

Atheros GPS NMEA

Orion NMEA Command

Custom NMEA command

FORMAT

u-Nav custom NMEA messages are structured according to the standard template of NMEA format. Every message starts with a dollar-sign ('\$'). After this prefix there will be a u-Nav command prefix 'PUNV' (not registered) and a comma (','), After the comma, there is the command field which is defined in section 3. The command field ends with an asterisk (*) and a two digit hexadecimal CRC checksum. The line is executed after <carriage return> <new line> character pair.

Example line: "\$PUNV,<command>*cc<carriage return><new line>"

CRC Calculation

The CRC calculation is explained in the NMEA standard.

If the CRC is omitted or illegal, the message will be rejected. CRC value 'cc' (two lower case c-characters) will always be accepted.

Custom NMEA command

Sentence Termination Delimiter

All sentences end with the sentence termination delimiter <carriage return><new line>. This combination is “\r\n” in C-language format and hexadecimal ASCII values are ‘0D_h0A_h’. Both characters have to be sent after CRC to execute the command.

Custom NMEA command

The command field starts the custom command. The commands are defined below in Table 1.

Command	In/Out	Description
CONFIG	In	Request to configure configuration section
GETCONFIG	In	Request to read configure information of configuration section
STOP	In	Request to stop the navigation
SLEEP	In	Request to stop the navigation and enter to sleep mode
START	In	Request for immediate restart
CFG_R	Out	Request to reply message for read configure information
ERR	Out	Error

Table 1: u-Nav custom NMEA commands

If the NMEA string can be decoded to explicit command for the Orion system, the same message will be echoed back to sender.

Custom NMEA command

u-Nav Custom NMEA Command Restrictions

The current version of Orion will not operate properly if the user sends more than one custom NMEA messages in a second.

NMEA Message Sizes

According to the NMEA standard the maximum number of characters between the starting delimiter "\$" or "!" and the terminating <CR><LF> should be 79, i.e. the maximum needed buffer size should be 82 for one sentence.

For the custom NMEA messages the maximum size of the input messages is 128 characters and for the output messages 120 characters.

NMEA command

Custom NMEA Message Format

With CONFIG command the user can change the configuration of the system. The configuration takes effect immediately and it is also stored in non-volatile media. The format of CONFIG message is following:

\$PUNV,CONFIG,<section id>,<various number of comma separated fields>*cc

See section 3.4 for details.

By GETCONFIG command the user can read the configuration of the system. The format of GETCONFIG message is following:

\$PUNV,GETCONFIG,<section id>*41

See section 3.3.8 for details.

Output Configuration

The current configuration can be read in the system with the following command:

```
$PUNV,GETCONFIG,00*cc
```

The answer is as follows:

```
$PUNV,CFG_R,00, CM ,0,1000, UART , MASK *cc
```

The configuration command template for output configuration is as follows:

```
$PUNV,CONFIG,00, CM ,0,1000, UART , MASK *cc
```

Communication protocol (CM)	UART communication speed (UART)	NMEA mask (MASK)
0000 = NMEA in / NMEA out 0101 = UBP in / UBP out 0202 = AGPS in / AGPS out 0003 = IS-801 in / NMEA out	4800 = 4800 bps 9600 = 9600 bps 14400 = 14400 bps 19200 = 19200 bps 28800 = 28800 bps 38400 = 38400 bps 57600 = 57600 bps 115200 = 115200 bps	01 = GGA 02 = GLL 04 = GSA 08 = GSV 10 = RMC 20 = VTG 40 = ZDA 80 = DTM
Default: 0000	Default: 4800	Default: 1D

Output Configuration

- **Communication protocol (CM)** is a fixed length of two digits of hexadecimals. The first digit indicates the output communication protocol, the second one the input protocol. Note! If the user changes the input communication protocol to other than NMEA, it is not possible to return back to NMEA.
- **UART communication speed (UART)** is one decimal number that is the UART communication speed.
- **NMEA mask (MASK)** is hexadecimal number that enables selected output NMEA messages. Different combinations of the outputting messages can be selected by calculating the final hexadecimal number after adding all wanted hexadecimal masks together.
- The application profile subsystem will check the maximum length of NMEA messages when changing output section. If the speed is set to 4800 bps, the protocol is NMEA and if the selected NMEA messages will take more than 450 characters per second, the application profile subsystem will produce an error message and reject the changes.

Output Configuration

Examples:

To produce all other messages but DTM at the speed of 115200 bps:

\$PUNV,CONFIG,00,00,0,1000,115200,7F*cc

To disable the default NMEA messages:

\$PUNV,CONFIG,00,00,0,1000,4800,0*cc

Default settings:

\$PUNV,CONFIG,00,00,0,1000,4800,1C*cc

User Information Configuration

The current configuration can be read in the system by the following command:

```
$PUNV,GETCONFIG,03*cc
```

The answer is as follows:

```
$PUNV,CFG_R,03, HZ , MZ *cc
```

The configuration command template for user configuration is

```
$PUNV,CONFIG,03, HZ , MZ *cc
```

Hour zone (HZ)	Minute zone (MZ)
-11, -10, -9, ... , 12	0, 15, 30, 45
Default: 0	Default: 0

- **Hour zone (HZ)** is the amount of full hour difference from the GMT in decimal number.
- **Minute zone (MZ)** is the amount of extra minutes over the full hours in decimal number.

User Information Configuration

Examples:

To set the -8 hour time zone:

`$PUNV,CONFIG,03,-8,0*cc`

Default settings:

`$PUNV,CONFIG,03,0,0*cc`

Debugger Configuration

The current configuration can be read in the system by the following command:

```
$PUNV,GETCONFIG,04*cc
```

The answer is the following:

```
$PUNV,CFG_R,04, DBG ,0*cc
```

The configuration command template for debugger configuration is as follows:

```
$PUNV,CONFIG,04, DBG ,0*cc
```

Debug interval (DBG)
0 = disabled
5000 = enabled
Default = 5000

- **Debug interval (DBG)** is the interval between the debug messages.

Examples:

To disable debug messages:

```
$PUNV,CONFIG,04,0,0*cc
```

Default settings (enable debug messages):

```
$PUNV,CONFIG,04,5000,0*cc
```

Datum Configuration

The current configuration can be read in the system by the following command:

```
$PUNV,GETCONFIG,13*cc
```

The answer is as follows:

```
$PUNV,CFG_R,13, [Dx] , [Dy] , [Dz] , [Da] , [Df] , [Name] , [Set] *cc
```

The configuration command template for custom datum is as follows:

```
$PUNV,CONFIG,13, [Dx] , [Dy] , [Dz] , [Da] , [Df] , [Name] ,0*cc
```

To select one of the predefined datum, the syntax is as follows:

```
$PUNV,CONFIG,16, [Set] *cc
```

Datum Configuration

- ***Dx, Dy, Dz*** can be set to any of the required decimal number. The default value is 0.
- ***Da*** can be any positive number. The default value is 6378137.
- ***Df*** can be any value between 0 and 1. The default value is 0.003352810664.
- ***Name*** is the name of the selected datum. Custom datum name can be up to 8 characters long. The default is WGS84.
- ***Set*** is a pre-defined set number. The default value is 1, which is WGS84.

All predefined datums can be found in appendix A.

Examples:

Default settings:

`$PUNV,CONFIG,16,1*cc`

Version Number

The version numbers can be read by using the following command:

```
$PUNV,GETCONFIG,09*cc
```

The answer is as follows:

```
$PUNV,CFG_R,09, Orion , BB , Flash , Ubp , RF-IC ,  
                RF-mode , RF-CS , MClk *cc
```

- ***Ser*** is the serial number of the board (currently same in every board). Currently not used by the system.
- ***Orion*** is the Orion version string
- ***BB*** is the baseband type
- ***Flash*** is the flash type
- ***Ubp*** is the UBP version number
- ***RF-IC***, ***RF-mode*** and ***RF-CS*** are the RF type (these can be written by the user)
- ***MClk*** is the master clock frequency (this can be written by the user)

Changing the H/W parameters

The user can change the HW parameters (RF IC type, RF IC mode, RF IC CS and Master Clock) via NMEA interface. The command form is the following:

\$PUNV,CONFIG,09, *RF-IC* , *RF-mode* , *RF-xCs* , *MClk* *cc

Name	Type (size in bits)	Valid values	Description
RF-IC	INT (16)	-1, 1008, 8021	RF device ID. -1, for autodetection
RF-mode	INT (16)	-1, 1...20	RF device mode. -1 = Autodetection 1 = UNAV1, 2 = UNAV2, 3 = UNAV3, 4 = CDMA, 5 = GSM13, 6 = GSM26, 7 = CDMA_32, 8 = GSM13_32, 9 = GSM26_32
RF-xCs	INT (16)	0...3	RF chip SPI1 CS
MClk	INT (32)	-1, 0...60x10 ⁶	Used master clock frequency

Changing the H/W parameters

Examples:

The default 9018 configuration

`$PUNV,CONFIG,09,1008,1,3,16367600*cc`

The default 9118 configuration

`$PUNV,CONFIG,09,1008,1,1,16367600*cc`

Start/Stop command

Start and Stop Commands

The NMEA command to stop the navigation is

\$PUNV,STOP*29

The NMEA command for the sleep mode is

\$PUNV,SLEEP*7E

To wake up from sleep, send any kind of NMEA message to any UART port. The content of this message is disregarded by the system. After wakeup from sleep, the system is always started in auto mode.

The NMEA commands for a stop and an immediate restart are

\$PUNV,START,AUTO*52 (for auto start)

\$PUNV,START,COLD*59 (for cold start)

\$PUNV,START,HOT*0E (for hot start)

\$PUNV,START,FAST*5D (for fast start)

Start/Stop command

The confirmation will be echoed only after the system has stopped. Until that Orion will produce navigation data.

The table below shows what data is available in each start mode.

	Fast	Hot	Cold
Almanac	+	+	-
Ephemeris	+	+	-
Time accuracy	~10 ms	~300s	No time
Last known good fix	+	+	-

Position Pinning

The current configuration can be read in the system by the following command:

\$PUNV,GETCONFIG,17*cc

The answer is as follows:

\$PUNV,CFG_R,17,	<i>POSITION TRESHOLD</i>	,	<i>VELOCITY TRESHOLD</i>	<i>2D START MODE</i>	*cc
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The configuration command template for control configuration is as follows:

\$PUNV,CONFIG,17,	<i>POSITION TRESHOLD</i>	,	<i>VELOCITY TRESHOLD</i>	<i>2D START MODE</i>	*cc
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- ***Position threshold*** is the threshold value for position jump. Position pinning will be disabled if this value is reached.
- ***Velocity threshold*** is the threshold value for velocity calculation. Position pinning will be disabled if this value is reached.

Position Pinning

- *2D start mode*

0: only 3D start is allowed (default)

1: reserved, do not use

2: reserved, do not use

3: enable cold & auto start (all start modes if last good fix available, only cold if no last good fix)

ERR command

ERR command is a reply message of an error in the system. The template is:

\$PUNV,ERR,<ID>,<error>,<data>*cc

- ***<ID>*** is the section ID that causes the error.
- ***<error>*** is the error number defined in the section.
- ***<data>*** is error specific optional data.

This document describes only those error codes that occur with NMEA commands.

ID	ERROR	Description
5 (NMEA)	1	Illegal command form
5 (NMEA)	2	Illegal command prefix
5 (NMEA)	3	Illegal command
5 (NMEA)	4	Illegal section ID
5 (NMEA)	5	Illegal parameter
5 (NMEA)	6	Illegal CRC
5 (NMEA)	7	Illegal message
6 (APP)	0	Invalid data
6 (APP)	1	Invalid command
6 (APP)	2	Permission denied (Read only data)
6 (APP)	3	Invalid section ID
6 (APP)	4	Invalid file ID (Message from SA)
6 (APP)	5	Invalid return value

ERR command

Examples of error messages:

Illegal CRC:

\$PUNV,ERR,05,00006,00000*5B

Illegal command:

\$PUNV,ERR,05,00003,00000*5E

CFG_R command

CFG_R command is a reply message for request of reading configuration. This NMEA message contains all configuration information about the selected section. After CFG_R there is a comma (',') and two digits of selected section ID. After section ID there is a comma (',') and comma separated list of parameters in selected section.

For example the default value reply for section 3.3.1 (Output configuration) is:

\$PUNV,CFG_R,00,00,0,1000,4800,1C*31

STANDARD NMEA MESSAGE

Orion supports the following standard NMEA messages: DTM, GGA, GLL, GSA, GSV, RMC, VTG and ZDA.

The following format conventions have been used, in accordance with the NMEA standard:

- When a null field is used to indicate unavailability of data, also the field for the unit of measure is formatted as a null field
- Three digits are always used for decimal-fraction of seconds in UTC time
- Four digits are always used for decimal-fraction of minutes in latitude and longitude
- DTM: Six digits are always used for decimal-fraction of latitude and longitude offsets. Two digits are always used for decimal-fraction of altitude offset.

STANDARD NMEA MESSAGE

- GGA: UTC field starts from zero time and changes to measured time when measurement is available (a debugging feature). The number of satellites is always reported with two digits with leading zero when necessary
- GLL: UTC time field as in GGA
- GSA: satellite ID numbers are in range 0-99. They are always reported with two digits with leading zero when necessary
- GSV: no implementation-specifics
- RMC: UTC time field as in GGA, course and speed over ground as in VTG
- VTG: course over ground is reported with 0.1 degree precision, speed over ground is reported with 0.1 unit precision for both knots and km/h fields. In case of speed equals zero, the heading is reported as null.
- ZDA: Local zone hours are always presented as the user has configured them. The default configuration is 0. The hour zone is reported always by two digits (with leading zero when necessary), and with leading minus sign when necessary. Local zone minutes are always presented with two digits (with leading zero when necessary). UTC time field as in GGA.