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X1/A1/C1

INTERFACE PROTOCOL

LOGS & COMMANDS

INTRODUCTION

This document introduces the interface protocol applicable to Bynav IMU-enhanced GNSS receiver.

CONTENT

1 OVERVIEW

1.1 ASCII Format

The general format of messages is given below:

$-< message ID>, < data field >, < data field >, …, < data field > * < checksum > < CR><LF >

See the details in table 1-1. Description of reserved characters is shown in table 1-2.

Table 1 Standard Message Format

field	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 Reserved Characters

Reserved characters	Hexadecimal	Decimal	Description
<CR>	OD	13	Carriage return-
<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

1.2 Data type

Table 3 Data Type

Type	Binary Bytes	Description
Int	4	integer
Float	4	single accuracy floating point
Double	8	double accuracy floating point
Char	1	character
String	n	character string
Hex	n	hexadecimal

2 COMMANDS

Note: the commands marked with* only support X1/A1.

2.1 INTERFACEMODE

Configure the serial port input and output format

Format:

INTERFACEMODE x1 U1 U2

Example:

INTERFACEMODE COM1 BYNAV BYNAV

Description:

Field	Example	Format	Description
0	INTERFACEMODE	INTERFACEMODE	Log header
1	COM1	x1	Serial port number, COM1, COM2, COM3
2	BYNAV	U1	Input protocol type, see note②
3	BYNAV	U2	Output protocol type, see note②

Note①: After this command takes effect, you can use the SAVECONFIG command to save the related configuration to the FLASH.

Note②: Serial format:

BYNAV: NMEA0183 format;

LOG: Bynav self-defined debugging info;

RTCM: RTCM format;

NONE: disable input/output;

FPGA: record raw observation data, large amount of data;

AUTO: IN: automatically recognize input and output data format (commands+RTCM data), OUT: in BASE mode it can output NMEA0183 and RTCM correction data at the same time, in ROVER mode it is the same as BYNAV.

2.2 PJKPARA

➢ **Query PJK parameters**

Recommend input:

LOG PJKPARA

Format:

PJK Paramter A:x.x; 1/F:x.x; B0:x.xxx; L0:x.xxx; N0:x.x; E0:x.x; SCALE: x.x;

HEIGHTMODE:XXX;

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:

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

➢ **Set PJK parameters**

Format:

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

Example:

SET PJKPARA 6378245 298.3 0 0 0 500000 [0.99923 EHT]

Description:

Field	Example	Format	Description
0	SET PJKPARA	SET PJKPARA	Log header
1	6378245	xxxx.xx	Semi-major axis of ellipsoid (m)
2	298.3	xx.xx	Reciprocal flattening
3	0	x.xxx	Origin latitude (°)
4	0	x.xxx	Central meridian (°)
5	0	x.x	North offset (m)
6	500000	x.x	East offset (m)
7	0.99923	x.x	Scale factor
8	EHT	XXX	EHT: Ellipsoid hgt; GHT: Geodetic hgt

Note①: After this command takes effect, you can use the SAVECONFIG command to save it to the FLASH.

2.3 REBOOT

Reboot the program.

2.4 RESET

Restart the commands, and reload the last saved configuration.

2.5 SAVECONFIG

Save configuration into FLASH.

2.6 SERIALCONFIG

Set baud rate of certain serial port.

Format:

SERIALCONFIG x1 x2

Example:

SERIALCONFIG COM1 19200

Description:

Field	Example	Format	Description
0	SERIALCONFIG	SERIALCONFIG	Log header
1	COM1	x1	Serial port number, can be COM1, COM2, COM3
2	19200	x2	Baud rate

Note①: After this command takes effect, you can use the SAVECONFIG command to save the related configuration to the FLASH.

2.7 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:

Field	Example	Format	Description
0	ANT1	INSTranslation	ANT1: lever arm from IMU body frame to ANT1(primary)
1			ANT2: lever arm from IMU body frame to ANT2(secondary)
2			USER: lever arm from IMU body frame to User output frame, that is to change navigation center to 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	Input Frame	IMUBODY	IMU Body Fram
10		VEHICLE	Vehicle Frame

2.8 SETINSROTATION*

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

Format:

SETINSROTATION INSRotation X Y Z [XSD YSD ZSD]

Example:

SETINSROTATION RBV 1.0 2.0 3.0 0.05 0.05 0.05

Description:

Field	Example	Format	Description
0	RBV	INSTranslation	RBV: Rotation parameter from IMU Body Frame to Vehicle Frame
1			USER: Rotation parameter from IMU Body Frame to User Output Frame
2	1.0	X	Rotation parameter of X axis (°), -90~+90
3	2.0	Y	Rotation parameter of Z axis (°) , -180~ + 180
4	3.0	Z	Rotation parameter of Y axis (°) , -180~ + 180
5	0.05	XSD	Optional, the standard deviation of rotation parameter of X axis (°), by default 0.0, 0~45
6	0.05	YSD	Optional, the standard deviation of rotation parameter of Y axis (°), by default 0.0, 0~45
7	0.05	ZSD	Optional, the standard deviation of rotation parameter of Z axis (°), by default 0.0, 0~45

2.9 SETALIGNMENTVEL*

Configure the minimum carrier traveling speed required for alignment.

Format:

SETALIGNMENTVEL V

Example:

SETALIGNMENTVEL 5.0

Description:

Field	Example	Format	Description
0	≥2m/s	V	Minimum alignment velocity, default 2m/s, inferior limit 1m/s

2.10 INSCALIBRATE*

Initialize calibration.

Format:

INSCALIBRATE Offset Trigger

Example:

INSCALIBRATE RBV NEW

Description:

Field	Example	Format	Description
0	RBV	Offset	Calibrate RBV from IMU Body frame to Vehicle frame
1	NEW	Trigger	**NEW:** cover the last calibration value and start a new one
			STOP: stop calibration and use the obtained estimated value
			RESET: reset the calibration process and save the last calibration value

2.11 DNSCONFIG

Configure DNS server of Ethernet

Format:

DNSCONFIG NumDNSServers IP

Example:

DNSCONFIG 1 192.168.1.5

Description:

Field	Example	Format	Description
0	1	NumDNSServers	0: DNS server quantity, no IP address needed when set as 0
			1: 1 DNS server
1	192.168.1.5	IP	Main DNS server address

2.12 IPCONFIG

Configure static or dynamic TCP/IP parameters of the Ethernet

Format:

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

Example:

IPCONFIG ETHA STATIC 192.168.74.10 255.255.255.0 192.168.74.1

Description:

Field	Example	Format	Description
0	ETHA	InterfaceName	Ethernet interface name (default ETHA)
1	STATIC	AddressMode	DHCP: use dynamic IP address
			STATIC: use static IP address
2	192.168.74.10	IPAddress	IP address (default 192.168.8.151)
3	255.255.255.0	Netmask	Subnet mask (default 255.255.0.0)
4	192.168.74.1	Gateway	Gateway (default 192.168.8.1)

2.13 ICOMCONFIG

Configure the transmission/application layer of the Ethernet

Format:

ICOMCONFIG Port Protocol Endpoint

Example:

ICOMCONFIG ICOM1 TCP :2000

Description:

Field	Example	Format	Description
0	ICOM1	Port	Ports: ICOM1/2/3/4
1	TCP	Protocol	DISABLED: disable network service
			TCP: use TCP
			UDP: use UDP
2	2000	Endpoint	Host: port number. If the host field is blank, X1 serves as a server to monitor the port number; if not blank, X1 serves as client to connect actively to the address (Note: a space is mandatory between Protocol and Endpoint)

2.14 FREQUENCYOUT

Configure pulse signal output

Format:

FREQUENCYOUT Switch PluseWidth Period Edge Instance

Example:

FREQUENCYOUT ENABLE 20000000 100000000 POSITIVE 1

Description:

Field	Example	Format	Description
0	ENABLE	Switch	DISABLE: disable pulse signal output
			ENABLE: enable pulse signal output
1	20000000	PluseWidth	Pulse width, in 10 ns, duty ratio= pulse width / period, pulse width cannot be larger than period
2	100000000	Period	Period, unit in 10ns, 1Hz to 20MHz
3	POSITIVE	Edge	Valid in positive edge output
			Valid in negative edge output
4	1	Instance	0: EVENT_OUT0 (invalid, this signal is not drawn for X1)
			1: EVENT_OUT1

2.15 SETINSPROFILE*

Set INS profile

Format:

SETINSPROFILE Profile

Example:

SETINSPROFILE LAND

Description:

Field	Parameter	Value	Description
0	Profile	Default	Basic model
		LAND	Land Vehicle model

2.16 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

Parameter	Value	Description
INSUpdate	POS	Position updates
	ZUPT	Zero Velocity Updates (ZUPT)
	ADR	Carrier phase updates
	ALIGN	Dual-antenna heading updates

	DMI	Distance measuring device updates
Trigger	DISABLE	Disable
	ENABLE	Enable

2.17 TRANS

➢ **Configure serial port data transmission**

Format:

TRANS ON x1 x2

Example:

TRANS ON COM1 COM2

Description:

Field	Example	Format	Description
0	TRANS ON	TRANS ON	Log header
1	COM1	x1	Serial port number, can be COM1, COM2, COM3
2	COM2	x2	Serial port umber, can be COM1, COM2, COM3

Note①: After this command takes effect, you can use the SAVECONFIG command to save the related configuration to the FLASH.

➢ **Disable serial port data transmission**

Recommended input:

TRANS OFF

2.18 UNLOG

➢ **Disable certain message output of a certain port**

Format:

UNLOG x1 U

Example:

UNLOG COM3 GPGGA

Description:

Field	Example	Format	Description
0	UNLOG	UNLOG	Log header
1	COM3	x1	Serial port number, can be COM1, COM2, COM3
2	GPGGA	U	Output messages, see chapter 3

Note①: After this command takes effect, you can use the SAVECONFIG command to save the related configuration to the FLASH.

- **Disable certain message output**

Format:

UNLOG U

Example:

UNLOG GPGGA

Description:

Field	Example	Format	Description
0	UNLOG	UNLOG	Log header
1	GPGGA	U	Output messages, see chapter 3

Note①: After this command takes effect, you can use the SAVECONFIG command to save the related configuration to the FLASH.

- **Disable massage output of certain port**

Format:

UNLOGALL x1

Example:

UNLOGALL COM1

Description:

Field	Example	Format	Description
0	UNLOG	UNLOG	Log header
1	COM1	x1	Serial port number, can be COM1, COM2, COM3

Note①: After this command takes effect, you can use the SAVECONFIG command to save the related configuration to the FLASH.

- **Disable all message output, including correction data under base station mode.**

Recommended input:

UNLOGALL

Note①: After this command takes effect, you can use the SAVECONFIG command to save the related configuration to the FLASH.

2.19 FRESET

Clear the configuration, to be completed.

FRESET [OPTION]

Currently the OPTION can be:

STANDARD: clear all ephemeris, almanac and GLONASS bias correction data

EPHAL: clear all ephemeris and almanac

GPSALMANAC: clear GPS almanac

GPSEPHEM: clear GPS ephemeris

GLOALMANAC: clear GLONASS almanac

GLOEPHEM: clear GLONASS ephemeris

QZSSALMANC: clear QZSS almanac

QZSSEPHEMERIS: clear QZSS ephemeris

BDSALMANAC: clear BDS almanac

BDSEPHEMERIS: clear BDS ephemeris

IONUTC: clear Ionosphere parameters

GLOIFB: clear GLONASS bias correction data

2.20 AUTH

Authorization, take effect after reboot.

Format

AUTH ADD [AUTHSTR]: add authorization

AUTH REMOVE: remove authorization

Example

AUTH ADD E40F99631670CA4F205EB67FE0D2B048

2.21 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 [ON/OFF]

Example

DUALANTENNAPOWER OFF

2.22 GPSREFWEEK

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

Format

GPSREFWEEK [WEEKNUM]

Example

GPSREFWEEK 2553

2.23 NMEATALKER

Configure NMEA header, i.e, the header of the messages GGA/RMC/ZDA etc. When the parameter is not set, it is used to query the current configuration.

Format

NMEATALKER [GP/GN/BD]

Example

NMEATALKER GP

2.24 QUALITYCHECK

Quality check engine. It is to enable another positioning engine to verify the current RTK results, when under blockage and RTK initialization, it is effective to avoid wrong or too early fixed solution, but at the same time it will laed to additional computational burden, so it is not recommended to be enabled for GNSS/INS products. Th 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] [ON/OFF]

Example

QUALITYCHECK POS ON

2.25 RTKTYPE

Configure the receiver working mode, rover station: ROVER; base station: BASE. When the parameter is not set, it is used to query the current configuration.

Format

RTKTYPE [ROVER/BASE]

Example

RTKTYPE ROVER

2.26 SAVEEPHDATA

Save the current ephemeris data.

2.27 ECUFTOFF

Set elevation cut-off angle (°) of the satellites used in the solution， take effect after savconfig and reboot. When the parameter is not set, it is used to query the current configuration.

Format

ECUFTOFF [elevation cut-off angle °]

Example

ECUFTOFF 5

2.28 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 ON [baseline length m] [margin m]

SETBASELINE OFF

Example

SETBASELINE 1 0.03

2.29 SETGLOIFB

For the base station receiver that does not broadcast the GLONASS frequency bias correction data, you can use this command to set the GLO bias correction data calibrated in another way, otherwise, the base station GLONASS observations will not be able to fix the ambiguity.

2.30 SNRCUTOFF

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

Format

SNRCUTOFF [SNR]

Example

SNRCUTOFF 40

2.31 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 dowm 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 full-frequency

WORKFREQS L1L2 GPS : set GPS work frequency

WORKFREQS : query current work frequency

2.32 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

2.33 SET

Set the receiver parameters, take effect after savconfig and reboot. Currently the [OPTION] can be:

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

PJKPARA PJK: PJK parameters, refer to 2.2 PJKPARA

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

Format

SET [OPTION] [PARA]

Example

SET OBSFREQ 2

SET SHIFRDATUM 0 0 0

2.34 OUTPUTSOURCE

Set the 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.

Currently there're three sources:

RAW: raw RTK solution results

KF: RTK solution results after Kalman Filter

INS: INS solution resultts

The following messages are 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]

Example

OUTPUTSOURCE RAW

2.35 FIX

Set base station coordinates, take effect after saveconfig and reboot. When the parameter is not set, it is used to query the current configuration.

Format

FIX [AUTO/POSITION/NONE]

AUTO: take 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 cooerdinates, 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

2.36 RTKTIMEOUT

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

Format

RTKTIMEOUT [DIFFAGE]

Example

RTKTIMEOUT 35

2.37 NTRIPCONFIG

Configure NTRIP connecttion。

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:

Field	Example	Format	Description
0	NTRIPCONFIG	NTRIPCONFIG	NTRIP configuration instruction
1	NCOM1	PORT	NTRIP port（NCOM1/NCOM2）
2	CLIENT	DISABLED	NTRIP connection type
		SERVER	
		CLIENT	
3	V1	PROTOCOL	NTRIP protocol type（V1/V2），default V1
4	192.168.1.88:8888	ENDPOINT	NTRIP connecting IP & ports
5	NTRIP	MOUNTPOINT	NTRIP connecting mount point
6	BYNAV	USER NAME	User name
7	BYNAV	PASSWORD	Password
8	ALL	BINDINTERFACE	Bind interface, fixed ALL

3 LOGS

3.1 Log Header (ASCII)

Users and computers can read ASCII information directly. All ASCII information follows the following general rules:

1. The header of each message is “#”;
2. The variable length of each log message or command depends on the amount of data and format;

3. All data fields are separated by "," with two exceptions:
   - In the first case, the last field of Header is followed by ";", which indicates the beginning of the message;
   - In the second case, the last data field is followed by "*", which indicates the end of the message.
4. Each LOG message has a hexadecimal number beginning with "*" and a carriage return character used to indicate the end of the line, for example: *1234ABCD[CR][LF]. The hexadecimal number is the 32-bit CRC checksum of all characters in this log, but does not include the "#" identifier and "*" and the following 8-bit CRC numbers.
5. An ASCII string is a field that is quoted in double quotes, such as "ASCII string". If a delimiter is applied with double quotes, the string is still a field and the delimiter is ignored (for example, "xxx, xxx"). It is illegal to have double quotes in a string.
6. If the receiver detects an incorrect input message, it will return an error message.

ASCII message structure:

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

The description of the ASCII message header structure is as follows:

ID	Field	Type	Description	Optional Input
1	Sync	Char	Sync character, ASCII message always starts with "#"	N
2	Message	Char	ASCII name of log or command in this manual	N
3	Port	Char	Port that generates log information. String is interface name+x, x is a number from 1-31. If no virtual interface is indicated, the virtual interface is assumed to be 0.	Y
4	Sequence #	Long	Used for multiple log outputs. This is a decreasing number from N-1 to 0, 0 means the last one. Most log messages are only 1 at a time, in this case, the value is 0.	N
5	% Idle Time	Float	The minimum percentage of processor idle time, calculated once per second.	Y
6	Time Status	Enum	GPS time quality, Unknown or Fine, the former indicates that	Y

			the receiver has not yet calculated the accurate GPS time.	
7	Week	Ulong	GPS weeks	Y
8	Seconds	GPSec	GPS Seconds into Week (ms)	Y
9	Receiver Status	Ulong	An eight-digit hexadecimal number used to indicate the status of various hardware and software.	Y
10	Reserved	Ulong	Reserved	Y
11	Receiver s/w Version	Ulong	Number ranged in 0-65535 to indicate receiver firmware version	Y
12	;	Char	Indicate that Header ends	N

3.2 LOGS

3.2.1 BESTPOS

Output best position.

Recommended command:

LOG BESTPOSA ONTIME 1

Example:

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

Field	Example	Example	Format	Description
0	#BESTPOSA,,,,,,,,,;	#BESTPOSA,,,,,,,,,;	#BESTPOSA,,,,,,,,,;	Log header, see Note ③
1	sol stat	SOL_COMPUTED	A	Solution status, see Note ①
2	pos type	SINGLE	A	Positioning status, see note ②
3	lat	28.23315179260	xxx.xx	Latitude (°)
4	lon	112.87713400113	xxx.xx	Longitude (°)
5	hgt	79.7665	xxx.xx	Height above mean sea level (m)
6	undulation	-17.0381	xxx.xx	Undulation (m), the relationship between the

				geoid and the ellipsoid of the chosen datum
7	datum id#	WGS84	A	Datum ID number
8	lat σ	1.2642	xx.xx	Latitude standard deviation (m)
9	lon σ	1.6209	xx.xx	Longitude standard deviation (m)
10	hgt σ	2.1834	xx.xx	Height standard deviation (m)
11	Stn id	"0"	A	Base station ID, 0 for single point positioning.
12	diff_age	0.000	xx.xx	Differential age (s)
13	sol_age	0.022	xx.xx	Solution age (s)
14	#SVs	28	Xx	Number of satellites tracked
15	#solnSVs	27	Xx	Number of satellites used in solution
16	#solnL1SVs	27	Xx	Number of satellites with L1/E1/B1 signals used in solution
17	#solnMultiSVs	27	Xx	Number of satellites with multi-frequency signals usedin solution
18	0	0		Reserved
19	ext sol stat	00	A	Extension solution status
20	Galileo and BDS sig mask	30	Xx	Galileo and BeiDou signals used mask
21	GPS and GLONASS sig mask	13	Xx	GPS and GLONASS signals used mask
22	e3cce9ef	e3cce9ef	hhhhhhhh	Check sum

Note ①: Solution status: SOL_COMPUTED: solution computed; INSUFFICIENT _ OBS: insufficient observations; NO_CONVERGENCE: no convergence; COLD_START: not yet converged from cold start; V_H_LIMIT: height or velocity limits exceeded; VARIANCE: variance exceeds limits; INTEGRITY_WARNING: large residuals make position unreliable; UNABTHORIZED: position type is unauthorized.

Note ②: Positioning or Velocity Status: NONE: no solution; DOPPLER_VELOCITY: Velocity computed using instantaneous Doppler; SINGLE: single point solution; PSRDIFF: pseudorange differential; NARROW_FLOAT: Multi-frequency RTK solution with unresolved,

float carrier phase ambiguities; NARROW_INT: Multi-frequency RTK solution with carrier phase ambiguities resolved to narrow-lane integers; PPP- converged PPP solution.

Note ③: Log header format is explained in the following table:

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

Field	Example	Description
0	#BESTPOSA	Log header
1	COM3	Serial port
2	0	Message numbers, 0 means there is only one message
3	0.0	Fixed to be zero
4	FINESTEERING	Fixed FINESTEERING
5	1975	The number of GPS Weeks from January 6, 1980 to the current week (GPS time)
6	393343.000	The number of seconds from 00:00:00 of this Sunday to the current time (GPS time)
7	00000000	Fixed to be zero
8	0000	Reserved
9	113	Receiver software version

3.2.2 COMCONFIG

Output serial port configuration information.

Recommended input:

LOG COMCONFIG

Format:

Port Baudrate Parity Databit Stopbit FormatIn FormatOut

Example:

COM1 115200 N 8 1 IN:RTCM OUT:RTCM
COM2 460800 N 8 1 IN:BYNAV OUT:BYNAV

Description:

Field	Example	Format	Description
0	COM1	Port	Serial port number, can be COM1, COM2
1	115200	Baudrate	Baud rate
2	N	Parity	Parity: 'N'-no parity; 'O'-odd parity; 'E'-even parity
3	8	Databit	Databit, can be 7, 8
4	1	Stopbit	Stopbit, can be 1, 2
5	RTCM	FormatIn	Input format: can be RTCM, BYNAV, NONE, FPGA
6	RTCM	FormatOut	Output format: can be RTCM, BYNAV, NONE, FPGA

3.2.3 DOP

Output DOP value.

Recommended command:

LOG GPDOP ONTIME 1

Format:

$GPDOP,HHMMSS.SS,xx.xx,xx.xx,xx.xx,xx.xx,xx.xx*hh

0, 1, 2, 3, 4, 5, 6*7

Example:

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

Description:

Field	Example	Format	Description
0	$GPDOP	$--DOP	Data ID
1	022518.00	HHMMSS.SS	UTC time
2	1.03	xx.xx	PDOP: Position Dilution Of Precision
3	0.61	xx.xx	HDOP: Horizontal Dilution Of Precision
4	0.83	xx.xx	VDOP: Vertical Dilution Of Precision
5	0.61	xx.xx	TDOP: Time Dilution Of Precision
6	1.19	xx.xx	GDOP: Geometric Dilution Of Precision
7	70	Hh	Check sum

3.2.4 GGA

Output the receiver time, position and other information.

Recommended command:

LOG GPGGA ONTIME 1

Format:

$--GGA, hhmmss.ss, ddff.ff, a, ddff.ff, a, x, xx, x.x, x.x, M, x.x, M, x.x, xxxx *hh

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 *15

Example:

$GPGGA,062134.00,2813.9908005,N,11252.6285300,E,1,28,0.5,83.6844,M,-17.038,M,0.000,0000*60

Description:

Field	Example	Format	Description
0	$GPGGA	$--GGA	Data ID
1	062134.00	hhmmss.ss	UTC time
2	2813.9908005	ddff.ff	Latitude, see note ①
3	N	a	Latitude direction (N = North, S=South)
4	11252.6285300	dddff.ff	Longitude, see note ②
5	E	a	Longitude direction (E = East, W =West)
6	1	x	Solution status, see note ③
7	28	xx	Number of satellites in use.
8	0.5	x.x	HDOP: Horizontal Dilution Of Precision
9	83.6844	x.x	Antenna altitude above/below mean sea level
10	M	U	Antenna altitude (m)
11	-17.038	x.x	Undulation - the relationship between the geoid and the WGS84 ellipsoid "-"means the sea level is lower than CGS-2000 Ellipsoid
12	M	U	Undulation (m)
13	0.000	xxxx	Differential age (s), see note ④
14	0000	x.x	Differential base station ID, see note ⑤
15	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.

3.2.5 HEADINGA

Output heading from Ture North.

Recommended command:

LOG HEADINGA ONTIME 1

Format:

#HEADINGA,COMx,0,0,FINESTEERING,xxxx,hhmmss.sss,00000000,0000,0000;U,U,

0; 1, 2,

x.xxx,x.xxx,x.xx,a,y.yyy,y.yyy,“xxxx”, x , x , x , x , xx,xx,xx,xx *hh

3, 4, 5, 6, 7, 8, 9, 10, 11,12,13, 14, 15, 16, 17*18

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:

Field	Structure	Format	Description
0	#HEADINGA,……;	#HEADINGA	Log header, see Note ③
1	SOL_COMPUTED	U	Solution status, see note ①
2	NARROW_INT	U	Heading status, see note ②.
3	length	x.xxx	Heading baseline length (m)
4	heading	x.xxx	Heading in degrees, 0 ~ 360(°)
5	pitch	x.xxx	Pitch: -90 ~ +90(°)
6	0	a	Reserved

7	hdg std dev	y.yyy	Heading standard deviation (°)
8	ptch std dev	y.yyy	Pitch standard deviation (°)
9	stn ID	Xxxx	Station ID, it will be zero if it's not differential.
10	#SVs	x	Number of satellites tracked
11	#solnSVs	x	Number of satellites used in heading solution
12	#obs	x	Number of satellites above the elevation mask angle
13	#multi	x	Number of satellites above the mask angle with L2
14	00	xx	Reserved
15	ext sol stat	xx	Extented solution status
16	10	xx	Reserved
17	Sig mask	xx	Signals used in the solution
18	63131FA1	hh	Check sum

Note ①: SOL_COMPUTED: solution computed; INSUFFICIENT_OBS: insufficient observations; COLD_START: not yet converged from cold start.

Note ②: NONE: no heading; NARROW_INT: fixed solution; NARROW_FLOAT: floating point solution.

Note ③: Log header format is explained in the following table:

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

Field	Example	Description
0	#HEADINGA	Log header
1	COM3	Serial port
2	0	Message numbers, 0 means there is only one measage
3	0.0	Fixed to be zero
4	FINESTEERING	Fixed FINESTEERING
5	1975	The number of GPS Week from January 6, 1980 to the current week (GPS time)
6	393343.000	The number of seconds from 00:00:00 of this Sunday to current time (GPS time)
7	00000000	Fixed to be zero
8	0000	Reserved
9	113	Receiver software version

3.2.6 KSXT

Output time, positioning and heading, velocity information.

Recommended input:

LOG KSXT ONTIME 1

Format:

$KSXT,YYYYMMDDhhmmss.ss,x1,x2,x3,x4,x5,x6,x7,x8,x9,x10,x11,x12,x13,x14,x15,x16,x17,x18,x19,x20,x21,x22,x23*hh

Example:

$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:

Field	Structure	Format	Description
1	$KSXT	$KSXT	Log header
2	20191219093115.00	YYYYMMDDhhmmss.ss	Satellite time in format of yyyymmddhhmmss.ss, e.g. 2016040106284180 means 2016(year)4(month)1(day)06(hour)28(mins)41.80(secs)
3	112.87713062	x1	Longitude (°)
4	28.23315515	x2	Latitude (°)

5	65.5618	x3	Height (m)
6	0.00	x4	Yaw, the angle between the line connecting two antennas and True North (primary antenna positioning and secondary antenna heading) (0 °~ 360 °)
7	0.00	x5	Pitch (-90 °~90 °)
8	336.65	x6	Speed angle, the angle between vehicle traveling direction and True North (0 °~360 °)
9	0.010	x7	Speed in vehicle traveling direction (km/h)
10		x8	Roll (-90 °~90 °)
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)

3.2.7 ORI

Output heading information.

Recommended command:

LOG GPORI ONTIME 1

Format:

$--ORI, hhmmss.ss,x,x.x,x.x,x.x, x.x,x.x,x.x *hh

0, 1,2, 3, 4, 5, 6, 7, 8*9

Example:

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

Description:

Field	Example	Format	Description
0	$GPORI	$--ORI	Log header
1	060723.00	hhmmss.ss	UTC time
2	2	x	Solution status, see note ①
3	3.25000000	x.x	Baseline length (m)
4	30.450000	x.x	Azimuth (°)
5	6.112233	x.x	Pitch (°)
6	Reserved	x.x	X of baseline vector (m)
7	Reserved	x.x	Y of baseline vector (m)
8	Reserved	x.x	Z of baseline vector (m)
9		HH	Check sum

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

3.2.8 PASHR

Output heading information

Recommended input:

LOG PASHR ONTIME 1

Format:

$PASHR,hhmmss.ss,xxx.xx,T,xxx.xx,xxx.xx,heave,xx.xxx,xx.xxx,xx.xxx,a*hh

Example:

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

Description:

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

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

3.2.9 PTNL PJK

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

Recommended command:

LOG PTNLPJK ONTIME 1

Format:

$PTNL,PJK,hhmmss.ss,mmddyy,xxxx.xxx,N,xxxx.xxx,E,a,xx,xx.xx,axxx.xx,U*hh

0, 1, 2, 3,4, 5,6,7, 8, 9, 10,11*12

Example:

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

Description:

Field	Example	Format	Description
0	$PTNL,PJK	$PTNL,PJK	Log header
1	022832.00	hhmmss.ss	UTC time
2	111617	mmddyy	Date (mmddyyyy)
3	+3125709.515	xxxx.xxx	X axis, unit: m
4	N	-	X axis direction
5	+684258.136	xxxx.xxx	Y axis, unit: m
6	E	-	Y axis direction
7	1	a	Solution status, see note ①
8	30	xx	Number of satellites used in solution
9	0.526	xx.xx	HDOP
10	EHT+63.147	axxx.xx	Height: EHT-Earth Height GHT-Height above sea level
11	M	U	Unit: m
12	7A	hh	Check sum

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

3.2.10 RMC

Output the simplest navigation data.

Recommended command:

LOG GPRMC ONTIME 1

Format:

$--RMC,hhmmss.ss,A,ddff.ff,a,dddff.ff,a,x.x, x.x,ddmmyy,x.x, a, a *hh

1, 2,3, 4, 5, 6,7, 8, 9, 10, 11,12*13

Example:

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

Description:

Field	Structure	Format	Description
0	$GPRMC	$--RMC	Log header
1	utc	Hhmmss.ss	UTC time
2	pos status	x.x	Position status: A-valid data, V-invalid data
3	lat	ddff.ff	Latitude, see note ①
4	lat dir	a	Latitude direction (N = North, S = South)
5	lon	dddff.ff	Longitude, see note ②
6	lon dir	a	Longitude direction: (E = East, W = West)
7	speed Kn	x.x	Speed over ground, knots (N)
8	track true	x.x	Track made good, degrees True, heading from True North
9	date	ddmmyy	Date: dd/mm/yy
10	mag var	x.x	Magnetic variation (°)
11	var dir	a	Magnetic variation direction E/W
12	mode ind	a	Positioning mode indicator,, see note ③.
13	*xx	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: N = invalid data; A= autonomous; F= floating point; R=differential

3.2.11 VER

Output version number

Recommended input:

LOG VERSION

Format:

$--VER,x1,x2,x3,x4,x5,x6*hh

Example:

$BDVER,V7.22_A98648_T,19060377,20081383,20081273,20081394,20080419,20060303,20060302*27

Description:

Field	Structure	Format	Description
0	$BDVER	$--VER	Log header
1	V7.22_A98648_T	Vx.xx_YYYY	Firmware version
2	19060377	x1	FPGA version
3	20081383	x2	ARM version
4	20081273	x3	PB version
5	20081394	x4	Solution base version
6	20080419	x5	Kernel version
7	20060303	x6	Web server version
8	20060302	x7	Web interface version
9	6D	hh	Check sum

3.2.12 ZDA

Output UTC time, date and local time zone.

Recommended command:

LOG GPZDA ONTIME 1

Format:

$--ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh

0, 1,2, 3, 4, 5, 6*7

Example:

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

Description:

Field	Example	Format	Description
0	$GPZDA	$--ZDA	Log header
1	utc	hhmmss.ss	UTC time
2	day	xx	Day
3	month	xx	Month
4	year	xxxx	Year
5	8	xx	Local time zone, see note ①.
6	0	xx	difference in local time zone, see note ①.
7	*xx	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.

3.2.13 BESTGNSSPOS

Output GNSS positioning (non-INS).

Recommended command:

LOG Port BESTGNSSPOS ONTIME 1

Example:

#BESTGNSSPOSA,ICOM4,0,0.0,FINESTEERING,2109,367696.000,00000000,0000,82;SOL_COMPUTED,NARROW_INT,28.23315515415,112.87713068512,82.5990,-17.0381,WGS84,0.0106,0.0110,0.0250,"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	Log header	-	H	0
2	Sol Type	Solution status	Enum	4	H
3	Pos Type	Position type	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	Float	4	H+32
8	Datum ID	Datum ID	Enum	4	H+36
9	Lat σ	Latitude standard deviation	Float	4	H+40

10	Lon σ	Longitude standard deviation	Float	4	H+44
11	Hgt σ	Height standard deviation	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	Uchar	1	H+65
17	#solnL1SVs	Number of L1/E1/B1 satellites used	Uchar	1	H+66
18	#solnMultiSVs	Number of multi-frequency satellites used	Uchar	1	H+67
19	Reserved		Uchar	1	H+68
20	Ext sol stat	Extended solution status	Hex	1	H+69
21	Galileo and BeiDou sig mask	Galileo&BeiDou signal mask	Hex	1	H+70
22	GPS and GLONASS sig mask	GPS&GLONASS signal mask	Hex	1	H+71
23	xxx	32-bitCRC parity	Hex	4	H+72
24	[CR][LF]	Message terminator	-	-	-

Note ①: Solution status: SOL_COMPUTED: solution computed; INSUFFICIENT_OBS: insufficient observations; NO_CONVERGENCE: no convergence; COLD_START: not yet converged from cold start; V_H_LIMIT: height or velocity limits exceeded; VARIANCE: variance exceeds limits; INTEGRITY_WARNING: large residuals make position unreliable; UNABTHORIZED: position type is unauthorized; SINGLE-single point solution.

Note ②: Positioning or Velocity Status: NONE: no solution; DOPPLER_VELOCITY: Velocity computed using instantaneous Doppler; SINGLE: single point solution; PSRDIFF: pseudorange differential; NARROW_FLOAT: Multi-frequency RTK solution with unresolved, float carrier phase ambiguities; NARROW_INT: Multi-frequency RTK solution with carrier phase ambiguities resolved to narrow-lane integers; PPP- converged PPP solution.

3.2.14 BESTGNSSVEL

GNSS velocity (non-INS).

Recommended input:

LOG Port BESTGNSSVELA ONTIME 1

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	Log header	-	H	0
2	Sol Status	Solution status	Enum	4	H
3	Vel Type	Velocity type	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)	Double	8	H+32
9	Reserved			Float	4
10	xxx	32-bitCRC parity	Hex	4	H+44
11	[CR][LF]	Message terminator		-	-

3.2.15 CORRIMUDATA*

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 of CORRIMUDATA, in units of radians for the attitude rate and m/s for the accelerations.

Recommended input:

LOG Port CORRIMUDATAA ONNEW

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	Log header	-	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	Hex	4	H+56
11	[CR][LF]	Message terminator	-	-	-

3.2.16 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 of CORRIMUDATA, in units of radians for the attitude rate and m/s for the accelerations.（This log is the short header version of the **CORRIMUDATA**）

Recommended input:

LOG Port CORRIMUDATASA ONTIME 0.01

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	Log header	-	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	Hex	4	H+56
11	[CR][LF]	Message terminator	-	-	-

3.2.17 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 input:

LOG ENUAVR ONTIME 1

Example:

#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	Field	Description	Binary format	Binary bytes	Binary offset
1	ENUAVR header	Log header	-	H	0
2	ANT1 East	ANT1 East position (m)	Double	8	H
3	ANT1 North	ANT1 North position (m)	Double	8	H+8
4	ANT1 Up	ANT1 Up position (m)	Double	8	H+16
5	ANT2 East	ANT2 East position (m)	Double	8	H+24
6	ANT2 North	ANT2 North position (m)	Double	8	H+32
7	ANT2 Up	ANT2 Up position (m)	Double	8	H+40
8	Roll	Roll (°)	Double	8	H+48
9	Pitch	Pitch (°)	Double	8	H+56
10	Count	Count	Int	4	H+64
11	xxx	32-bitCRC	Hex	4	H+68
12	[CR][LF]	Message terminator	-	-	-

3.2.18 ICOMCONFIG

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

Recommended input:

ICOMCONFIG Port Protocol Endpoint

Example:

ICOMCONFIG ICOM1 TCP1 TCP 192.168.1.8:1000 ICOMCONFIG ICOM2 TCP :2000

Description:

Field	ASCII value	Description
Port	ICOM1	Name of thr port
	ICOM2	
	ICOM3	
	ICOM4	
Protocol	DISABLED	disable the service
	TCP	Use raw TCP
	UDP	Use raw UDP
Endpoint	Host:Port	host:port, If host is blank, X1 will act as a server to monitor the port number, 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)

3.2.19 IPSTATUS

Output the configuration of IP address, netmask, gateway and a list of DNS servers currently in use.

Recommended input:

LOG Port IPSTATUSA ONCE

Example:

#IPSTATUSA,ICOM4,0,0.0,FINESTEERING,2106,444455.800,00000000,0000,68;1,ETHA,"192.168.8.130","255.255.0.0","192.168.1.9",0*f276973e

Description:

ID	Field	Description	Binary format	Binary bytes	Binary offset
1	IPSTATUS header	Log header	-	H	0
2	#IPRec	Number of records to follow	Ulong	4	H
3	Interface	Name of the network interface	Enum	4	H+4
4	IP Address	IP address	String[16]	variable 1	H+8
5	Netmask	Netmask	String[16]	variable 1	H+24
6	Gateway	Gateway	String[16]	variable 1	H+40
7	#DNSServer	DNS server	Ulong	4	H+4+(#IPRec ×52)

8	IP Address	DNS server IP address	String[16]	variable 1	H+4+(#IPRec ×52)+4
9	xxx	32-bitCRC	Hex	4	H+4+(#IPRec ×52) +4+(# DNSServer×16)
10	[CR][LF]	Message terminator	-	-	-

3.2.20 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.

Recommended input:

LOG Port INSATTA ONTIME 1

Example:

#INSATTA,ICOM4,0,0.0,FINESTEERING,2106,444520.000,00000000,0000,68;2106,444520.00000000,179.817646100, 0.384419858,0.601726410,INS_ALIGNMENT_COMPLETE*127e6ba7

Description:

ID	Field	Description	Binary format	Binary bytes	Binary offset
1	INSATT header	Log header	-	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 status, see note①	Enum	4	H+36
8	xxx	32-bitCRC	Hex	4	H+40
9	[CR][LF]	Message terminator	-	-	-

Note①: INS status:

Status Marking	Description
INS_INACTIVE	Alignment not activated
WAITING_INITIALPOS	Waiting for position
WAITING_AZIMUTH	Waiting for Azimuth
INS_ALIGNING	In coarse alignment
INS_ALIGNMENT_COMPLETE	Coarse alignment completed
INS_HIGH_VARIANCE	High covariance Attitude estimation not converged
INS_SOLUTION_GOOD	Alignment completed, good results
INS_SOLUTION_FREE	Poor satellite signals, results not available

3.2.21 INSCALSTATUS*

Report the status and estimated value in current calibration

Recommended input:

LOG INSCALSTATUSA ONTIME 1

Example:

#INSCALSTATUSA,ICOM4,0,0.0,FINESTEERING,2106,445650.000,00000000,0000,68;RBV,0.00

00,0.0000,0.0000,45.0000,45.0000,45.0000,INS_CONVERGING,0*d1c62c20

Description:

ID	Field	Description	Binary format	Binary bytes	Binary offset
1	INSCALSTATUS header	Log header	-	H	0
2	Offset Type	Offset Type	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	Initial offset source	Enum	4	H+28
10	Calibration Count	Calibration count	Ulong	4	H+32
11	xxx	32-bit CRC	Hex	4	H+36
12	[CR][LF]	Message terminator	-	-	-

3.2.22 INSCONFIG*

Check configuration and anaylize system in post-processing

Recommended input:

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	Log header	-	H	0
2	IMU Type	IMU type	Enum	4	H

3	Mapping	direction	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	Enum	4	H+8
7	Enabled Updates	Enabled Updates type	Hex	4	H+12
8	Alignment Mode	Alignment Mode	Enum	4	H+16
9	Relative INS Output Frame	Relative INS Output Frame defined by user	Enum	4	H+20
10	Relative INS Output Direction	Relative INS Output Direction defined by user	Bool	4	H+24
11	INS Receiver Status	INS Receiver Status	Hex	4	H+28
12	Reserved	-	Uchar	1	H+32
13	Reserved	-	Uchar	1	H+33
14	Reserved	-	N/A	2	H+34
15	Reserved	-	N/A	4	H+36
16	Reserved	-	N/A	4	H+40
17	Reserved	-	N/A	4	H+44
18	Reserved	-	N/A	4	H+48
19	Reserved	-	N/A	4	H+52
20	Reserved	-	N/A	4	H+56
21	Number of Translations	Number of Translations	Ulong	4	H+60
22	Translation	Translation	Enum	4	variable
23	Frame	Frame	Enum	4	variable
24	X Offset	X-axis Offset	Float	4	variable
25	Y Offset	Y-axis Offset	Float	4	variable
26	Z Offset	Z-axis Offset	Float	4	variable
27	X Uncertainty	X-axis Uncertainty	Float	4	variable
28	Y Uncertainty	Y-axis Uncertainty	Float	4	variable
29	Z Uncertainty	Z-axis Uncertainty	Float	4	variable
30	Translation Source	Translation Source	Enum	4	variable
variable	Number of Rotations	Number of Rotations	Ulong	4	variable
variable	Rotation	Rotation	Enum	4	variable
variable	Frame	Frame	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-axis Rotation Std Dev	Float	4	variable
variable	Y Rotation Std Dev	Y-axis Rotation Std Dev	Float	4	variable
variable	Z Rotation Std Dev	Z-axis Rotation Std Dev	Float	4	variable
variable	Rotation Source	Rotation Source	Enum	4	variable

variable	xxx	32-bitCRC	Hex	4	variable
variable	[CR][LF]	Message terminator	-	-	-

3.2.23 INSPOS*

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

Recommended input

LOG Port INSPOSA ONTIME 1

Example:

#INSPOSA,ICOM4,0,0.0,FINESTEERING,2107,34578.000,00000000,03de,68;2107,34578.000000000,28.23317171539,112.87712332635,81.4569,INS_ALIGNMENT_COMPLETE*3070d086

Description:

ID	Field	Description	Binary format	Binary bytes	Binary offset
1	INSPOS header	Log header	-	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 status, see *3.2.20 note①*	Enum	4	H+36
8	xxx	32-bitCRC parity	Hex	4	H+40
9	[CR][LF]	Message terminator	-	-	-

3.2.24 INSPVA*

Output position, velocity and attitude.

Recommended input:

LOG Port INSPVAA ONTIME 1

Example:

#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	Log header	-	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	IMU Status, see *3.2.20 note①*	Enum	4	H+84
14	xxx	32-bitCRC parity	Hex	4	H+88
15	[CR][LF]	Message terminator	-	-	-

3.2.25 INSPVAS*

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

Recommended input:

LOG Port INSPVASA ONTIME 1

Example:

%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	Log header	-	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	IMU Status, see *3.2.20 note①*	Enum	4	H+84
14	xxx	32-bitCRC	Hex	4	H+88
15	[CR][LF]	Message terminator	-	-	-

3.2.26 INSPVAX*

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

Recommended input:

LOG Port INSPVAXA ONTIME 1

Example:

#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,-0.0191,0.0006,179.789714292,0.387541550,1.405962922,0.0240,0.0168,0.0218,0.0047,0.0049,0.0054,0.0553,0.0553,1.0818,00000000,0*fd6e3a89

Description:

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSPVAX header	Log header	-	H	0
2	INS Status	INS status	Enum	4	H
3	Pos Type	Position type	Enum	4	H+4
4	Lat	Latitude (°)	Double	8	H+8
5	Lon	Longitude (°)	Double	8	H+16
6	Hgt	Ellipsoid height (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	Extented Solution status	Hex	4	H+120
24	Time Since Update	Time Since Update (s)	Ushort	2	H+124
25	xxx	32-bitCRC	Hex	4	H+126
26	[CR][LF]	Message terminator	-	-	-

3.2.27 INSSPD*

Output velocity in horizontal and vertical directions.

Recommended input:

LOG Port INSSPDA ONTIME 1

Example:

#INSSPDA,ICOM4,0,0.0,FINESTEERING,2107,37106.000,00000000,0000,68;2107,37106.000000000,5.233402789,0.014530860,-0.000531521,INS_ALIGNMENT_COMPLETE*4ac6a980

Description:

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset
1	INSSPD header	Log header	-	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 status, see *3.2.20 note①*	Enum	4	H+36
8	xxx	32-bitCRC	Hex	4	H+40
9	[CR][LF]	Message terminator	-	-	-

3.2.28 INSSTDEV*

Output the INS position, velocity and attitude standard deviation.

Recommended input:

LOG Port INSSTDEVA ONTIME 1

Example:

#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	Log header	-	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	Ulong	4	H+36
12	Time Since Update	Elapsed time since the last ZUPT or position update (seconds)	Ushort	2	H+40
13	Reserved		Ushort	2	H+42
14	Reserved		Ulong	4	H+44
15	Reserved		Ulong	4	H+48
16	xxxx	32-bitCRC	Hex	4	H+52
17	[CR][LF]	Message terminator	-	-	-

3.2.29 INSVEL*

Output velocity in the Local Level frame (ENU).

Recommended input:

LOG Port INSVELA ONTIME 1

Example:

#INSVELA,ICOM4,0,0.0,FINESTEERING,2107,37289.000,00000000,0000,68;2107,37289.000000000,0.0099,-0.0082,-0.0014,INS_ALIGNMENT_COMPLETE*7c7a85fb

Description:

ID	Field	Description	Binary Format	Binary Bytes	Binary Offset

1	INSVEL header	Log header	-	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	Double	8	H+12
5	East Velocity	East velocity	Double	8	H+20
6	Up Velocity	Up velocity	Double	8	H+28
7	Status	INS status, see *3.2.20 note①*	Enum	4	H+36
8	xxx	32-bitCRC parity	Hex	4	H+40
9	[CR][LF]	Message terminator	-	-	-

3.2.30 MARKTIME, MARK2TIME

Mark the EVENT_IN time.

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

MARK2TIME: to mark external trigger EVENT_IN time.

Recommended input:

LOG Port MARKTIMEA ONNEW

LOG Port MARK2TIMEA ONNEW

Example:

#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	MARKTIMEA/ MARK2TIME header	Log header	-	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	Enum	4	H+36
9	xxx	32-bitCRC parity	Ulong	4	H+40
10	[CR][LF]	Message terminator	-	-	-

3.2.31 RAWIMU*

Provide the IMU raw observation data, and the reference origin is the enclosure navigation center.

Recommended input:

LOG Port RAWIMUA ONNEW

Example:

```
#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	Log short header	-	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-bitCRC parity	Hex	4	H+40
12	[CR][LF]	Message terminator	-	-	-

*unit: LSB (Least Significant Bit), conversion scale factor related with IMU model.

3.2.32 RAWIMUS*

Provide IMU raw observation data, and some additional information beside RAWIMU, and the reference origin is the enclosure navigation center. (Note that the log header is the short version of **RAWIMU**.)

Recommended input:

LOG Port RAWIMUSA ONNEW

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	RAWIMU header	Log short header	-	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-bitCRC parity	Hex	4	H+40
12	[CR][LF]	Message terminator	-	-	-

*unit: LSB (Least Significant Bit), conversion scale factor related with IMU model.

3.2.33 RAWIMUX*

Output extended IMU raw observation data, and the reference origin is the enclosure navigation center.

Recommended input:

LOG Port RAWIMUXA ONNEW

Example:

#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	Log header	-	H	0
2	Imu Info	IMU info: Bit 0 set to 1 indicates IMU failure	Hex	1	H
3	Imu Type	IMU model*	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	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-bitCRC parity	Hex	4	H+40
14	[CR][LF]	Message terminator	-	-	-

*IMU model: 3: X1-3; 6: X1-6.

3.2.34 RAWIMUSX*

Provide extended IMU raw observation data, and some additional information beside RAWIMU, and the reference origin is the enclosure navigation center. (Note that the log header is the short version of **RAWIMUX**)

Recommended input:

LOG Port RAWIMUSXA ONNEW

Example:

#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	RAWIMUSX header	Log header	-	H	0
2	Imu Info	IMU info: Bit 0 set to 1 indicates IMU failure	Hex	1	H
3	Imu Type	IMU model*	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	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-bitCRC parity	Hex	4	H+40
14	[CR][LF]	Message terminator	-	-	-

*IMU model: 3: X1-3; 6: X1-6.

3.2.35 AUTHORIZATION

Output authorization information.

Recommended input

LOG AUTHORIZATION ONCE

Example

AuthStr: 90F2D223547EAA4BF799FBD564732364;

AuthMode: X1-3H;

AuthWeek: 12287;

InsEnable: TRUE;

DualAntEnable: TRUE;

RawOutEnable: TRUE;

AssistEnable: TRUE;

OdoEnable: TRUE;

MaxInsFreq: 100;

MaxRTKFreq: 5;

FrqMask: B1IB2IB3IB1CB2AB2BL1L1CL2CL2PL5G1G2E1E5BE5AI5;

NavSys: GPS GLONASS GALILEO BEIDOU QZSS IRNSS;

Format

AuthStr：Authorization code

AuthMode：Receiver model

AuthWeek: Authorization valid period (GPS WEEK)

InsEnable：INS status

DualAntEnable: Dual antenna status

RawOutEnable: Raw observation output status

AssistEnable: GNSS/INS auxiliary function (selfcheck, Lever Arm measurement, RBV)

OdoEnable: Odometry function

MaxInsFreq: Max. INS output frequency

MaxRTKFreq: Max. RTK output frequency

FrqMask: Frequency

NavSys: Satellite system

3.2.36 FLASHDNA

Output receiver DNA

Recommended input

LOG FLASHDNA ONCE

Example

FlashDNA: 0000000000EF6018D46888950B163E39; 0

Format

FlashDNA: [FLASHDNA]; [AUTH EXPIRATION]

3.2.37 REFSTATIONA

Output base station coordinates (ECEF)

Recommended input

LOG REFSTATIONA ONCE

LOG REFSTATIONINFOA ONCE

Example

RefStation: 0.00000000 0.00000000 0.000

Format

RefStation: [X] [Y] [Z]

3.2.38 SHIFTDATUM

Output frame shift parameters X, Y, Z

Recommended input

LOG SHIFRDATUM ONCE

Example

ShiftDatum :0.000 0.000 0.000

Format

ShiftDatum :[X] [Y] [Z]

3.2.39 IPCONFIG

Output receiver network configuration

Recommended input

LOG IPCONFIG ONCE

Example

IPCONFIG STATIC 192.168.8.130 255.255.0.0 192.168.1.9

Format

IPCONFIG [AddressMode] [IPAddress] [NetMask] [GateWay]

3.2.40 NMEATALKER

Output NMEA talker

Recommended input

LOG NMEATALKER ONCE

Example

NMEATALKER GP

Format

NMEATALKER [HEADER]

3.2.41 RTKCONFIG

Output RTK configuration

Recommended input

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

Format

RTK Type: receiver work mode

DualAnt: enable dual antenna mode

OBS Intr: observation frequency

FPGARaw Freq: FPGA raw data frequency

RTK Freq: satellites tracking frequency

Elev Mask: elevation mask

Snr Mask: CNR mask

NAVSYS: satellites tracking system

3.2.42 ATR

Output positioning and heading information.

Recommended command:

LOG GPATR ONTIME 1

Format:

$--ATR,hhmmss.ss, a, x.x, x.x, x.x, x.x, a, x.x,x.x, *hh

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10*11

Example:

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

Description:

Field	Example	Format	Description
0	GPATR	$--ATR	Data ID
1	062743.00	hhmmss.ss	UTC time
2	4	a	Positioning status, see note ①.
3	0.000	x.x	Baseline length (m)
4	-0.002	x.x	North distance (m)
5	0.000	x.x	East distance (m)
6	0.006	x.x	Up distance (m)
7	4	a	Heading status, see note ①.
8	37.19	x.x	Yaw (°)
9	-76.84	x.x	Pitch (°)
10	*	-	Reserved
11	7F	hh	Check sum

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

3.2.43 ENU

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

Recommended command:

LOG GPENU ONTIME 1

Format:

$--ENU,hhmmss.ss,xx.xx,xx.xx,xx.xx,a,xx.xx,xx.xx,xx.xx,a,xx.xx,xx.xx,xx.xx,a,xx.xx,xx.xx,xx.xx,a,xx.xx,xx.xx,xx.xx,a,xx.xx,xx.xx,xx.xx,a,a,xx,xxxx*hh

Example:

$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

Field	Example	Format	Description
0	$GPENU	$--ENU	Log 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 note②
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.

3.2.44 FPD

Output position and attitude information.

Recommended command:

LOG GPFPD ONTIME 1

Format:

$--FPD,xxxx,ssssss,xx.xx,xx.xx,xx.xx,xxx.xx,xxx.xx,xxx.xx,xx.xx,xx.xx,xx.xx,xx.xx, xx, xx,a*hh

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,13,14,15*16

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:

Field	Example	Format	Description
0	$GPFPD	$--FPD	Data ID
1	1975	xxxx	The number of GPS Weeks from January 6, 1980 to the current week (GPS time)
2	3555908.00	ssssss	The number of seconds from 00:00:00 of this Sunday to the current time (GPS time)
3	296.248	xx.xx	Yaw 0 °~ 360 °
4	-71.075	xx.xx	Pitch -90 °~ 90 °
5	1.579	xx.xx	Roll -180 °~ 180 °
6	28.233170896	xxx.xx	Latitude -90 °~ 90 °
7	112.877141017	xxx.xx	Longitude -180 °~ 180 °
8	61.053	xxx.xx	Height (m)
9	-0.157	xx.xx	East velocity (m/s)
10	0.020	xx.xx	North velocity (m/s)
11	-0.021	xx.xx	Up velocity (m/s)
12	3.898	xx.xx	Baseline length (m)
13	30	xx	Number of Satellites for antenna 1
14	30	xx	Number of satellites for antenna 2
15	1	A	Solution status, see note ①
16	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.

3.2.45 GST

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

Recommended command:

LOG GPGST ONTIME 1

Format:

$GPGST,HHMMSS.SS,A.A,B.B,C.C,D.D,E.E,F.F,G.G *CC<CR><LF>

0, 1, 2, 3, 4, 5, 6, 7, 8, *9

Example:

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

Description:

Field	Example	Format	Description
0	$GPGST	$--GST	Data ID
1	utc	hhmmss.ss	UTC time, (hours/minutes/seconds)
2	rms	a.a	RMS value of the standard deviation of the pseudorange to the navigation process.
3	smjr std	b.b	Standard deviation of semi-major axis of error ellipse (m)
4	smnr std	c.c	Standard deviation of semi-minor axis of error ellipse (m)
5	orient	d.d	Orientation of semi-major axis of error ellipse (degrees from true north)
6	lat std	e.e	Standard deviation of latitude error (m)
7	lon std	f.f	Standard deviation of longitude error (m)
8	alt std	g.g	Standard deviation of altitude error (m)
9	*xx	*cc	Check sum

3.2.46 GSV

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

Recommended command:

LOG GPGSV ONTIME 1

Format:

$--GSV, x.x, x.x, xx, xxx, x.x, x.x, x.x, … …*hh

0, 1, 2, 3, 4, 5, 6, 7, … … *n

Example:

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

Description:

Field	Example	Format	Description
0	$GPGSV	$--GSV	Log header
1	# msgs	x.x	Total number of GSV messages
2	msg #	x.x	Current GSV message number
3	# sats	xx	Number of satellites in view
4	prn	xxx	Satellite PRN number
5	elev	x.x	Elevation, degrees, 90 maximum
6	azimuth	x.x	Azimuth, degrees True, 000 to 359
7	SNR	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	*xx	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).

3.2.47 HDT

Output heading in degrees from True North.

Recommended command:

LOG GPHDT ONTIME 1

Format:

$--HDT,x.x,T*hh

0, 1,2*3

Example:

$GPHDT,98.397404,T*39

Description:

Field	Structure	Format	Description
0	$GPHDT	$--HDT	Log header
1	heading	x.x	Heading in degree
2	true	T	Degrees True
3	*xx	hh	Check sum

3.2.48 HPD

Output GPS positioning and heading messages.

Recommended command:

LOG GPHPD ONTIME 1

Format:

$GPHPD,xxxx,xxxx.xx,xx.xx,xx.xx,xx.xx,xx.xx,xxx.xx,xxx.xx,xxx.xx,xx.xx,xx.xx,xx.xx,xx.xx,xx.xx,

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,

xx.xx,xx.xx,xx.xx,xx.xx,xx.xx,xx.xx,xx,xx, a *hh

13, 14, 15, 16, 17, 18, 19, 20, 21 *22

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:

Field	Example	Format	Description
0	$GPHPD	$--HPD	Log header
1	1975	xxxx	The number of GPS week from January 6, 1980 to current week (GPS time)
2	355985.00	xxxx.xx	The number of seconds from 00:00:00 of this Sunday to the current time (GPS time)
3	296.248	xx.xx	Yaw 0 ~ 360(°)
4	-71.075	xx.xx	Pitch -90 ~ 90(°)
5	292.096	xx.xx	The angle of the ground velocity from True North (0-359.99°)
6	28.233173291	xxx.xx	Latitude (°)
7	112.877139847	xxx.xx	Longitude (°)
8	61.040	xxx.xx	Height (m)

9	-492.200	xx.xx	East distance of rover station relative to base station (m)
10	567.901	xx.xx	North distance of rover station relative to base station (m)
11	-28.918	xx.xx	Up distance of rover station relative to base station (m)
12	-0.003	xx.xx	East velocity (m/s)
13	0.001	xx.xx	North velocity (m/s)
14	-0.006	xx.xx	Up velocity (m/s)
15	0.005	xx.xx	East velocity difference between two measurements (m/s)
16	-0.003	xx.xx	North velocity difference between the two measurements (m/s)
17	-0.006	xx.xx	Up velocity difference between two measurements (m/s)
18	1.808	xx.xx	Baseline length (m)
19	30	xx	Available Satellites from Secondary Antenna
20	30	xx	Available Satellites from Primary Antenna
21	1	a	Solution status, see Note ①
22	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.

3.2.49 NTR

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

Recommended command:

LOG GPNTR ONTIME 1

Format:

$--NTR,hhmmss.ss ,a,xxx.xxx,xxx.xxx,xxx.xxx, xxx.xxx,xxx*hh

0, 1, 2, 3, 4, 5, 6, 7*8

Example:

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

Description:

Field	Structure	Format	Descriptio
0	$GPNTR	$--NTR	Log header
1	utc	hhmmss.ss	UTC time
2	pos status	a	Solution status, see note ①

3	distance	xxx.xxx	Oblique distance between the rover and the base (m)
4	distance in north	xxx.xxx	Distance in X direction (m) "+": north of the base "-": south of the base
5	distance in east	xxx.xxx	Distance in Y direction (m) "+": east of the base "-": west of the base
6	distance in vertical direction	xxx.xxx	Distance in H direction (m) "+": above the base "-": below the base
7	Station ID	xxx	Station ID
8	*xx	hh	Check sum

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

3.2.50 PTNL AVR

Output yaw information.

Recommended input:

LOG PTNLAVR ONTIME 1

Format:

$PTNL,AVR,hhmmss.ss,xxx.xxx,Yaw,xx.xx,Tilt, , ,xx.xx,a,xx.xx,xx*hh

0, 1, 2, 3, 4, 5, 6, 7, 8, 9,10, 11,12*13

Example:

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

Description:

Field	Example	Format	Description
0	$PTNL,AVR	$PTNL,AVR	Log header
1	032735.00	hhmmss.ss	UTC time
2	+37.1860	xxx.xxx	Yaw (°)
3	Yaw	Yaw	Yaw mark
4	-76.8374	xx.xx	Pitch (°)
5	Tilt	Tilt	Pitch mark

6		-	Reserved
7		-	Reserved
8	0.001	xx.xx	Baseline length (m)
9	3	a	Solution status, see note ①
10	1.5	xx.xx	PDOP: Position Dilution Of Precision
11	21	xx	Number of satellites used in solution
12	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.

3.2.51 TRA

Output Yaw, Pitch and Roll.

Recommended input:

LOG GPTRA ONTIME 1

Format:

$--TRA,hhmmss.ss,xxx.xx,xxx.xx,xx.xx,a,xx,xx.xx,xxxx*hh

Example:

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

Description:

Field	Structure	Format	Description
0	$GPTRA	$--TRA	Log header
1	063027.30	hhmmss.ss	UTC time
2	101.78	xxx.xx	Yaw (°)
3	071.19	xxx.xx	Pitch(°)
4	-00.00	xx.xx	Roll(°)
5	4	a	Solution status, see note①
6	10	xx	Number of satellites used in solution
7	0	xx.xx	Differential age (s)
8	0004	xxxx	Station ID
9	51	hh	Check sum

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

3.2.52 VTG

Track made good and the velocity relative to the ground.

Recommended command:

LOG GPVTG ONTIME 1

Format:

$--VTG,xxx.xxx,U,xxx.xxx,U,xxx.xxx,U,xxx.xxx,U,U*33

0, 1, 2, 3, 4, 5, 6, 7, 8,9*10

Example:

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

Description:

Field	Structure	Format	Description
0	$GPVTG	$--VTG	Log header
1	track true	xxx.xxx	Track made good, degrees True, 000 ~ 359(°)
2	T	U	Degrees True
3	track mag	xxx.xxx	Track made good, degrees Magnetic; 000 ~ 359 (°)
4	M	U	Magnetic track indicator
5	speed Kn	xxx.xxx	Speed over ground, 000~999 in knots (nautical miles per hour)
6	N	U	Nautical speed indicator (N = Knots)
7	speed Km	xxx.xxx	Speed, kilometers/hour: 000~999
8	K	U	Speed indicator (K = km/hr)
9	mode ind	U	Positioning mode indicator, see note ①.
10	*xx	hh	Check sum

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

3.2.53 NTRIPCONFIG

Output NTRIP configuration information

Recommended input:

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:

Field	Structure	Format	Description
0	NCOM1	PORT	NTRIP ports（NCOM1/NCOM2）
1	CLIENT	DISABLED	NTRIP connect type
		SERVER	
		CLIENT	
2	V1	PROTOCOL	NTRIP protocol type（V1/V2）
3	192.168.1.88:8888	ENDPOINT	NTRIP connecting IP & port num
4	NTRIP	MOUNTPOINT	NTRIP connecting mount point
5	BYNAV	USER NAME	User name
6	BYNAV	PASSWORD	Password
7	ALL	BINDINTERFACE	Bind interface, fixed to ALL

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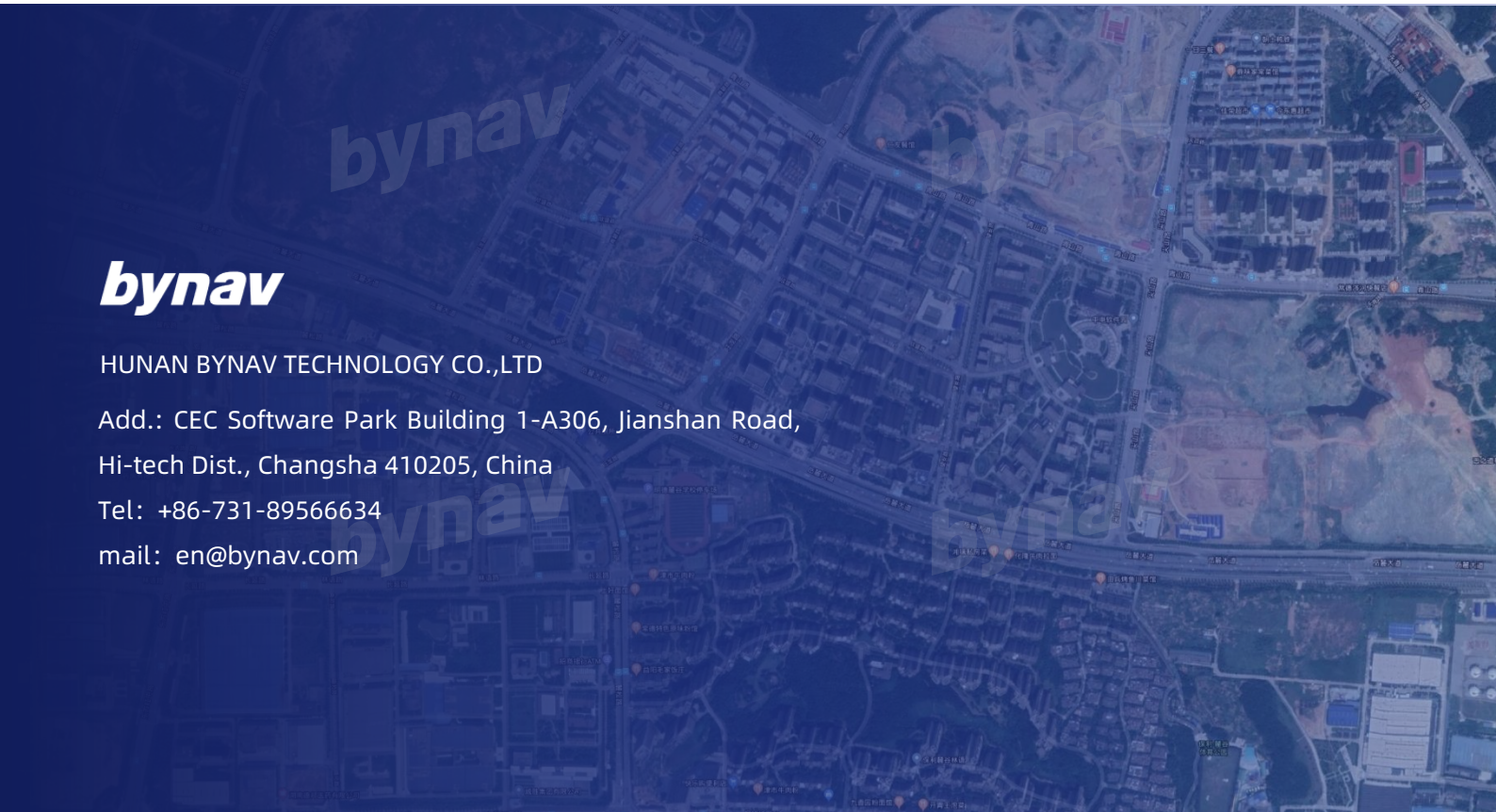

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