000EF6018D46888950B163E39	[FLASHDNA]	Flash DNA
3	UniqueID	UniqueID	ID header
4	0000000000EF6018D46888950B163E39	[UNIQUEID]	ID
5	0	[AUTH EXPIRATION]	Expiration: 0-not expired, 1-expired

4.3.7 FLASHDNAA

Output the flash DNA. (no binary format)

Format:

LOG FLASHDNAA ONCE

Example:

#FLASHDNAA,COM3,0,99.8,FINESTEERING,2146,110330.000,00000000,0000,754;00000

00000EF6018D469085293122F39,3130303133DD5120E459316193122F39,0*4c3b62b4

Description:

ID	Field	Description
1	FLASHDNAA header	Header, see Standard ASCII
2	FLASHDNA	FLASHDNA
3	UNIQUEID	ID
4	AuthState	Authorization status (0-valid, 1-expired)
5	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)
6	[CR][LF]	Message terminator (ASCII only)

4.3.8 ICOMCONFIG

Output ethernet port configuration

Format:

LOG ICOMCONFIG ONCE

Example:

ICOM1 TCP :1111 IN:AUTO OUT:AUTO

ICOM2 TCP :2222 IN: AUTO OUT: AUTO

ICOM3 TCP :3333 IN: AUTO OUT: AUTO

ICOM4 TCP :4444 IN: AUTO OUT: AUTO

Description:

ID	Example	Format	Description	
1	ICOM1	Port	Ethernet port, can be ICOM1, ICOM2, ICOM3, ICOM4	
2	TCP	Protocol	DISABLED	Ethernet disabled
3			TCP	Use TCP
4			UDP	Use UDP
5	:1111	Host:Port	Host: port number. If the host field is blank, the receiver works as a server to monitor the port number; if not blank, the receiver works as client to connect actively to the address	
6	IN: AUTO	IN:FORMAT	Input format: can be RTCM, BYNAV, NONE, FPGA, LOG, AUTO, refer INTERFACEMODE	
7	OUT: AUTO	OUT:FORMAT	Output format: can be RTCM, BYNAV, NONE, FPGA, LOG, AUTO, refer INTERFACEMODE	

4.3.9 INSCONFIG*

Ouptut INS configuration

4.3.9.1 Simplified Format

Format:

LOG INSCONFIG

Example:

<INSCONFIG ICOM4 0 90.7 FINESTEERING 2131 450079.920 00000000 0000 741

< IMU-3 0 10 0 LAND 0000021f AUTOMATIC ROVER FALSE 00000000 0 0

< 0 0 0 0 0 0 0

< 3

< ANT1 VEHICLE 0.1000 -0.3800 0.1600 0.0500 0.0500 0.0500 FROM_COMMAND

< ANT2 VEHICLE 0.1000 0.3700 0.1600 0.0500 0.0500 0.0500 FROM_COMMAND

< USER VEHICLE 0.1000 -0.3800 0.1600 0.0000 0.0000 0.0000 FROM_COMMAND

< 2

< RBV IMUBODY 0.000000000 0.000000000 0.000000000 0.0500 0.0500 0.0500 FROM_COMMAND

USER IMUBODY 0.000000000 0.000000000 0.000000000 0.0000 0.0000 0.0000 FROM_NVM

Description:

ID	Example	Format	Description
1	<INSCONFIG ICOM4 0 90.7 FINESTEERING 2131 450079.920 00000000 0000 741	INSCONFIG header	Header, see Standard ASCII
2	IMU-3	IMU Type	IMU type, seeTable 4- 20 IMU

3	0	Mapping	Mapping/orientation
4	10	Initial Alignment Velocity	Min. alignment velocity set by user
5	0	Heave Window	Heave window (s)
6	LAND	Profile	INS profile, see 0Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH. SETINSPROFILE*
7	0000021f	Enabled Updates	Enabled Updates
8	AUTOMATIC	Alignment Mode	Alignment mode, see Table 4- 21 System Alignment Mode
9	ROVER	Relative INS Output Frame	The user specified output frame of the Relative INS Vector, seeTable 4- 22 User specified output frame and direction of relative INS vector
10	FALSE	Relative INS Output Direction	The user specified output direction of the Relative INS Vector, seeTable 4- 22 User specified output frame and direction of relative INS vector
11	00000000	INS Receiver Status	INS receiver status: First (lower) byte- INS reset, as described by INSResetEnum Second byte- =0x01, IMUcommunication error =0x00, normal

			=other, reserved Upper 2 bytes-reserved
12	0	Reserved	Reserved
13	0	Reserved	Reserved
14	0	Reserved	Reserved
15	0	Reserved	Reserved
16	0	Reserved	Reserved
17	0	Reserved	Reserved
18	0	Reserved	Reserved
19	0	Reserved	Reserved
20	0	Reserved	Reserved
21	3	Number of Translations	Number of Translations
22	ANT1	Translation	Translation type, see Table 4- 23 Translation offset
23	VEHICLE	Frame	Frame of translation (IMUBODY or VEHICLE)
24	0.1000	X Offset	X-axis offset (m)
25	-0.3800	Y Offset	Y-axis offset (m)
26	0.1600	Z Offset	Z-axis offset (m)
27	0.0500	X Uncertainty	X-axis uncertainty (m)
28	0.0500	Y Uncertainty	Y-axis uncertainty (m)

29	0.0500	Z Uncertainty	Z-axis uncertainty (m)
30	FROM_COMMAND	Translation Source	Translation source, see Table 4- 11
Variable	2	Number of Rotations	Number of rotation entries to follow
Variable	RBV	Rotation	Rotation, see Table 4- 25 type
Variable	IMUBODY	Frame	Frame of rotation (IMUBODY or VEHICLE)
Variable	0.000000000	X Rotation	X-axis rotation (°)
Variable	0.000000000	Y Rotation	Y-axis rotation (°)
Variable	0.000000000	Z Rotation	Z-axis rotation (°)
Variable	0.0500	X Rotation Std Dev	X rotation offset standard deviation (°)
Variable	0.0500	Y Rotation Std Dev	Y rotation offset standard deviation (°)
Variable	0.0500	Z Rotation Std Dev	Z rotation offset standard deviation (°)
Variable	FROM_COMMAND	Rotation Source	Rotation source, see Table 4- 11

4.3.9.2 ASCII Format

Format:

LOG INSCONFIGA ONCE

Example:

#INSCONFIGA,ICOM4,0,0.0,FINESTEERING,2107,34338.000,00000000,0000,68;X1-3,0,10,0,LAND_BASIC,0000021f,AUTOMATIC,ROVER,FALSE,00000000,0,0,0,0,0,0,0,0,3,ANT1,VEHICLE,0.0140,-0.9800,0.2000,0.0010,0.0980,0.0200,FROM_COMMAND,ANT2,VEHICLE,0.0140,0.9900,0.2000,0.0010,0.0990,0.0200,FROM_COMMAND,USER,VEHICLE,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,FROM_NVM,2,RBV,VEHICLE,0.000000000,0.000000000,0.000000000,0.0000,0.0000,0.0000,FROM_NVM,USER,VEHICLE,0.000000000,0.000000000,0.000000000,0.0000,0.0000,0.0000,FROM_NVM*9713ab27

Description:

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSCONFIG header	Header, see Standard ASCII	-	H	0
2	IMU Type	IMU type, see Table 4- 20 IMU	Enum	4	H
3	Mapping	Mapping/orientation	Uchar	1	H+4
4	Initial Alignment Velocity	Min. alignment velocity set by user	Uchar	1	H+5
5	Heave Window	Heave window (s)	Ushort	2	H+6
6	Profile	INS profile, see 0Note: After sending this command, you can enter the SAVECONFIG command to save it to the FLASH. SETINSPROFILE*	Enum	4	H+8
7	Enabled	Enabled Updates	Hex	4	H+12

	Updates				
8	Alignment Mode	Alignment mode, see Table 4- 21 System Alignment Mode	Enum	4	H+16
9	Relative INS Output Frame	The user specified output frame of the Relative INS Vector, seeTable 4- 22 User specified output frame and direction of relative INS vector	Enum	4	H+20
10	Relative INS Output Direction	The user specified output direction of the Relative INS Vector, seeTable 4- 22 User specified output frame and direction of relative INS vector	Bool	4	H+24
11	INS Receiver Status	INS receiver status: First (lower) byte- INS reset, as described by INSResetEnum Second byte- =0x01, IMUcommunication error =0x00, normal =other, reserved Upper 2 bytes-reserved	Hex	4	H+28
12	Reserved	Reserved	Uchar	1	H+32
13	Reserved	Reserved	Uchar	1	H+33
14	Reserved	Reserved	N/A	2	H+34
15	Reserved	Reserved	N/A	4	H+36
16	Reserved	Reserved	N/A	4	H+40

17	Reserved	Reserved	N/A	4	H+44
18	Reserved	Reserved	N/A	4	H+48
19	Reserved	Reserved	N/A	4	H+52
20	Reserved	Reserved	N/A	4	H+56
21	Number of Translations	Number of Translations	Ulong	4	H+60
22	Translation	Translation type, see Table 4- 23 Translation offset	Enum	4	variable
23	Frame	Frame of translation (IMUBODY or VEHICLE)	Enum	4	variable
24	X Offset	X-axis offset (m)	Float	4	variable
25	Y Offset	Y-axis offset (m)	Float	4	variable
26	Z Offset	Z-axis offset (m)	Float	4	variable
27	X Uncertainty	X-axis uncertainty (m)	Float	4	variable
28	Y Uncertainty	Y-axis uncertainty (m)	Float	4	variable
29	Z Uncertainty	Z-axis uncertainty (m)	Float	4	variable
30	Translation Source	Translation source, see Table 4- 11	Enum	4	variable
Variable	Number of Rotations	Number of rotation entries to follow	Ulong	4	variable

Variable	Rotation	Rotation, see Table 4- 25 type	Enum	4	variable
Variable	Frame	Frame of rotation (IMUBODY or VEHICLE)	Enum	4	variable
Variable	X Rotation	X-axis rotation (°)	Float	4	variable
Variable	Y Rotation	Y-axis rotation (°)	Float	4	variable
Variable	Z Rotation	Z-axis rotation (°)	Float	4	variable
Variable	X Rotation Std Dev	X rotation offset standard deviation (°)	Float	4	variable
Variable	Y Rotation Std Dev	Y rotation offset standard deviation (°)	Float	4	variable
Variable	Z Rotation Std Dev	Z rotation offset standard deviation (°)	Float	4	variable

Variable	Rotation Source	Rotation source, see Table 4- 11	Enum	4	variable
Variable	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	variable
Variable	[CR][LF]	Message terminator (ASCII only)	-	-	-

Table 4- 21 System Alignment Mode

ASCII	Binary	Description
UNAIDED	0	Static coarse alignment or kinematic alignment methods are available.
AIDED_ TRANSFER	2	Seed the initial azimuth estimate from the ALIGN solution.
AUTOMATIC	3	Seed the full attitude from the ALIGN solution, perform a regular static coarse alignment or perform a kinematic alignment, whichever is possible first.
STATIC	4	Static coarse alignment method only.
KINEMATIC	5	Kinematic alignment method only.

Table 4- 22 User specified output frame and direction of relative INS vector

Type	ASCII	Binary	Description
Output	ROVER	1	ROVER–the output frame of the rover INS solution

Frame relative to INS vector	MASTER	2	MASTER-the output frame of the master INS solution ECEF-Earth Centered Earth Fixed LOCALLEVEL-local level frame The default is the ROVER.
	ECEF	3	
	LOCALLEVEL	4	
Direction relative to INS vector	FALSE	0	Rover to Master (default)
	TRUE	1	Master to Rover

Table 4- 23 Translation offset type

ASCII	Binary	Description
ANT1	1	Offset from IMU center of navigation to primary GNSS antenna phase center
ANT2	2	Offset from IMU center of navigation to secondary GNSS antenna phase center
EXTERNAL	3	Offset from the IMU center of navigation to the external position source location. This offset type is for use with the **EXTERNALPVAS** command (not supported now)
USER	4	Translation from the IMU center of navigation to the user output location. This offset shifts the position and velocity information in the INSPVA,INSPOS, INSVEL, INSATT, and INSSPD logs, along with their short headerand extended versions.
MARK1	5	Translation from the IMU center of navigation to the MARK1 output location. This offset shifts the position and velocity information in the MARK1PVA (do not support now) log.
MARK2	6	Translation from the IMU center of navigation to the MARK2 output

		location. This offset shifts the position and velocity information in the MARK2PVA (do not support now) log.
GIMBAL	7	Translation from the IMU center of navigation to the gimbal mount center of rotation.
MARK3	9	Translation from the IMU center of navigation to the MARK3 output location. This offset shifts the position and velocity information in the MARK3PVA (do not support now) log.
MARK4	10	Translation from the IMU center of navigation to the MARK4 output location. This offset shifts the position and velocity information in the MARK4PVA (do not support now) log.

Table 4- 24 Translation Input Frame

ASCII	Binary	Description
IMUBODY	0	provided in the IMU enclosure frame, take the IMU navigation center as the origin
VEHICLE	1	Take the vehicle frame as the reference and the IMU navigation center as the origin

Table 4- 25 Rotation offset type

ASCII	Binary	Description

USER	4	Translation from the IMU body frame to the user output frame. This offset shifts the attitude information in the INSPVA, INSPOS, INSVEL, INSATT, and INSSPD logs, along with their short headerand extended versions.
MARK1	5	Rotation from the IMU body frame to the MARK1 output frame. This offset shifts the attitude information in the MARK1PVA (do not support now) log.
MARK2	6	Rotation from the IMU body frame to the MARK2 output frame. This offset shifts the attitude information in the MARK2PVA (do not support now) log.
ALIGN	8	Rotation from the IMU body frame to an ALIGN dual antenna solution. When using a dual antenna ALIGN solution with SPAN, this offset will be calculated automatically if translational offsets to both the primary and secondary GNSS antennas are provided using the SETINSTRANSLATION command
MARK3	9	Rotation from the IMU body frame to the MARK3 output frame. This offset shifts the attitude information in the MARK3PVA (do not support now) log.
MARK4	10	Rotation from the IMU body frame to the MARK4 output frame. This offset shifts the attitude information in the MARK4PVA (do not support now) log.
RBV	11	Rotation from the IMU body frame to the vehicle frame.
RBM	12	Rotation from the IMU body frame to the gimbal mount body frame.

4.3.10 IPCONFIG

Output IP configuration

Format:

LOG IPCONFIG ONCE

Example:

IPCONFIG STATIC 192.168.8.130 255.255.0.0 192.168.1.9

Description:

ID	Example	Format	Description
1	IPCONFIG	IPCONFIG	Header
2	STATIC	[AddressMode]	IP type: STATIC, DHCP
3	192.168.8.130	IPAddress	IP address
4	255.255.0.0	[NetMask]	Subnet mask
5	192.168.1.9	[GateWay]	Gateway

4.3.11 IPSTATUS

Output the IP address, subnet mask, gateway and DNS server.

Format:

LOG Port IPSTATUSA ONCE

Example:

#IPSTATUSA,ICOM4,0,0.0,FINESTEERING,2106,444455.800,00000000,0000,68;1,ETHA,"192.16

8.8.130","255.255.0.0","192.168.1.9",0*f276973e

Description:

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	IPSTATUS header	Header, see Standard ASCII	-	H	0
2	#IPRec	Ethernet port number	Ulong	4	H
3	Interface	Ethernet interface	Enum	4	H+4
4	IP Address	IP address	String[16]	variable 1	H+8
5	Netmask	Subnet mask	String[16]	variable 1	H+24
6	Gateway	Gateway	String[16]	variable 1	H+40
7	#DNSServer	DNS server	Ulong	4	H+4+(#IP Rec×52)
8	IP Address	DNS server IP address	String[16]	variable 1	H+4+(#IP Rec × 52)+4
9	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+4+(#IP Rec × 52) +4+(# DNSServe

					r×16)
10	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.3.12 LOGLIST

List all ports that are currently outputting messages, and the messages being output

4.3.12.1 Simplified Format

Format:

LOG LOGLIST

Example:

<LOGLIST ICOM4 0 100.0 FINESTEERING 2144 7251.000 00000000 0000 754

< 12

< COM2 RTCM1074 ONTIME 1.000000 0.000000 NOHOLD

< COM2 RTCM1084 ONTIME 1.000000 0.000000 NOHOLD

< COM2 RTCM1094 ONTIME 1.000000 0.000000 NOHOLD

< COM2 RTCM1114 ONTIME 1.000000 0.000000 NOHOLD

< COM2 RTCM1124 ONTIME 1.000000 0.000000 NOHOLD

< COM2 RTCM1006 ONTIME 5.000000 0.000000 NOHOLD

< COM2 RTCM1033 ONTIME 10.000000 0.000000 NOHOLD

< COM3 GPGGA ONTIME 1.000000 0.000000 NOHOLD

< ICOM1 GPGGA ONTIME 1.000000 0.000000 NOHOLD

< ICOM4 BESTPOSA ONTIME 1.000000 0.000000 NOHOLD

< ICOM4 HEADINGA ONTIME 1.000000 0.000000 NOHOLD

< CCOM1 BESTPOSA ONTIME 1.000000 0.000000 NOHOLD

Description:

ID	Example	Format	Description
1	<LOGLIST ICOM4 0 100.0 FINESTEERING 2144 7251.000 00000000 0000 754	LOGLIST header	Header, see Standard ASCII
2	12	# logs	Number of logs, max. 80
3	COM2	port	Port, see Table1- 7
4	RTCM1074	message	Message ID
5	ONTIME	trigger	0 = ONNEW 1 = ONCHANGED 2 = ONTIME 3 = ONNEXT 4 = ONCE 5 = ONMARK See 3.1.11
6	1.000000	period	Output period (ONTIME)
7	0.000000	offset	Time offset (ONTIME)
8	NOHOLD	hold	0 = NOHOLD 1 = HOLD See 3.1.11
9...	Next message		

4.3.12.2 ASCII Format

Format:

LOG LOGLISTA ONCE

Example:

#LOGLISTA,COM3,0,100.0,COARSE,2143,455743.800,00000000,0000,754;10,COM2,RTCM1074,ONTIME,1.000000,0.000000,NOHOLD,COM2,RTCM1084,ONTIME,1.000000,0.000000,NOHOLD,COM2,RTCM1094,ONTIME,1.000000,0.000000,NOHOLD,COM2,RTCM1114,ONTIME,1.000000,0.000000,NOHOLD,COM2,RTCM1124,ONTIME,1.000000,0.000000,NOHOLD,COM2,RTCM1006,ONTIME,5.000000,0.000000,NOHOLD,COM2,RTCM1033,ONTIME,10.000000,0.000000,NOHOLD,COM2,GPGGA,ONTIME,1.000000,0.000000,NOHOLD,ICOM1,GPGGA,ONTIME,1.000000,0.000000,NOHOLD,CCOM1,INSCAN10,ONTIME,1.000000,0.000000,NOHOLD*e618828c

Description:

ID	Field	Description	Format
1	LOGLIST header	Header, see Standard ASCII	-
2	# logs	Number of logs, max. 80	long
3	port	Port, seeTable1- 7	Enum
4	message	Message ID	Char [ ]
5	trigger	0 = ONNEW 1 = ONCHANGED 2 = ONTIME 3 = ONNEXT 4 = ONCE 5 = ONMARK See 3.1.11	Enum
6	period	Output period (ONTIME)	double

7	offset	Time offset (ONTIME)	double
8	hold	0 = NOHOLD 1 = HOLD See 3.1.11	Enum
9...	Next message		
Variable	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex
Variable	[CR][LF]	Message terminator (ASCII only)	-

4.3.12.3 Binary Format

Format:

LOG LOGLISTB ONCE

Description:

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	LOGLIST header	Header, see Standard ASCII	-	H	0
2	# logs	Number of logs, max. 80	Ulong	4	H
3	port	Port, see Table1- 7	Enum	4	H+4
4	message	Message ID	Ushort	2	H+8
5	message type	Bits 0-4 = reserved Bits 5-6 = format identifier 00 = binary	Char	1	H+10

		01 = bynav ASCII 10 = NMEA 11 = reserved Bit 7 = response identifier 0 = Original message 1 = Response message			
6	Reserved	Reserved	Char	1	H+11
7	trigger	0 = ONNEW 1 = ONCHANGED 2 = ONTIME 3 = ONNEXT 4 = ONCE 5 = ONMARK See 3.1.11	Enum	4	H+12
8	period	Output period (ONTIME)	double	8	H+16
9	offset	Time offset (ONTIME)	double	8	H+24
10	hold	0 = NOHOLD 1 = HOLD See 3.1.11	Enum	4	H+32
11...	Next message, offset= H + 4 + (#logs x 32)				
Variable	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+4+ (#logs x 32)

4.3.13 NMEATALKER

Output NMEA talker.

Format:

LOG NMEATALKER ONCE

Example:

NMEATALKER GP

Description:

ID	Example	Format	Description
1	NMEATALKER	NMEATALKER	Header
2	GP	[HEADER]	NMEA talker

4.3.14 NTRIPCONFIG

Output NTRIP configuration.

Format:

LOG NTRIPCONFIG ONCE

Example:

NCOM1 CLIENT v1 192.168.1.88:8888 NTRIP BYNAV BYNAV IN:RTCM OUT:RTCM

NCOM2 DISABLED v1 IN:NONE OUT:NONE

Description:

ID	Example	Format	Description
1	NCOM1	PORT	NTRIP port (NCOM1/NCOM2)
2	CLIENT	DISABLED	NTRIP mode
		SERVER	
		CLIENT	
3	V1	PROTOCOL	NTRIP protocol (V1/V2)
4	192.168.1.88:8888	ENDPOINT	NTRIP IP and port number
5	NTRIP	MOUNTPOINT	NTRIP mountpoint
6	BYNAV	USER NAME	Username
7	BYNAV	PASSWORD	Password
8	ALL	BINDINTERFACE	Binding interface, fixed to be ALL

4.3.15 PJKPARA

Query PJK parameter.

Format:

LOG PJKPARA

Example:

PJK Paramter A:6378137.00; 1/F:298.257222101; B0:0.000000; L0:0.000000; N0:0.000;

E0:500000.000; SCALE:1.000000; HEIGHTMODE:EHT;

Description:

ID	Example	Format	Description
1	PJK Paramter	PJK Paramter	Header

2	A	A	Semi-major axis of ellipsoid ID
3	6378245.00	xxxx.xx	Semi-major axis of ellipsoid (m)
4	1/F	1/F	Reciprocal flattening ID
5	298.357222101	xx.xx	Reciprocal flattening
6	B0	B0	Origin latitude ID
7	0.000000	x.xxx	Origin latitude (°)
8	L0	L0	Central meridian ID
9	0.000000	x.xxx	Central meridian (°)
10	N0	N0	North offset ID
11	0.000	x.x	North offset (m)
12	E0	E0	East offset ID
13	500000.000	x.x	East offset (m)
14	SCALE	SCALE	Scale Factor mark
15	1.000000	x.x	Scale Factor
16	HEIGHTMODE	HEIGHTMODE	PJK height
17	EHT	XXX	EHT: Ellipsoid hgt; GHT: Geodetic hgt

4.3.16 REFSTATION/ REFSTATIONINFO

Output current base station coordinates, output latitude, longitude and height coordinates without frequency control parameters, and output ECEF coordinates with frequency control parameters.

Format:

LOG REFSTATION

LOG REFSTATIONINFO

LOG REFSTATION ONCE

LOG REFSTATIONINFO ONCE

Example:

RefStation: 28.23243023 112.87494990 69.696

RefStation: -2186028.842 5181373.595 2999256.821

Description:

ID	Example	Format	Description
1	RefStation	RefStation	Header
2	28.23243023/ -2186028.842	[B/X]	BLH coordinates longitude/ECEH coordinates X
3	112.87494990/5181373.595	[L/Y]	BLH coordinates latitude /ECEH coordinates Y
4	69.696/2999256.821	[H/Z]	BLH coordinates height /ECEH coordinates Z

4.3.17 REFSTATIONA

Output base station coordinates (no binary format)

Format:

LOG REFSTATIONA ONCE

Example:

#REFSTATIONA,ICOM4,0,81.9,FINESTEERING,2129,440707.400,00000000,0000,742;0.000,0.000,0.000*f40f1626

Description:

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	REFSTATIONA header	Header, see Standard ASCII	-	H	0
2	X	Base coordinates (ECEF)	Double	4	H
3	Y	Base coordinates (ECEF)	Double	4	H+4
4	Z	Base coordinates (ECEF)	Double	4	H+8
5	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Hex	4	H+12
6	[CR][LF]	Message terminator (ASCII only)	-	-	-

4.3.18 RTKCONFIG

Output RTK configuration.

Format:

LOG RTKCONFIG ONCE

Example:

RTK Type: ROVER

DualAnt: TRUE

OBS Intr: 0.20

FPGARaw Freq: 0.20

RTK Freq: B1IB2IL1L2CL2PG1G2

Elev Mask: 5.0 deg

Snr Mask: 20.0

NAVSYS: GPS GLONASS GALILEO BEIDOU QZSS IRNSS

Description:

ID	Example	Format	Description
1	RTK Type: ROVER	RTK Type	RTK type
2	DualAnt: TRUE	DualAnt	Dual antenna mode, TRUE-enabled, FALSE-disabled
3	OBS Intr:0.20	OBS Intr	Observation frequency
4	FPGARaw Freq:0.20	FPGARaw Freq	FPGA frequency
5	RTK Freq:B1IB2IL1L2CL2PG1G2	RTK Freq	Satellite frequency
6	Elev Mask:5.0 deg	Elev Mask	Elevation mask
7	Snr Mask:20.0	Snr Mask	SNR mask
8	NAVSYS:GPS GLONASS GALILEO BEIDOU QZSS IRNSS	NAVSYS	Satellite system

4.3.19 SHIFTDATUM

Output coordinates shift parameter X, Y, Z

Format:

LOG SHIFTDATUM ONCE

Example:

ShiftDatum :0.000 0.000 0.000

Description:

ID	Example	Format	Description
1	ShiftDatum	ShiftDatum	Header
2	0.000	X	X shift (ECEF)
3	0.000	Y	Y shift (ECEF)
4	0.000	Z	Z shift (ECEF)

4.3.20 VERSION

Output version information.

Format:

LOG VERSION

Example:

$BDVER,V7.54_0EC870_T,19060377,21010633,21010525,21010643,20122624,20101504,2007

3004,20122406*71

Description:

ID	Example	Format	Description
1	$BDVER	$--VER	Header
2	V7.54_0EC870_T	Vx.xx_YYYY	Firmware version
3	19060377	x1	FPGA version

4	21010633	x2	ARM version
5	21010525	x3	PB version
6	21010643	x4	Solution base version
7	20122624	x5	Kernel version
8	20101504	x6	Web server version
9	20073004	x7	Web interface version
10	20122406	x8	Check sum
11	71	hh	Firmware version

4.4 Other Logs

4.4.1 ENU

Output the distance in East, North and Up from rover relative to base under different filter conditions.

Recommended

LOG GPENU ONTIME 1

ASCIIExample

$GPENU,120446.00,-1301.1411,-42.4221,10.2936,1,-1301.1396,-42.4226,10.2876,1,-1301.1396,-42.4226,10.2876,0,-1301.1396,-42.4226,10.2876,0,-1301.1396,-42.4226,10.2876,0,-1301.1396,-42.4226,10.2876,0,4,24,1.000*47

Description

ID	Example	Format	Description

0	$GPENU	$--ENU	Header
1	120446.00	hhmmss.ss	UTC time
2	-1301.1411	xx.xx	De(distance in East), unit:m, see note①
3	-42.4221	xx.xx	Dn(distance in North), unit:m, see note ②
4	10.2936	xx.xx	Du(distance in Up), unit:m, see note③
5	1	a	Filter output times in 1s Filter window: 1, see note④
6	-1301.1396	xx.xx	De(distance in East), unit:m
7	-42.4226	xx.xx	Dn(distance in North), unit:m
8	10.2876	xx.xx	Du(distance in Up), unit:m
9	1	a	Filter output times in 1min Filter window: 60
10	-1301.1396	xx.xx	De(distance in East), unit:m
11	-42.4226	xx.xx	Dn(distance in North), unit:m
12	10.2876	xx.xx	Du(distance in Up), unit:m
13	0	a	Filter output times in 15min Filter window: 900
14	-1301.1396	xx.xx	De(distance in East), unit:m
15	-42.4226	xx.xx	Dn(distance in North), unit:m
16	10.2876	xx.xx	Du(distance in Up), unit:m
17	0	a	Filter output times in 1h Filter window: 3600
18	-1301.1396	xx.xx	De(distance in East), unit:m

19	-42.4226	xx.xx	Dn(distance in North), unit:m
20	10.2876	xx.xx	Du(distance in Up), unit:m
21	0	a	Filter output times in 12h Filter window: 43200
22	-1301.1396	xx.xx	De(distance in East), unit:m
23	-42.4226	xx.xx	Dn(distance in North), unit:m
24	10.2876	xx.xx	Du(distance in Up), unit:m
25	0	a	Filter output times in 24h Filter window: 86400
26	4	a	Positioning status, see note ⑤
27	24	xx	Number of Satellites used in solution
28	1.000	xxxx	Differential age
29	47	hh	Check sum

Note①: De (distance in East): Distance in East from Rover relative to Base

Note②: Dn (distance in North): Distance in North from Rover relative to Base

Note③: Du (distance in Up): Distance in Up from Rover relative to Base

Note④: Filter output times: 1-filter times reach the configured filter window; 0- filter times don't reach the configured filter window.

Note⑤: Solution status 0-invalid solution; 1-single point solution; 4-fixed solution; 5-floating point solution.

4.4.2 ENUAVR*

Output the primary and secondary antenna position in ENU coordinates, as well as the IMU body attitude in local level frame (ENU). Mainly used to calculate Lever Arm.

Recommended

LOG ENUAVR ONTIME 1

ASCIIExample

#ENUAVR,COM1,0,0.0,FINESTEERING,2095,127522.000,00000000,0000,25;-1075.1430,-98.4608,-8.6259,-1075.1430,-98.4610,-8.6258,-3.1407,-0.0016,58*2865555d

Description

ID	Example	Format	Description
0	#ENUAVR,COM1,0,0.0,FINESTEERING,2095,127522.000,00000000,0000,25;	ENUAVR header	Header, see Standard ASCII
1	1075.1430	ANT1 East	ANT1 East position (m)
2	-98.4608	ANT1 North	ANT1 North position (m)
3	-8.6259	ANT1 Up	ANT1 Up position (m)
4	-1075.1430	ANT2 East	ANT2 East position (m)
5	-98.4610	ANT2 North	ANT2 North position (m)
6	-8.6258	ANT2 Up	ANT2 Up position (m)
7	-3.1407	Roll	Roll (0~360°)
8	-0.0016	Pitch	Pitch (-90~90°)

9	58	Count	Count
10	2865555d	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)
11	--	[CR][LF]	Message terminator (ASCII only)

4.4.3 KSXT

Output timing, positioning, heading, velocity.

Recommended

LOG KSXT ONTIME 1

ASCIIExample

$KSXT,20191219093115.00,112.87713062,28.23315515,65.5618,0.00,0.00,336.65,0.010,,3,0,0,23,-1075.146,-98.462,-8.618,-0.004,0.009,0.004,1.0,30,*3FCF0C9B

Description

ID	Example	Format	Description
1	$KSXT	$KSXT	Header
2	20191219093115.00	YYYYMMDDhhmmss.ss	Satellite time in a specific format, e.g. 2016040106284180 means 2016(year) 4(month) 1(day) 06(hour) 28(mins) 41.80(secs)
3	112.87713062	x1	Longitude (°), 8 decimals
4	28.23315515	x2	Latitude (°), 8 decimals
5	65.5618	x3	Height (m), 4 decimals
6	0.00	x4	Heading, the angle between the line connecting two antennas and True North (primary antenna positioning and secondary antenna heading) (0° ~ 360°), 2 decimals

7	0.00	x5	Pitch (-90° ~ 90°), 2 decimals
8	336.65	x6	Speed angle, the angle between vehicle traveling direction and True North (0° ~ 360°), 2 decimals
9	0.010	x7	Speed in vehicle traveling direction (km/h), 3 decimals
10		x8	Roll (-90° ~ 90°), 2 decimals
11	3	x9	Positioning status: 0-invalid solution; 1-single point solution; 2-RTK floating point; 3-RTK fixed point
12	0	x10	Heading status: 0-invalid solution; 1-single point solution; 2-RTK floating point; 3-RTK fixed point
13	0	x11	Number of satellites used in heading
14	23	x12	Number of satellites used in positioning (primary antenna)
15	-1075.146	x13	East position under geographic coordinates with the base station as the origin (m) (empty if none)
16	-98.462	x14	North position under geographic coordinates with the base station as the origin (m) (empty if none)
17	-8.618	x15	Up position under geographic coordinates with the base station as the origin (m) (empty if none)
18	-0.004	x16	East speed under geographic coordinates (km/h) (empty if none)
19	0.009	x17	North speed under geographic coordinates (km/h) (empty if none)
20	0.004	x18	Up speed under geographic coordinates (km/h) (empty if none)
21	1.0	x19	Age of differential
22	30	x20	Number of satellites tracked in base station
23		x23	Reserved

23	Parity	3FCF0C9B	XOR check sum (Hex string, check from the beginning of the frame)

4.5 RTCM Format

4.5.1 Introduction

RTCM is a commonly used data transmission format, proposed by the International Maritime Industry Radio Technology Committee to formulate standards for differential global navigation and positioning systems and real-time dynamic operations.

4.5.2 Structure

RTCM data is transmitted in the form of frames. The frame structure of RTCM3.2 standard format is as follows:

ID	Content	Bit	Comments
1	Sync code	8	Set to '11010011', hexadecimal 'D3'
2	Reserved	6	Set to '000000'
3	Length	10	length of data, expressed in bytes
4	Data	Variable	Max. 1023bytes, if it is not an integer byte, the last byte is filled with 0 to fill the whole byte number
5	CRC	24	Check sum

Therefore, the data header of each frame of RTCM data is fixed as '1101 0011 0000 00', and the hexadecimal is 'D3 0_'.

4.5.3 RTCM Supported by Bynav

4.5.3.1 Base RTCM

The bynav base can output the following RTCM messages:

RTCM1003, GPS L1/L2 code and phase

RTCM1004, GPS L1/L2 code, phase, ambiguity and CNR

RTCM1005, antenna reference point coordinates XYZ

RTCM1006, antenna reference point and antenna height coordinates XYZ

RTCM1011, GLONASS L1/L2 code and phase

RTCM1012, GLONASS L1/L2 code, phase, ambiguity and CNR

RTCM1074, Full GPS Pseudoranges and PhaseRanges plus CNR

RTCM1075, Full GPS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR

RTCM1076, Full GPS Pseudoranges and PhaseRanges plus CNR (high resolution)

RTCM1077, Full GPS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR (high resolution)

RTCM1084, Full GLONASS Pseudoranges and PhaseRanges plus CNR

RTCM1085, Full GLONASS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR

RTCM1086, Full GLONASS Pseudoranges and PhaseRanges plus CNR (high resolution)

RTCM1087, Full GLONASS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR (high resolution)

RTCM1094, Full GALILEO Pseudoranges and PhaseRanges plus CNR

RTCM1095, Full GALILEO Pseudoranges, PhaseRanges, PhaseRangeRate and CNR

RTCM1096, Full GALILEO Pseudoranges and PhaseRanges plus CNR (high resolution)

RTCM1097, Full GALILEO Pseudoranges, PhaseRanges, PhaseRangeRate and CNR (high resolution)

RTCM 1104, Full SBAS Pseudoranges and PhaseRanges plus CNR

RTCM 1105, Full SBAS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR

RTCM 1106, Full SBAS Pseudoranges and PhaseRanges plus CNR (high resolution)

RTCM 1107, Full SBAS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR (high resolution)

RTCM 1114, Full QZSS Pseudoranges and PhaseRanges plus CNR

RTCM 1115, Full QZSS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR

RTCM 1116, Full QZSS Pseudoranges and PhaseRanges plus CNR (high resolution)

RTCM 1117, Full QZSS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR (high resolution)

RTCM 1124, Full BDS Pseudoranges and PhaseRanges plus CNR

RTCM 1125, Full BDS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR

RTCM 1126, Full BDS Pseudoranges and PhaseRanges plus CNR (high resolution)

RTCM 1127, Full BDS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR (high resolution)

RTCM1134, Full IRNSS Pseudoranges and PhaseRanges plus CNR [bynav-defined]

RTCM1135, Full IRNSS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR [bynav-defined]

RTCM1136, Full IRNSS Pseudoranges and PhaseRanges plus CNR (high resolution) [bynav-defined]

RTCM1137, Full IRNSS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR (high resolution) [bynav-defined]

RTCM1019, GPS ephemeris

RTCM1020, GLONASS ephemeris

RTCM1042, BDS ephemeris

RTCM1044, QZSS ephemeris

RTCM1046, GALILEOephemeris

RTCM1048, IRNSS ephemeris [bynav-defined]

RTCM1033, receiver and antenna description

RTCM1230, GLONASS phase deviation

4.5.3.2 Rover RTCM

Bynav rover support parse the RTCM messages that are output by bynav base station, as well as the following messages:

RTCM1073, Compact GPS Pseudoranges and PhaseRanges

RTCM1083, Compact GLONASS Pseudoranges and PhaseRanges

RTCM1093, Compact GALILEO Pseudoranges and PhaseRanges

RTCM 1103, Compact SBAS Pseudoranges and PhaseRanges

RTCM 1113, Compact QZSS Pseudoranges and PhaseRanges

RTCM 1123, , Compact BDS Pseudoranges and PhaseRanges

4.6 Ephemeris and Observation Data

4.6.1 Introduction

The ephemeris and observation dats use the following messages:

Table 4- 26 Output messages

Message	Description	Header
bdsephemerisb	Decoded BDS ephemeris	1696
galephemerisb	Decoded GALILEO ephemeris	1122
gpsephemb	Decoded GPS ephemeris	7
gloephemerisb	Decoded GLONASS ephemeris	723
qzssephemerisb	Decoded QZSS ephemeris	1336
rangecmpb	Compressed satellites observation information	140

4.6.2 Configuration

➢ Output observation data (can be converted to .obs file)

log comx rangecmpb ontime 1

Output frequency can be configured as required.

➢ Output navigation data (can be converted to .nav file)

log comx bdsephemerisb onchanged

log comx galephemerisb onchanged

log comx gpsephemb onchanged

log comx gloephemerisb onchanged

log comx qzssephemerisb onchanged

After configuring the above 5 messages, the receiver will output the navigation date of each satellite system when the navigation data is updated (BDS nav data is updated 1h/time, GAL - 10min/time, GPS/QZSS - 2h/time, GLO - 0.5h/time). If the logging time is short and does not reach the nav data update period, the receiver may not receive the complete nav data. You can send the above 5 messages after starting to log the data, and the receiver will output the current nav data.

You can use ONTIME to configure the output frequency. If ontime 1 is configured, the message will output once per second, and each time the message outputs the ephemeris of one satellite. After all the satellite ephemeris are output, it will continue to cyclically output.

4.6.3 Format

The ephemeris and observation data output in binary format, which has a unified data structure. Each message is composed of a data header and a data body, see the header structure in Table1- 6 Standard Binary Header Structure

4.6.4 Messages

4.6.4.1 bdsephemerisb

Description: Output BDS ephemeris, multiple messages are transmitted, one for each SV ephemeris collected.

Message ID: 1696。

Command: log comx bdsephemerisb onchanged

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
0	Header	See Table1- 6 Standard Binary Header Structure		H	0
1	Satellite ID	BDS Satellite ID	Ulong	4	H
2	Week	BeiDou week number	Ulong	4	H+4
3	URA	User range accuracy (m)	Double	8	H+8
4	Health	Satellite health flag: 0=healthy; 1=not healthy	Ulong	4	H+16
5	tgd1	B1 group delay (s)	Double	8	H+20
6	tgd2	B2 group delay (s)	Double	8	H+28
7	AODC	Age of data, clock	Ulong	4	H+36
8	toc	Reference time of clock parameters (s)	Ulong	4	H+40
9	a0	clock correction polynomial (s)	Double	8	H+44
10	a1	Linear term of clock correction polynomial (s/s)	Double	8	H+52
11	a2	Quadratic term of clock correction polynomial (s/s^2)	Double	8	H+60
12	AODE	Age of data, ephemeris	Ulong	4	H+68
13	toe	Reference time of ephemeris parameters (s)	Ulong	4	H+72
14	RootA	Square root of semi-major axis (sqrt(m))	Double	8	H+76
15	ecc	Eccentricity (dimensionless)	Double	8	H+84
16	ω	Argument of perigee (radians)	Double	8	H+92
17	△n	Mean motion difference from computed	Double	8	H+100

		value (radians/s)			
18	M0	Mean anomaly at reference time (radians)	Double	8	H+108
19	Ω0	Longitude of ascending node of orbital of plane computed according to reference time (radians)	Double	8	H+116
20	Ω	Rate of right ascension (radians/s)	Double	8	H+124
21	i0	Inclination angle at reference time (radians)	Double	8	H+132
22	IDOT	Rate of inclination angle (radians/second)	Double	8	H+140
23	Cuc	Amplitude of cosine harmonic correction term to the argument of latitude (radians)	Double	8	H+148
24	Cus	Amplitude of sine harmonic correction term to the argument of latitude (radians)	Double	8	H+156
25	Crc	Amplitude of cosine harmonic correction term to the orbit radius (m)	Double	8	H+164
26	Crs	Amplitude of sine harmonic correction term to the orbit radius (m)	Double	8	H+172
27	Cic	Amplitude of cosine harmonic correction term to the angle of inclination (radians)	Double	8	H+180
28	Cis	Amplitude of sine harmonic correction term to the angle of inclination (radians)	Double	8	H+188
29	Parity	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Ulong	4	H+196
30		Message terminator (ASCII only)			

4.6.4.2 galephemerisb

Description: Output GAL ephemeris, multiple messages are transmitted, one for each SV ephemeris collected.

Message ID: 1122。

Command: log comx galephemerisb onchanged

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset

0	Header	See Table1- 6 Standard Binary Header Structure		H	0
1	Satellite ID	GAL satellite ID	Ulong	4	H
2	FNAV flag	FNAV receive flag	Bool	4	H+4
3	INAV flag	INAV receive flag	Bool	4	H+8
4	E1BHealth	E1B health flag: 0=received incorrectly; 1= received correctly	Uchar	1	H+12
5	E5aHealth	E5a health flag: 0=received incorrectly; 1= received correctly	Uchar	1	H+13
6	E5bHealth	E5b health flag: 0=received incorrectly; 1= received correctly	Uchar	1	H+14
7	E1BDVS	E1B valid flag: 0=invalid; 1=valid	Uchar	1	H+15
8	E5aDVS	E5a valid flag: 0=invalid; 1=valid	Uchar	1	H+16
9	E5bDVS	E5b valid flag: 0=invalid; 1=valid	Uchar	1	H+17
10	SISA	Signal in space accuracy	Uchar	1	H+18
11	Reserved		Uchar	1	H+19
12	IODNav	Issue of data ephemeris	Ulong	4	H+20
13	Toe	Ephemeris reference time (s)	Ulong	4	H+24
14	RootA	Square root of semi-major axis	Double	8	H+28
15	△n	Mean motion difference (radians/s)	Double	8	H+36
16	M0	Mean anomaly at ref time (radians)	Double	8	H+44
17	ecc	Eccentricity	Double	8	H+52
18	ω	Argument of perigee (radians)	Double	8	H+60
19	Cuc	Amplitude of cosine harmonic correction term to the argument of latitude (radians)	Double	8	H+68
20	Cus	Amplitude of sine harmonic correction term to the argument of latitude (radians)	Double	8	H+76

21	Crc	Amplitude of cosine harmonic correction term to the orbit radius (m)	Double	8	H+84
22	Crs	Amplitude of sine harmonic correction term to the orbit radius (m)	Double	8	H+92
23	Cic	Amplitude of cosine harmonic correction term to the angle of inclination (radians)	Double	8	H+100
24	Cis	Amplitude of sine harmonic correction term to the angle of inclination (radians)	Double	8	H+108
25	i0	Inclination angle at reference time (radians)	Double	8	H+116
26	IDOT	Rate of inclination angle (radians/s)	Double	8	H+124
27	Ω0	Right ascension (radians)	Double	8	H+132
28	Ω	Rate of right ascension (radians/s)	Double	8	H+140
29	FNAVtoc	FNAV SV clock correction term (s)	Ulong	4	H+148
30	FNAVa0	FNAV Clock aging parameter (s)	Double	8	H+152
31	FNAVa1	FNAV Clock aging parameter (s/s)	Double	8	H+160
32	FNAVa2	FNAV Clock aging parameter (s/s/s)	Double	8	H+168
33	INAVtoc	INAV SV clock correction term (s)	Ulong	4	H+176
34	INAVa0	INAV Clock aging parameter (s)	Double	8	H+180
35	INAVa1	INAV Clock aging parameter (s/s)	Double	8	H+188
36	INAVa2	INAV Clock aging parameter (s/s/s)	Double	8	H+196
37	E1E5aBGD	E1E5a Group delay (s)	Double	8	H+204
38	E1E5bBGD	E1E5b Group delay (s)	Double	8	H+212
39	[CR][LF]	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Ulong	4	H+220
40		Message terminator (ASCII only)			

4.6.4.3 gpsephemb

Description: Output GAL ephemeris, multiple messages are transmitted, one for each SV ephemeris collected.

Message ID: 7。

Command: log comx gpsephemb onchanged

ID	Field	Description	Binary	Binary	Binary

			Format	Bytes	Offset
0	Header	See Table1- 6 Standard Binary Header Structure		H	0
1	PRN	GPS Satellite PRN number	Ulong	4	H
2	Tow	GPS Time stamp of subframe 1 (s)	Double	8	H+4
3	Health	Satellite health status: 0=healthy; 1=unhealthy	Ulong	4	H+12
4	IODE1	Issue of ephemeris data 1	Ulong	4	H+16
5	IODE 2	Issue of ephemeris data 2	Ulong	4	H+20
6	WN	GPS toe week number	Ulong	4	H+24
7	Z WN	Z count week number	Ulong	4	H+28
8	Toe	Reference time for ephemeris (s)	Double	8	H+32
9	A	Semi-major axis (m)	Double	8	H+40
10	△n	Mean motion difference (radians/s)	Double	8	H+48
11	M0	Mean anomaly of reference time (radians)	Double	8	H+56
12	ecc	Eccentricity	Double	8	H+64
13	ω	Argument of perigee (radians)	Double	8	H+72
14	Cuc	Amplitude of cosine harmonic correction term to the argument of latitude (radians)	Double	8	H+80
15	Cus	Amplitude of sine harmonic correction term to the argument of latitude (radians)	Double	8	H+88
16	Crc	Amplitude of cosine harmonic correction term to the orbit radius (m)	Double	8	H+96
17	Crs	Amplitude of sine harmonic correction term to the orbit radius (m)	Double	8	H+104
18	Cic	Amplitude of cosine harmonic correction term to the angle of inclination (radians)	Double	8	H+112
19	Cis	Amplitude of sine harmonic correction term to the angle of inclination (radians)	Double	8	H+120
20	i0	Inclination angle at reference time (radians)	Double	8	H+128
21	IDOT	Rate of inclination angle (radians/s)	Double	8	H+136
22	Ω0	Right ascension (radians)	Double	8	H+144
23	Ω	Rate of right ascension (radians/s)	Double	8	H+152
24	IODC	Issue of data clock	Ulong	4	H+160
25	Toc	SV clock correction term (s)	Double	8	H+164

26	Tgd	Estimated group delay difference (s)	Double	8	H+172
27	a0	Clock aging parameter (s)	Double	8	H+180
28	a1	Clock aging parameter (s/s)	Double	8	H+188
29	a2	Clock aging parameter (s/s/s)	Double	8	H+196
30	AS	Anti-spoofing on: 0=FALSE 1=TRUE	Bool	4	H+204
31	N	Corrected mean motion (radians/s)	Double	8	H+208
32	URA	User Range Accuracy variance (m)2	Double	8	H+216
33	[CR][LF]	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Ulong	4	H+224
34		Message terminator (ASCII only)			

4.6.4.4 gloephemerisb

Description: Output GAL ephemeris, multiple messages are transmitted, one for each SV ephemeris collected.

Meassage ID: 723。

Command: log comx gloephemerisb onchanged

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
0	Header	See Table1- 6 Standard Binary Header Structure		H	0
1	sloto	GLO PRN identification (sloto +37)	Ushort	2	H
2	freq	Frequency channel (0~20)	Ushort	2	H+2
3	sat type	Satellite type: 0= GLO_SAT 1= GLO_SAT_M 2= GLO_SAT_K	Uchar	1	H+4
4	Reserved			1	H+5
5	Week	Reference week of ephemeris (GPS)	Ushort	2	H+6
6	Time	Reference time of ephemeris (GPS ms)	Ulong	4	H+8
7	leaps	Integer seconds between GPS and	Ulong	4	H+12

		GLONASS time. (Jump seconds, may not be correct)			
8	Nt	Calendar number of day within 4 year interval starting at Jan 1 of a leap year	Ushort	2	H+16
9	Reserved			1	H+18
10	Reserved			1	H+19
11	issue	15 minute interval number corresponding to ephemeris reference time	Ulong	4	H+20
12	Health	Ephemeris health: 0~3=healthy 4~15=unhealthy	Ulong	4	H+24
13	pos x	X coordinate for satellite at reference time (PZ-90.02) (m)	Double	8	H+28
14	pos y	Y coordinate for satellite at reference time (PZ-90.02) (m)	Double	8	H+36
15	pos z	Z coordinate for satellite at reference time (PZ-90.02) (m)	Double	8	H+44
16	vel x	X coordinate for satellite velocity at reference time (PZ-90.02) (m/s)	Double	8	H+52
17	vel y	Y coordinate for satellite velocity at reference time (PZ-90.02) (m/s)	Double	8	H+60
18	vel z	Z coordinate for satellite velocity at reference time (PZ-90.02), (m/s)	Double	8	H+68
19	acc x	X coordinate for lunisolar acceleration at reference time (PZ-90.02), (m/s/s)	Double	8	H+76
20	acc y	Y coordinate for lunisolar acceleration at reference time (PZ-90.02) (m/s/s)	Double	8	H+84
21	acc z	Z coordinate for lunisolar acceleration at reference time (PZ-90.02) (m/s/s)	Double	8	H+92
22	Tau_N	Correction to the nth satellite time t_n relative to GLONASS time t_c (s)	Double	8	H+100
23	△Tau_N	Time difference between navigation RF signal transmitted in L2 sub-band and navigation RF signal transmitted in L1 subband by nth satellite (s)	Double	8	H+108
24	γ	Frequency correction (s/s)	Double	8	H+116

25	Tk	Time of frame start (since start of GLONASS day) (s)	Ulong	4	H+124
26	P	Technological parameter	Ulong	4	H+128
27	Ft	User range	Ulong	4	H+132
28	age	Age of data (days)	Ulong	4	H+136
29	Flags	Information flags, see note 1	Ulong	4	H+140
30	[CR][LF]	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Ulong	4	H+144
31		Message terminator (ASCII only)			

Note 1: Last 2bit is P1 falg, indicates the length of the time period of the ephemeris reference time tb.

P1 value	**Tb period**
00	0min
01	30min
10	45min
11	60min

The last 3 bit is the P2 flag, which indicates the parity of the value when the length of the corresponding tb time period is 30 or 60 min,

0=even

1=odd

The last 4th bit is the P3 identifier, indicating whether the frame provides almanac parameters about 5 satellites or 4 satellites.

0=4 satellites

1=5 satellites

4.6.4.5 qzssephemerisb

Description: Output GAL ephemeris, multiple messages are transmitted, one for each SV ephemeris collected.

Message ID: 1336

Command: log comx qzssephemerisb onchanged

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
0	Header	See Table1- 6 Standard Binary Header Structure		H	0
1	PRN	QZSS PRN number	Ulong	4	H
2	Tow	Time stamp of subframe 0 (s)	Double	8	H+4
3	Health	Satellite Health status: 0=healthy; 1=unhealthy	Ulong	4	H+12
4	IODE1	Issue of ephemeris data 1	Ulong	4	H+16
5	IODE 2	Issue of ephemeris data 2	Ulong	4	H+20
6	WN	GPS reference week number	Ulong	4	H+24
7	Z WN	count week number	Ulong	4	H+28
8	Toe	Reference time for ephemeris (s)	Double	8	H+32
9	A	Semi-major axis (m)	Double	8	H+40
10	△n	Mean motion difference (radians/s)	Double	8	H+48
11	M0	Mean anomaly of reference time (radius)	Double	8	H+56
12	ecc	Eccentricity	Double	8	H+64
13	ω	Argument of perigee (radians)	Double	8	H+72
14	Cuc	Amplitude of cosine harmonic correction term to the argument of latitude (radians)	Double	8	H+80
15	Cus	Amplitude of sine harmonic correction term to the argument of latitude (radians)	Double	8	H+88
16	Crc	Amplitude of cosine harmonic correction term to the orbit radius (m)	Double	8	H+96
17	Crs	Amplitude of sine harmonic correction term to the orbit radius (m)	Double	8	H+104

18	Cic	Amplitude of cosine harmonic correction term to the angle of inclination (radians)	Double	8	H+112
19	Cis	Amplitude of sine harmonic correction term to the angle of inclination (radians)	Double	8	H+120
20	i0	Inclination angle at reference time (radians)	Double	8	H+128
21	IDOT	Rate of inclination angle (radians/s)	Double	8	H+136
22	Ω0	Right ascension (radians)	Double	8	H+144
23	Ω	Rate of right ascension (radians/s)	Double	8	H+152
24	IODC	Issue of data clock	Ulong	4	H+160
25	Toc	SV clock correction term (s)	Double	8	H+164
26	Tgd	Estimated group delay difference (s)	Double	8	H+172
27	a0	Clock aging parameter (s)	Double	8	H+180
28	a1	Clock aging parameter (s/s)	Double	8	H+188
29	a2	Clock aging parameter (s/s/s)	Double	8	H+196
30	AS	Anti-spoofing on: 0= FALSE 1=TRUE	Bool	4	H+204
31	N	Corrected mean motion (radians/s)	Double	8	H+208
32	URA	User Range Accuracy variance, m2	Double	8	H+216
33	Fit Interval	Curve fit interval: 0 = Ephemeris data are effective for 2 hours 1 = Ephemeris data are effective for more than 2 hours	Uchar	1	H+224
34	Reserved	Reserved	Uchar	1	H+225
35	Reserved	Reserved	Uchar	1	H+226
36	Reserved	Reserved	Uchar	1	H+227
37	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Ulong	4	H+228
38	[CR][LF]	Message terminator (ASCII only)			

4.6.4.6 rangecmpb

Description: output compressed raw observation data of current satellited tracked

Message ID: 140

Command: log comx rangecmpb ontime 1

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
0	Header	See Table1- 6 Standard Binary Header Structure		H	0
1	# obs	Number of satellite observations with information to follow	Ulong	4	H
2	Range	Observation data of the first satellite, see note1	-	24	H+4
3	Next PRN	Observation data of the next satellite	-	24	H+28
n	...	...	-		H+52
n+1	xxx	32-bit CRC, see Table 4- 7 32-CRC check code (C)	Ulong	4	H+4+ (# obs *24)
n+2	[CR][LF]	Message terminator (ASCII only)			

Note 1: The compressed raw data of one satellite is 192bits (24byte), and the specific content is as follows:

Bit number	Bit length	Accumulated bits	Description
0~31	32	32	Channel tracking status word: see note 2 32bits tracking status
32~59	28	60	Doppler frequency (Hz)
60~95	36	96	Pseudorange (m)

<table>
<tr><td>96~127</td><td>32</td><td>128</td><td>ADR (Accumulated Doppler Range, week)

a. ADR (Accumulated Doppler Range) is calculated as follows:
ADR_ROLLS = (RANGECMP_PSR / WAVELENGTH + RANGECMP_ADR) / MAX_VALUE
Round to the closest integer
IF (ADR_ROLLS ≤ 0)
ADR_ROLLS = ADR_ROLLS - 0.5
ELSE
ADR_ROLLS = ADR_ROLLS + 0.5
At this point integerise ADR_ROLLS
CORRECTED_ADR = RANGECMP_ADR - (MAX_VALUE*ADR_ROLLS)
where
ADR has units of cycles
WAVELENGTH = 0.1902936727984 for GPS L1
WAVELENGTH = 0.2442102134246 for GPS L2
MAX_VALUE = 8388608</td></tr>
<tr><td>128~131</td><td>4</td><td>132</td><td>Pseudorange Standard Deviation (m)

Code StdDev-PSR (m)
0 0.050
1 0.075
2 0.113
3 0.169
4 0.253
5 0.380
6 0.570
7 0.854
8 1.281
9 2.375
10 4.750
11 9.500
12 19.000
13 38.000
14 76.000
15 152.000</td></tr>
<tr><td>132~135</td><td>4</td><td>136</td><td>ADR Standard Deviation (Accumulated Doppler Range, week)</td></tr>
<tr><td>136~143</td><td>8</td><td>144</td><td>Number of satellites

1~32=GPS

38~61=GLONASS

1~36=Galileo

1~40=BDS</td></tr>
</table>

			193~202=QZSS 1~7=NavIC
144~164	21	165	Lock Time (s)
165~169	5	170	CNR (dB-Hz) Range 20~51, output 20 when ≤20, output 51 when ≥51
170~175	6	176	GLONASS frequency number
176~191	16	192	Reserved

Note 2: The tracking status is 32bits (4byte) in total, and the specific content is as follows:

Bit number	**Bit length**	**Accumulated bits**	**Description**
0~4	5	5	Tracking State: 0= Idle 1= Sky Search 2= Wide frequency band pull-in 3= Narrow frequency band pull-in 4= Phase lock loop 6= Channel steering 7= Frequency lock loop 9= Channel alignment 10= Code search 11= Aided phase lock loop 23= Side peak detection
5~9	5	10	SV channel number
10	1	11	Phase lock flag

			0=not locked 1=locked
11	1	12	Parity known flag 0 = Not known 1 = Known
12	1	13	Code locked flag 0 = Not locked 1 = Locked
13~15	3	16	Correlator type 0=N/A 1= Standard correlator: spacing = 1 chip 2= Narrow Correlator: spacing < 1 chip 3= Reserved 4= PAC 5= Narrow PAC 6= Reserved
16~18	3	19	Satellite system 0=GPS 1=GLONASS 2=SBAS 3=Galileo 4=BDS 5=QZSS 6=NavIC

			7=Other
19	1	20	Reserved
20	1	21	Grouping 0 = Not grouped 1 = Grouped
21~25	5	26	Signal type (Dependent on satellite system above) GPS 0=L1 C/A 5=L2P 9=L2P encryption 14=L5Q 16=L1C 17=L2C GLONASS 0=L1 C/A 1=L2 C/A 5=L2P SBAS 0=L1 C/A 6=L5I

			Galileo 2=E1C 6=E6B 7=E6C 12=E5a Q 17= E5b Q 20=E5 AltBOC Q BDS 0=B1D1 1=B2D1 2=B3D1 4=B1D2 5=B2D2 6=B3D2 7=B1C 9=B2a 10=B2b QZSS 0=L1 C/A 14=L5Q 16=L1C 17=L2C

			NavIC 0=L5 Other 19=L band
26	1	27	Reserved
27	1	28	Primary L1 channel 0 = Not primary 1 = Primary
28	1	29	Carrier phase measurement 0 = Half Cycle Not Added 1 = Half Cycle Added
29	1	30	Digital filtering on signal 0 = No digital filter 1 = Digital filter
30	1	31	PRN lock flag 0 = PRN Not Locked Out 1 = PRN Locked Out
31	1	32	Channel assignment 0 = Automatic 1 = Forced

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