



875-0374

Reference Manual

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NMEA2000

Proprietary Messages

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

This product complies with the essential requirements and other relevant provisions of Directive 2014/53/EU. The declaration of conformity may be consulted at <https://hemispheregnss.com/About-Us/Quality-Commitment>.

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6469663	7162348	7437230	8085196	8265826	2004320401
6501346	7277792	7460942	8102325	8271194	
6539303	7292185	7689354	8138970	8307535	
6549091	7292186	7808428	8140223	8311696	
6711501	7373231	7835832	8174437	8334804	
6744404	7388539	7885745	8184050	RE41358	
6865465	7400294	7948769	8190337		

Other U.S. and foreign patents pending.

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Contact your local dealer for technical assistance. To find the authorized dealer near you:

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Overview

Product Support

Single Frame Packet Definition

Multi-Frame Fast-Packet Definition

Overview

This document outlines the NMEA2000-based proprietary messages supported by some Hemisphere GNSS products. The command set in this document is applicable to the V104n. For documentation of standard NMEA2000 messages, refer to the official specifications from the National Marine Electronics Association (NMEA).

Product Support

If you have any questions regarding the use of NMEA2000 Proprietary Messages, see [Technical Support](#).

Single Frame Packet Definition – PGX EFX (Destination addressable)

8 Bytes CAN frame define

Data Field	0	1	2	3	4	5	6	7
Define	CMDL 8 bits data	CMDH 2 bits data 3 bits reserved 2 bits type (0=read/ok, 1=write, 2=error) 1 bit multiframe = 0	data	data	data	data	data	data

For all single-frame messages, the first two bytes will be the message ID = (CMDH * 255) + CMDL.

Where CMDH is the CoMmanD High byte, and CMDL is the CoMmanD Low byte.

The upper bits of the CMDH are used to specify the read (R), or write (W) status of the message. The 'Error' indication will only be sent in a response - it is not valid to specify the error bit when sending a frame to the receiver. When specifying a read, all data contents are ignored. Specify a read by setting the 0x20 bit to zero, specify write by setting it to 1 (0x20).

In the event of an error, the first data byte will be filled with an error code providing more information about the nature of the error. General Error = 1, Invalid argument = 2, Value out of range = 3, Unknown message = 4

The remaining fields 2 through 7 will be the contents of this message. For the meaning of each field, please refer to the specific message definition below. Each field is also marked as 'R' for read only, 'W' for write only, and "R/W" for readable/writable fields.

These messages do not follow the NMEA2000 specification in terms of required data contents of every frame, according to v2.000 Appendix A-6. The addresses of the message must be used to know the content and format of the messages being transferred.

Different ID ranges define different functional areas.

Reserved/unused fields will be specified with data 0xFF.

All multi-byte data parameter replies are in little-endian format (least significant byte first).

Example

Single frame message must broadcast 8 bytes of data - ALWAYS. No exceptions.

As an example for the MSGID 0x0001 message, to specify a read of the current manufacturer code, send the contents (all hex digits).

01,00,00,00,00,00,FF,FF

When sending a read command, all contents of the data fields are ignored (bytes 2,3,4,5,6,7 of the message) but MUST be transmitted.

To specify a write of manufacturer code decimal 88 (hex 0x58), set the type bits in the CMDH data byte to WRITE (all hex digits)

01,20,58,00,00,00,FF,FF

MSGID 0x0001 - N2K,MCODE

single frame

Description: NMEA2000 Manufacturer Code

Corresponding Serial Command: \$JN2KSETUP,MCODE

4 bytes, unsigned long R/W

Data Field	0	1	2	3	4	5	6	7
Define	01	00	D0	D1	D2	D3	FF	FF

Max 0x3FFFF

MSGID 0x0002 - N2K,PCODE

single frame

Description: NMEA2000 Product Code

Corresponding Serial Command: \$JN2KSETUP,PCODE

2 bytes, unsigned R/W

Data Field	0	1	2	3	4	5	6	7
Define	02	00	D0	D1	FF	FF	FF	FF

MSGID 0x0003 - N2K,LOAD

single frame

Description: NMEA2000 Load Equivalency

Corresponding Serial Command: \$JN2KSETUP,LOAD

1 byte, unsigned R/W

Data Field	0	1	2	3	4	5	6	7
Define	03	00	D0	FF	FF	FF	FF	FF

MSGID 0x0004 - N2K,CERT

single frame

Description: NMEA2000 Certification Level

Corresponding Serial Command: \$JN2KSETUP,CERT

1 byte, unsigned R/W

Data Field	0	1	2	3	4	5	6	7
Define	04	00	D0	FF	FF	FF	FF	FF

MSGID 0x0005 - JVERSION

single frame

Description: CAN Processor Software Version

Corresponding Serial Command: \$JVERSION

6 bytes, ASCII Read only

Data Field	0	1	2	3	4	5	6	7
Define	05	00	App V1	App V2	App V3	App V4	Boot V1	Boot V2

Application and Bootloader version information

MSGID 0x0006 - N2K,RESET

single frame

Description: Reset NMEA2000 defaults

Corresponding Serial Command: \$JN2KSETUP,RESET

1 byte, unsigned Write only

Data Field	0	1	2	3	4	5	6	7
Define	06	20	D0	FF	FF	FF	FF	FF

Set D0 = 1 to reset all saved settings to their defaults

All other values are invalid.

After writing this message to the receiver, there will be no CAN reply. The receiver will reset and the next message on the bus will be an address claim message.

MSGID 0x0007 - N2K,ADDRESS

single frame

Description: NMEA2000 Default CAN node Address

Corresponding Serial Command: \$JN2KSETUP,ADDRESS

1 byte, unsigned R/W

Data Field	0	1	2	3	4	5	6	7
Define	07	00	D0	FF	FF	FF	FF	FF

MSGID 0x0008 - JDIFF

single frame

Description: Differential Type

Corresponding Serial Command: \$JDIFF

2 bytes, enumerated type R/W

Data Field	0	1	2	3	4	5	6	7
Define	08	00	D0	D1	FF	FF	FF	FF

Where D0 is the first field of the \$JDIFF response

and D1 is the second field of the \$JDIFF response

When specifying a specific differential type using the write command, only the D0 parameter is used.

D0 definition: PORTA (0), PORTB (1), BEACON (2), SBAS (3), RTK (4), LBAND (5), X (6), NONE (7), Unknown (8)

D1 definition: Unknown (0), NONE (1), CMR (2), DFX (3), EDIF (4), UNUSED (5), LBAND (6), ROX (7), RTCM2 (8), RTCM3 (9), SBAS (10), RTCM2.3 (11), BEIDOU (12)

MSGID 0x0009 - JDIFF,INCLUDE

single frame

Description: Differential Include/Exclude

Corresponding Serial Command: \$JDIFF,INCLUDE

2 bytes, unsigned R/W

Data Field	0	1	2	3	4	5	6	7
Define	09	00	D0	D1	FF	FF	FF	FF

Values are bitmasked: SBAS (0x0001), LBAND (0x0002), BEIDOU (0x0004), RTCM2 (0x0008), EDIF (0x0010), DFX (0x0020), CMR (0x0040), RTCM3 (0x0080), ROX (0x0100), RTCM_23 (0x0200)

Undefined bits are reserved for future use.

MSGID 0x000A - JMODES

single frame

Description: Receiver modes

Corresponding Serial Command: \$JMODES

4 bytes, bitmask of modes on/off R/W

Data Field	0	1	2	3	4	5	6	7
Define	0A	00	D0	D1	D2	D3	FF	FF

Values are bitmasked: BASE (0x00000001), FIXLOC (0x00000002), FOREST (0x00000004), GLOFIX (0x00000008), GPSONLY (0x00000010), L1ONLY (0x00000020), MIXED (0x00000040), NULLNMEA (0x00000080), SBASNORTK (0x00000100), SBASR (0x00000200), SURETRACK (0x00000400), TIMEKEEP (0x00000800), TUNNEL (0x00001000), WIDESEARCH (0x00002000), GLOFF (0x00004000), CMRPLUS (0x00008000), GPSSOFF (0x00010000), B3OFF (0x00020000), BDSOFF (0x00040000), SURVEY (0x00080000), STRICKRTK (0x00100000)

Undefined bits are reserved for future use.

MSGID 0x000B - JSBASPRN

single frame

Description: SBAS Satellite PRN info

Corresponding Serial Command: \$JSBASPRN

4 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	0B	00	PRN1	PRN2	PRN3	Mode	FF	FF

PRN values are defined by their single byte unsigned value. Only Eclipse based receivers support the third PRN. Single frequency Crescent receivers do not support the third SBAS PRN.

Mode 0 is manual assignment, 1 is automatic mode. When setting the mode to automatic, all prn fields are ignored.

MSGID 0x000C - JBAUD,PORTx

single frame

Description: PORTx Baud rate information

Corresponding Serial Command: \$JBAUD,xxxx,PORTx

Query value from \$JSHOW

4 bytes unsigned long R/W

Data Field	0	1	2	3	4	5	6	7
Define	0C	00	D0	D1	D2	D3	port	FF

port 0 = PORTA

port 1 = CAN controller GNSS receiver UART. Changing this value does not change any GNSS receiver port baud rate. Changes to this value are only allowed in GNSS receiver bootloader programming mode.

port 2 = UHF radio (if installed)

MSGID 0x000D - JMASK

single frame

Description: receiver mask angle

Corresponding Serial Command: \$JSHOW,MASK

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	0D	00	M0	FF	FF	FF	FF	FF

MSGID 0x000E - JATT,TILTAID

single frame

Description: Receiver tilt aid state

Corresponding Serial Command: \$JATT,TILTAID

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	0E	00	M0	FF	FF	FF	FF	FF

Where M0=1 corresponds to TILTAID,YES and M0=0 is TILTAID,NO

MSGID 0x000F - JATT,TILTCAL

single frame

Description: Receiver tilt calibration

Corresponding Serial Command: \$JATT,TILTCAL

1 byte Write only

Data Field	0	1	2	3	4	5	6	7
Define	0F	20	M0	FF	FF	FF	FF	FF

Write a value of M0=1 to initiate the tilt calibration.

MSGID 0x0010 - JATT,HBIAS

single frame

Description: Receiver HBias

Corresponding Serial Command: \$JATT,HBIAS

4 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	10	00	M0	M1	M2	M3	FF	FF

This corresponds to a 32bit signed int variable. M3 is the most significant byte of the variable.

Dynamic range of -180000 to +180000. Scale factor 1000 (a value of +90000 corresponds to a HBIAS of +90.000°)

MSGID 0x0011 - JATT,PBIAS

single frame

Description: Receiver PBias

Corresponding Serial Command: \$JATT,PBIAS

2 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	11	00	M0	M1	FF	FF	FF	FF

This corresponds to a 16bit signed short variable. M1 is the most significant byte of the variable.

Dynamic range of -30000 to +30000. Scale factor 1000 (a value of +15000 corresponds to a PBIAS of +15.000°)

MSGID 0x0012 - JATT,GYROAID

single frame

Description: Receiver Gyroaid status

Corresponding Serial Command: \$JATT,GYROAID

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	12	00	M0	FF	FF	FF	FF	FF

Where M0=1 corresponds to GYROAID,YES and M0=0 is GYROAID,NO

MSGID 0x0013 - JRESET

single frame

Description: Receiver reset command

Corresponding Serial Command: \$JRESET

2 bytes Write only

Data Field	0	1	2	3	4	5	6	7
Define	13	20	M0	D0	FF	FF	FF	FF

M0=0, \$JRESET

M0=1, \$JRESET,ALL

M0=2, \$JRESET,BOOT

M0=3, \$JBOOT

M0=4, do not reset (useful for turning bootloader notifications on and off)

M0=5, CAN controller reset - After writing this value to the receiver, there will be no CAN reply. The receiver will reset and the next message on the bus will be an address claim message.

D0=0, do not notify of bootloader message

MSGID 0x0014 - JI, serial number

single frame

Description: Receiver serial number

Corresponding Serial Command: \$JI

4 bytes Read only

Data Field	0	1	2	3	4	5	6	7
Define	14	00	M0	M1	M2	M3	FF	FF

M0 through M3 represent the receiver serial number. M3 is the most significant byte of the 4 bytes serial number.

For example, the receiver serial number 18600017 will be presented in the CAN message contents:

14,00,51,D0,1B,01,FF,FF

MSGID 0x0015 - JRAIM

single frame

Description: Raim Parameters

Corresponding Serial Command: \$JRAIM

6 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	15	00	HPR1	HPR2	PHPR1	PHPR2	PF1	PF2

HPR is a two-byte word specifying the Horizontal Protection Radius in m.

PHPR is a two-byte word specifying the maximum allowed probability that the position computed lies outside the HPR. Scale factor x1000.

PF is a two-byte word specifying the maximum allowed probability that there is a false alarm. Scale factor x1000.

MSGID 0x0016 - JATT,HIGHMP

single frame

Description: Receiver High Multipath status

Corresponding Serial Command: \$JATT,HIGHMP

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	16	00	M0	FF	FF	FF	FF	FF

Where M0=1 corresponds to HIGHMP,YES and M0=0 is HIGHMP,NO

MSGID 0x0017 - JAPP

single frame

Description: Get the receiver application types

Corresponding Serial Command: \$JAPP

3 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	17	00	APP1	APP2	InUse	FF	FF	FF

APP1 and APP2 are enumerated type where: Unknown (0), WAASRTKB (1), RTK (2), Reserved (3), SBASRTKB (4), AUTODIFF (5), ATTITUD2 (6), MFAATTGG (7), MFAATT (8), MFA (9), ATTITGG (10), NONE (11)

Writing to APP1 and APP2 fields is ignored.

InUse variable defines the current in use application slot, 1 or 2. Write a value to this field to specify which application slot to use. After specifying the alternate slot, the InUse slot will show the pre-reboot app value until the receiver reboots.

MSGID 0x0018 - JAGE

single frame

Description: Differential Age

Corresponding Serial Command: \$JAGE

2 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	18	00	D0	D1	FF	FF	FF	FF

MSGID 0x0019 - BIN1, stdev residuals

single frame

Description: Standard Deviation of Pseudorange errors in position solution

Corresponding Serial Command: Taken from StdDevResid field of BIN1 message

5 bytes Read only

Data Field	0	1	2	3	4	5	6	7
Define	19	00	D0	D1	D2	D3	Mode	FF

stdev residuals is a 4-byte unsigned long, Scale factor x1000. Read Only. (D0 through D3) from the BIN1 message.

Mode is the NavMode from the BIN1 message.

MSGID 0x001A - RD1

single frame

Description: Bit Error rate of differential satellite signals tracked

Corresponding Serial Command: \$RD1

5 bytes Read only

Data Field	0	1	2	3	4	5	6	7
Define	1A	00	BER1	BER2	AGC	DSPSTAT	ARMSTAT	FF

BER1 and BER2 have a scale factor of 0.5

All values taken from the RD1 status message.

MSGID 0x001B - JK (read)

single frame

Description: Receiver subscription code

Corresponding Serial Command: \$JK

4 bytes Read only

Data Field	0	1	2	3	4	5	6	7
Define	1B	00	U0	U1	D0	D1	FF	FF

U0/U1 are 2 byte upgrade codes from field 2 of the \$>JK reply

D0/D1 are 2 byte downgrade codes from field 3 of the \$>JK reply

MSGID 0x001D - JWCONF,12

single frame

Description: Switch receiver binary 99 output used in NMEA2000 129540 "GNSS Sats In View" between master and slave channels

Corresponding Serial Command: \$JWCONF,12,0/1

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	1D	00	M0	FF	FF	FF	FF	FF

Where M0=1 corresponds to slave antenna output, and M0=0 to master antenna output

MSGID 0x001F - JI, application version

single frame

Description: Receiver serial number

Corresponding Serial Command: \$JI

6 bytes Read only

Data Field	0	1	2	3	4	5	6	7
Define	1F	00	A1	A2	A3	A4	A5	A6

A1 through 6 represent the digits and characters of the version information in the JI message. The decimal place after the first digit is implied.

MSGID 0x0020 - JSYSVER

single frame

Description: Receiver bootloader version

Corresponding Serial Command: \$JSYSVER

1 byte Read only

Data Field	0	1	2	3	4	5	6	7
Define	20	00	ver	FF	FF	FF	FF	FF

MSGID 0x0021 - JT

single frame

Description: Receiver hardware type

Corresponding Serial Command: \$JT

4 bytes Read only

Data Field	0	1	2	3	4	5	6	7
Define	21	00	C1	C2	C3	C4	FF	FF

Each character of the \$>JT reply is included

MSGID 0x0022 - JATT,MSEP

single frame

Description: User Measured Antenna Separation

Corresponding Serial Command: \$JATT,MSEP

4 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	22	00	M0	M1	M2	M3	FF	FF

Value is 4 bytes unsigned long with a scale factor of 1000.

MSGID 0x0023 - JATT,CSEP

single frame

Description: Receiver Computed Antenna Separation

Corresponding Serial Command: \$JATT,CSEP

4 bytes Read only

Data Field	0	1	2	3	4	5	6	7
Define	23	00	M0	M1	M2	M3	FF	FF

Value is 4 bytes unsigned long with a scale factor of 1000.

MSGID 0x0024 - ERROR

single frame

Description: Receiver Error Condition Message

Corresponding Serial Command: N/A

This message is output only. Do not send this message to the receiver.

6 bytes Read only

Data Field	0	1	2	3	4	5	6	7
Define	24	00	M0	M1	M2	M3	M5	M6

6 bytes corresponding to individual error codes from the system.

0x01 = Failed to find receiver during auto-search

0x02 = Failed to receive periodic message from GNSS receiver after configuration

0x03 = Failed to receive GNSS replies, initiating receiver search again

0x04 = Failed to communicate with the internal UHF radio (if installed)

MSGID 0x0025 - NMEA2000 Message Control

single frame

Description: If the receiver is in NMEA2000 mode, this can be used to turn messages on or off, in lieu of using the NMEA2000 protocol messages for the same purpose.

Corresponding Serial Command: N/A

5 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	25	00	M0	M1	M2	M3	D0	FF

M = unsigned long bitmask of the enabled messages. Enabled messages will have their corresponding bit set, disabled messages will have their corresponding bit clear. The message rates are not controlled here, use the NMEA2000 messages for rate control. The default rates, as defined by the NME2000 specification, are used for output.

when writing, set D0 to 0 for temporary non-saved adjustment (for example, to speed up file transfers or upgrades) or to 1 to commit the change to flash.

Reserved bits cannot be written to. Each message on/off occupies one bit and the bit definitions, in order, are:

```
{PGN1F010, 0x1F010}, // 126992 System Time
{PGN1F801, 0x1F801}, // 129025 Position Rapid update
{PGN1F805, 0x1F805}, // 129029 GNSS Position Data
{PGN1F802, 0x1F802}, // 129026 COG & SOG, Rapid update
{PGN1F803, 0x1F803}, // 129027 Position Delta, High Precision rapid update
{PGN1F804, 0x1F804}, // 129028 Altitude Delta, High Precision Rapid update
{PGN1F809, 0x1F809}, // 129033 Local Time Offset
{PGN1F112, 0x1F112}, // 127250 Vessel Heading
{PGN1F113, 0x1F113}, // 127251 Rate of Turn
{PGN1F119, 0x1F119}, // 127257 Attitude, Yaw, Pitch, Roll
{PGN1F11A, 0x1F11A}, // 127258 Magnetic Variation
{PGN1FA02, 0x1FA02}, // 129538 GNSS Control Status
{PGN1FA03, 0x1FA03}, // 129539 GNSS DOPs
{PGN1FA04, 0x1FA04}, // 129540 GNSS Sats in View
{PGN1FA06, 0x1FA06}, // 129542 GNSS Pseudorange Noise Statistics
reserved - {PGN1F014, 0x1F014}, // 126996 Product Information
{PGN1FA09, 0x1FA09}, // 129545 GNSS RAIM Output
{PGN1FA0A, 0x1FA0A}, // 129546 GNSS RAIM Settings
{PGN2FFC8, 0x2FFC8}, // 196552 System Diagnostics
reserved - {PGN1EE00, 0x1EE00}, // 126464 Transmit PGNs group function
reserved - {PGNEE00, 0xEE00}, // 060928 Address Claim
reserved - {PGNE800, 0xE800}, // 059392 ISO Acknowledgment
reserved - {PGN1ED00, 0x1ED00}, // 126208 Request group function
{PGN2FF0B, 0x2FF0B}, // 196363 COG/SOG/Heading
{PGN2FF0C, 0x2FF0C}, // 196364 Latitude and Longitude
{PGN2FF0D, 0x2FF0D}, // 196365 Speed and StdevResid
{PGN2FF0E, 0x2FF0E}, // 196366 ROT, Picth, Roll
{PGNFEE6, 0xFEE6}, // 065254 Date and Time
```


MSGID 0x0026 - JNP

single frame

Description: Serial data precision value

Corresponding Serial Command: \$JNP

1 byte, unsigned R/W

Data Field	0	1	2	3	4	5	6	7
Define	26	00	D0	FF	FF	FF	FF	FF

MSGID 0x0027 - JSMOOTH

single frame

Description: Set the carrier smoothing interval (15 to 6000 seconds)

Corresponding Serial Command: \$JSMOOTH

2 bytes, unsigned R/W

Data Field	0	1	2	3	4	5	6	7
Define	27	00	D0	D1	FF	FF	FF	FF

MSGID 0x0028 - JATT,HTAU

single frame

Description: Receiver Heading smoothing time constant

Corresponding Serial Command: \$JATT,HTAU

2 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	28	00	M0	M1	FF	FF	FF	FF

This corresponds to a 16bit unsigned in variable. M1 is the most significant byte of the variable.

Scale factor 10 (a value of 50 corresponds to a HTAU of 5 seconds)

MSGID 0x0029 - JATT,HRTAU

single frame

Description: Receiver rate of turn smoothing time constant

Corresponding Serial Command: \$JATT,HRTAU

2 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	29	00	M0	M1	FF	FF	FF	FF

This corresponds to a 16bit unsigned int variable. M1 is the most significant byte of the variable.

Scale factor 10 (a value of 50 corresponds to a HRTAU of 5 seconds)

MSGID 0x002A - JATT,COGTAU

single frame

Description: Receiver course over ground smoothing time constant

Corresponding Serial Command: \$JATT,COGTAU

2 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	2A	00	M0	M1	FF	FF	FF	FF

This corresponds to a 16bit unsigned int variable. M1 is the most significant byte of the variable.

Scale factor 10 (a value of 50 corresponds to a COGTAU of 5 seconds)

MSGID 0x002B - JATT,SPDTAU

single frame

Description: Receiver speed output smoothing time constant

Corresponding Serial Command: \$JATT,SPDTAU

2 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	2B	00	M0	M1	FF	FF	FF	FF

This corresponds to a 16bit unsigned int variable. M1 is the most significant byte of the variable.

Scale factor 10 (a value of 50 corresponds to a SPDTAU of 5 seconds)

MSGID 0x002C - JATT,NEGTLT

single frame

Description: Receiver negative tilt status

Corresponding Serial Command: \$JATT,NEGTLT

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	2C	00	M0	FF	FF	FF	FF	FF

Where M0=1 corresponds to YES and M0=0 is NO

MSGID 0x002D - JATT,FLIPBRD

single frame

Description: Receiver flip board status

Corresponding Serial Command: \$JATT,FLIPBRD

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	2D	00	M0	FF	FF	FF	FF	FF

Where M0=1 corresponds to YES and M0=0 is NO

MSGID 0x002E - JATT,LEVEL

single frame

Description: Receiver level status

Corresponding Serial Command: \$JATT,LEVEL

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	2E	00	M0	FF	FF	FF	FF	FF

Where M0=1 corresponds to YES and M0=0 is NO

MSGID 0x002F - JATT,MOVEBAS

single frame

Description: Receiver moving base station status

Corresponding Serial Command: \$JATT,MOVEBAS

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	2F	00	M0	FF	FF	FF	FF	FF

Where M0=1 corresponds to YES and M0=0 is NO

MSGID 0x0030 - CANMODE

single frame

Description: Receiver CAN operating mode

Corresponding Serial Command: N/A

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	30	00	M0	FF	FF	FF	FF	FF

Where M0 is defined by the enumeration: 0=NMEA2000 mode, 1=CANopen mode, 2=CANopen mode with Autostart

MSGID 0x0031 - GPHEV Heave

single frame

Description: Receiver computed Heave Value

Corresponding Serial Command: \$GPHEV message

1 byte Write only

Data Field	0	1	2	3	4	5	6	7
Define	31	00	M0	M1	M2	M3	D0	FF

Value is a 4 byte signed long with a scale factor of 1000.

Write D0 = 0 to turn off this periodic message. Write D0 = 1 to turn on this periodic message at 1Hz output.

MSGID 0x0032 - JSAVE

single frame

Description: Save receiver configuration changes

Corresponding Serial Command: N/A

1 byte Write Only

Data Field	0	1	2	3	4	5	6	7
Define	32	20	1	FF	FF	FF	FF	FF

Write the data as defined to initiate a save.

MSGID 0x0033 - DIAGNOSTICS

single frame

Description: Diagnostics Message containing temperature and 1Hz gyro accumulation data for test verification

Corresponding Serial Command: \$JASC,X,1

1 byte Write Only

Data Field	0	1	2	3	4	5	6	7
Define	33	00	D0	T0	C0	A0	A1	A2

Write D0 = 0 to turn off this periodic message. Write D0 = 1 to turn on this periodic message at 1Hz output.

T0 = one byte signed temperature

C0 = gyro accumulation count for the previous 1 second

A = 3 bytes unsigned gyro accumulations

MSGID 0x0034 - INTLT Raw Tilt Values

single frame

Description: Receiver computed XY tilt values

Corresponding Serial Command: \$PSAT,INTLT message

1 byte Write only

Data Field	0	1	2	3	4	5	6	7
Define	34	00	D0	X0	X1	Y0	Y1	FF

X is a 2 bytes signed value with a scale factor of 100. First parameter from INTLT message.

Y is a 2 bytes signed value with a scale factor of 100. Second parameter from INTLT message.

Write D0 = 0 to turn off this periodic message. Write D0 = 1 to turn on this periodic message at 1Hz output.

MSGID 0x0037 - Distance to Base

single frame

Description: Distance from the rover to the base station, in meters

Corresponding Serial Command: \$JRTK,18 or from RTKSTAT

4 bytes Read only

Data Field	0	1	2	3	4	5	6	7
Define	37	00	D0	D1	D2	D3	FF	FF

Where D is the distance in m, unsigned long.

MSGID 0x0038 - JFREQ

single frame

Description: LBAND frequency and bitrate information

Corresponding Serial Command: \$JFREQ

6 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	38	00	F0	F1	F2	F3	B0	B1

F is the unsigned long 4 bytes frequency, in Hz * 10. For example, to send a frequency of 1539962.5Hz encode the value as 15399625. To send a frequency of 1557835Hz encode the value as 15578350. Write a frequency of zero to set the frequency selection to automatic mode.

B is the unsigned short 2 bytes bitrate.

MSGID 0x0039 - JLIMIT

single frame

Description: Set the threshold of estimated horizontal performance for which the DGPS position LED is illuminated (used in PGN 0x2FFC8 status)

Corresponding Serial Command: \$JLIMIT,RESID

2 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	39	00	M0	M1	FF	FF	FF	FF

Where M is a 2 bytes limit value, with scale factor 10.

MSGID 0x003A - JAIR

single frame

Description: Specify how the receiver will respond to the dynamics associated with airborne applications

Corresponding Serial Command: \$JAIR

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	3A	00	M0	FF	FF	FF	FF	FF

Where M0 is defined by 0=auto, 1=low, 2=norm, 3=high

MSGID 0x003B - JATT,EXACT

single frame

Description: Enable/disable internal filter reliance on the entered antenna separation

Corresponding Serial Command: \$JATT,EXACT

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	3B	00	M0	FF	FF	FF	FF	FF

Where M0=1 corresponds to YES and M0=0 is NO

MSGID 0x003C - JATT,PTAU

single frame

Description: Pitch filter time constant

Corresponding Serial Command: \$JATT,PTAU

2 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	3C	00	M0	M1	FF	FF	FF	FF

Where M corresponds to a 2byte filter constant, with scale factor 10.

MSGID 0x003D - JATT,ROLL

single frame

Description: Configure the Vector for roll or pitch GPS antenna orientation

Corresponding Serial Command: \$JATT,ROLL

1 byte R/W

Data Field	0	1	2	3	4	5	6	7
Define	3D	00	M0	FF	FF	FF	FF	FF

Where M0=1 corresponds to YES and M0=0 is NO

MSGID 0x003E - JPOS

single frame

Description: Set or read the approximate position set in the receiver.

Corresponding Serial Command: \$JPOS

4 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	3E	00	M0	M1	N0	N1	FF	FF

Where M is a 2 bytes latitude with +90 offset. N is a 2 bytes longitude with +180 offset.

MSGID 0x003F - Serial Messages

single frame

Description: Sends a serial command to adjust port messages on the available serial ports

Corresponding Serial Command: \$JASC and \$JBIN and \$JOFF

1 byte Write Only

Data Field	0	1	2	3	4	5	6	7
Define	3F	00	M0	FF	FF	FF	FF	FF

Currently supporting only the \$JOFF command. Send M0=0 for \$JOFF,PORTA, M0=1 for \$JOFF,PORTB, M0=2 for \$JOFF,PORTD.

MSGID 0x0040 - HPR StdDev

single frame

Description: Estimates of the standard deviation of the heading, pitch, and roll values

Corresponding Serial Command: \$PASHR message

Read Only

Data Field	0	1	2	3	4	5	6	7
Define	40	00	H0	H1	P0	P1	R0	R1

Where the values are two bytes unsigned short values, with a scale factor of 1000.

MSGID 0x0045 - JGEO

single frame

Description: LBAND Geostationary satellite information

Corresponding Serial Command: \$JGEO

Read Only

Data Field	0	1	2	3	4	5	6	7
Define	45	00	A0	L0	E0	Z0	FF	FF

Where A0 is the mode, 0=manually selected by user (from 0x0038 message), 1=automatically selected by the receiver.

L0 = half-longitude of the satellite orbit location (multiply by 2 to get the true longitude), 0 to 360.

E0 = elevation of the satellites

Z0 = half-azimuth of the satellite (multiply by 2 to get the true azimuth), 0 to 360

Multi-Frame Fast-Packet definition – PGN: 1EAFX (Destination addressable)

In general, our multi frame packet will comply to the N2K fast-packet definition protocol

8 Byte CAN Frame 0 definition

Data Field	0	1	2	3	4	5	6	7
Definition	SEQ (0 for the first frame)	Bytes	CMDL 8 bits data	CMDH 2 bits data 3 bits reserved 2 bits type (0=read, 1=write, 2=error) 1 bit multiframe = 1	data	data	data	data

1. **SEQ:** Data Field 2 will be the sequence number of multi-frames,
2. **Bytes:** Total amounts of data followed by this message
3. **CMDL/CMDH:** This two bytes will indicate the ID (CMDH * 255 + CMDL) of this message

CMDH must always set bit 0x80 for multi-frame messages.

The following packages will carry the actual data that specified by **Bytes**

8 Bytes CAN Frame 1+ definition

Data Field	0	1	2	3	4	5	6	7
Definition	SEQ (incremented from the previous frame)	data	data	data	data	data	data	data

For the meaning of every filed, please refer to the message definitions below.

MSGID 0x8001 - N2K,VERSION

multi-frame

Description: NMEA2000 Version

Corresponding Serial Command: \$JN2KSETUP,VERSION

32 bytes R/W

Read Command Example:

Data Field	0	1	2	3	4	5	6	7
Define	00	length	01	80	data			

MSGID 0x8002 - JK (write)

multi-frame

Description: Send a subscription code to the receiver

Corresponding Serial Command: \$JK,xxxxxxxxxxxx

variable bytes Write Only

Data Field	0	1	2	3	4	5	6	7
Define	00	length	02	A0	data			

The data in the message must be encoded such that each 2 characters of the code get transmitted in a single byte. For example, if your code is 10 characters long, it would get sent as 5 bytes of data. The bytes are expanded internally to the full hex string and sent to the receiver.

The reply is a single byte response where 0=OK, 1=Error.

MSGID 0x8003 - JPOSOFFSET

multi-frame

Description: Position Offset

Corresponding Serial Command: \$JPOSOFFSET

12 bytes R/W

Data Field	0	1	2	3	4	5	6	7
Define	00	32	03	80	data			

This information can be used to store a position offset location of the installed unit, relative to a fixed location. This can be used in external devices or consoles to compute position offset information back to a center line of the vessel, or other location. These stored values are not used internally for any computations, but only for user usage.

Any other 12 bytes of user data can be stored in these fields for user storage of information.

Write command must be exactly 12 bytes.

MSGID 0x8004 - JVERSION

multi-frame

Description: Product version name

Corresponding Serial Command: \$JVERSION

variable byte Read Only

Data Field	0	1	2	3	4	5	6	7
Define	00	length	04	80	data			

This is the version name from the \$JVERSION command.

MSGID 0x8005 - JAUTH

multi-frame

Description: Co-processor Authorization Code

Corresponding Serial Command: \$JAUTH

4 bytes R

variable byte W

Data Field	0	1	2	3	4	5	6	7
Define	00	length	05	80	data			

Read command returns bitmask of the enabled options. No options bits are currently defined at this time. All fields are zero.

MSGID 0x8008 - Generic GNSS Serial Command

multi-frame

Description: Send a generic serial command to the GNSS receiver. No feedback is provided from the receiver reply. The response will indicate successful receiver response (reply with some '\$>') or timeout. The timeout interval waiting for the reply is 2s.

variable bytes Write Only

Data Field	0	1	2	3	4	5	6	7
Define	00	length	08	A0	data			

The reply is a single byte response where 0=OK, 1=Error

The data in the message will be sent to the receiver exactly as received. This message can be useful for sending specific commands to the receiver where there is not yet a pre-defined message ID available.

MSGID 0x8009 - RAW data transfer for differential

multi-frame

Description: Send raw data to the GNSS receiver. No feedback is provided from the receiver. The response will indicate success if the bytes were transferred.

variable bytes Write Only

Data Field	0	1	2	3	4	5	6	7
Define	00	length	09	A0	data			

The reply is a single byte response where 0=OK, 1=Error

The data in the message will be sent to the receiver exactly as received. This message can be useful for sending differential corrections to the receiver that do not generate receiver replies such a CMR, RTCM3, or ROX messages. Do not use this message to transfer any data to the receiver that may generate a "\$>" reply.

MSGID 0x800A - JI, Extended info

multi-frame

Description: Fleet Number,

Corresponding Serial Command: \$JI

variable bytes Read Only

Data Field	0	1	2	3	4	5	6	7
Define	00	length	0A	80	data			

Data comprises, 1 byte fleet number, 1 byte hardware revision, 4 bytes production date code, 1 byte DSP version, remainder of bytes for variable length software version string

MSGID 0x800B - N2K,MODEL

multi-frame

Description: NMEA2000 Model

Corresponding Serial Command: \$JN2KSETUP,MODEL

32 bytes R/W

Read Command Example:

Data Field	0	1	2	3	4	5	6	7
Define	00	length	0B	80	data			

MSGID 0x800D - RTKSTAT

multi-frame

Description: RTK status information and receiver tracking information

Corresponding Serial Command: \$JASC,PSAT,RTKSTAT or \$JQUERY,RTKSTAT

X bytes Read only

Read Command Example:

Data Field	0	1	2	3	4	5	6	7
Define	00	length	0D	80	data			

Data is directly from the RTKSTAT information message of the receiver: Lx = GPS, Gx = GLONASS, Bx = BeiDou, Ex = Galileo

2 bytes bit-mask of the systems in use: 0x0001 = L1, 0x0002 = L2, 0x0004 = L5, 0x0008 = G1, 0x0010 = G2, 0x0020 = B1, 0x0040 = B2, 0x0080 = B3, 0x0100 = E5a, 0x0200 = E5b, 0x0400 = Eba+b, 0x0800 = E6. All others reserved.

8 bytes, in 4 bit masks (dynamic range of 0 to 16), satellites per system in use, following the system order defined above.

4 bytes, in 2 bit masks (dynamic range of 0 to 3), grade of the system, following the system order defined above.
1=A, 2=B, 3=C, 0=D

1 byte cycle slip flags. Bit-masked: 0x01 = rover, 0x02 = base

1 byte ionospheric scintillation count. 0=no scintillation detected. Otherwise, 1 to 100 indicating severity of scintillation.

2 bytes bit-masked accuracy status flags.

- 0x1 = no differential or differential too old, for the application
- 0x2 = problems with differential message
- 0x4 = horizontal position estimate poor for the application
- 0x8 = HDOP high, poor satellite geometry
- 0x10 = fewer than 6 L1 satellites used
- 0x20 = poor L1 SNRs
- 0x40 = not in RTK mode
- 0x80 = not in RTK mode or RTK only recently solved (< 10 secs ago)
- 0x100 = RTK solution compromised, may fail

4 bytes unsigned long, horizontal accuracy estimate *1000, in m.

MSGID 0x800E - ATTSTAT

multi-frame

Description: Attitude status information and multi-antenna tracking information

Corresponding Serial Command: \$JASC,PSAT,ATTSTAT or \$JQUERY,ATTSTAT

X bytes Read only

Read Command Example:

Data Field	0	1	2	3	4	5	6	7
Define	00	length	0E	80	data			

Data is directly from the ATTSTAT information message of the receiver: Lx = GPS, Gx = GLONASS, Bx = BeiDou, Ex = Galileo

1 bytes unsigned value indicating common satellites tracked between master and slave antennas.

2 bytes bit-mask of the systems in use for the slave antenna. Same definition as RTKSTAT.

8 bytes, in 4 bit masks (dynamic range of 0 to 16), satellites per system in use for the slave antenna, following the system order defined above.

4 bytes, in 2 bit masks (dynamic range of 0 to 3), grade of the system in use for the slave antenna, following the system order defined above. 1=A, 2=B, 3=C, 0=D

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warranty disclaimers and limitations of liability set forth herein, that the same reflect an agreed-to allocation of risk between the parties (including the risk that a remedy may fail of its essential purpose and cause consequential loss), and that the same forms an essential basis of the bargain between the parties. Licensee agrees and acknowledges that Hemisphere would not have been able to sell the Product at the amount charged on an economic basis without such limitations.

18. **PROPRIETARY RIGHTS INDEMNITY.** Hemisphere shall indemnify, defend and hold harmless Licensee from and against any and all actions, claims, demands, proceedings, liabilities, direct damages, judgments, settlements, fines, penalties, costs and expenses, including royalties and attorneys' fees and related costs, in connection with or arising out of any actual infringement of any third party patent, copyright or other intellectual property right by the Software or by its use, in accordance with this Agreement and documentation, PROVIDED THAT: (a) Hemisphere has the right to assume full control over any action, claim, demand or proceeding, (b) Licensee shall promptly notify Hemisphere of any such action, claim, demand, or proceeding, and (c) Licensee shall give Hemisphere such reasonable assistance and tangible material as is reasonably available to Licensee for the defense of the action, claim, demand or proceeding. Licensee shall not settle or compromise any of same for which Hemisphere has agreed to assume responsibility without Hemisphere's prior written consent. Licensee may, at its sole cost and expense, retain separate counsel from the counsel utilized or retained by Hemisphere.
19. **INFRINGEMENT.** If use of the Software may be enjoined due to a claim of infringement by a third party then, at its sole discretion and expense, Hemisphere may do one of the following: (a) negotiate a license or other agreement so that the Product is no longer subject to such a potential claim, (b) modify the Product so that it becomes non-infringing, provided such modification can be accomplished without materially affecting the performance and functionality of the Product, (c) replace the Software, or the Product, with non-infringing software, or product, of equal or better performance and quality, or (d) if none of the foregoing can be done on a commercially reasonable basis, terminate this license and Licensee shall stop using the Product and Hemisphere shall refund the price paid by Licensee less an amount on account of amortization, calculated on a straight-line basis over a deemed useful life of three (3) years.
The foregoing sets out the entire liability of Hemisphere and the sole obligations of Hemisphere to Licensee in respect of any claim that the Software or its use infringes any third party rights.
20. **INDEMNIFICATION.** Except in relation to an infringement action, Licensee shall indemnify and hold Hemisphere harmless from any and all claims, damages, losses, liabilities, costs and expenses (including reasonable fees of lawyers and other professionals) arising out of or in connection with Licensee's use of the Product, whether direct or indirect, including without limiting the foregoing, loss of data, loss of profit or business interruption. **TERMINATION.** Licensee may terminate this Agreement at any time without cause. Hemisphere may terminate this Agreement on 30 days notice to Licensee if Licensee fails to materially comply with each provision of this Agreement unless such default is cured within the 30 days. Any such termination by a party shall be in addition to and without prejudice to such rights and remedies as may be available, including injunction and other equitable remedies. Upon receipt by Licensee of written notice of termination from Hemisphere or termination by Licensee, Licensee shall at the end of any notice period (a) cease using the Software; and (b) return to Hemisphere (or destroy and provide a certificate of a Senior Officer attesting to such destruction) the Software and all related material and any magnetic or optical media provided to Licensee. The provisions of Sections 6), 7), 8), 9), 10), 15), 21), 26) and 27) herein shall survive the expiration or termination of this Agreement for any reason.
21. **EXPORT RESTRICTIONS.** Licensee agrees that Licensee will comply with all export control legislation of Canada, the United States, Australia and any other applicable country's laws and regulations, whether under the Arms Export Control Act, the International Traffic in Arms Regulations, the Export Administration Regulations, the regulations of the United States Departments of Commerce, State, and Treasury, or otherwise as well as the export control legislation of all other countries.
22. **PRODUCT COMPONENTS.** The Product may contain third party components. Those third party components may be subject to additional terms and conditions. Licensee is required to agree to those terms and conditions in order to use the Product.
23. **FORCE MAJEURE EVENT.** Neither party will have the right to claim damages as a result of the other's inability to perform or any delay in performance due to unforeseeable circumstances beyond its reasonable control, such as labor disputes, strikes, lockouts, war, riot, insurrection, epidemic, Internet virus attack, Internet failure, supplier failure, act of God, or governmental action not the fault of the non-performing party.
24. **FORUM FOR DISPUTES.** The parties agree that the courts located in Calgary, Alberta, Canada and the courts of appeal there from will have exclusive jurisdiction to resolve any disputes between Licensee and Hemisphere concerning this Agreement or Licensee's use or inability to use the Software and the parties hereby irrevocably agree to attorn to the jurisdiction of those courts. Notwithstanding the foregoing, either party may apply to any court of competent jurisdiction for injunctive relief.
25. **APPLICABLE LAW.** This Agreement shall be governed by the laws of the Province of Alberta, Canada, exclusive of any of its choice of law and conflicts of law jurisprudence.
26. **CISG.** The United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement or any transaction hereunder.
27. **GENERAL.** This is the entire agreement between Licensee and Hemisphere relating to the Product and Licensee's use of the same, and supersedes all prior, collateral or contemporaneous oral or written representations, warranties or agreements regarding the same. No amendment to or modification of this Agreement will be binding unless in writing and signed by duly authorized representatives of the parties. Any and all terms and conditions set out in any correspondence between the parties or set out in a purchase order which are different from or in addition to the terms and conditions set forth herein, shall have no application and no written notice of same shall be required. In the event that one or more of the provisions of this Agreement is found to be illegal or unenforceable, this Agreement shall not be rendered inoperative but the remaining provisions shall continue in full force and effect.



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