IG-500E
Generic NMEA
Integration Manual

Document : IG500EINMEA.3
Revision : 3 - 29. May. 2012

SBG Systems
3bis, chemin de la Jonchère
92500 Rueil Malmaison
FRANCE

Email : support@sbg-systems.com
Phone : +33 1 80 88 45 00

Revision history

Rev.	Date	Author	Information
2	29. May. 2012	Alexis GUINAMARD	Updated documentation with firmware V2 specifications
1	25 Nov 2010	Alexis GUINAMARD	First version of this document

Index

1. Introduction

This manual covers the IG-500E integration with generic NMEA GPS receivers.

The NMEA protocol is supported by almost all GPS receivers, which makes the IG-500E compatible with all of these.

NMEA integration with IG-500E is quite straightforward and does not require so much configuration.

2. Electrical connections requirements

2.1. Serial protocol

This protocol is used either on a standard RS-232 or RS-422 format (depending on configuration). GPS receiver and IG-500E ground pins must be connected together for proper operation.

The NMEA protocol is only used from the GPS receiver to the IG-500E. The IG-500E Tx does not need to be connected on the GPS.

Transmission format:

- Default speed : 9 600 bps to 921 600 bps
- 8 bits data
- 1 stop bit
- No parity
- No flow control

Note: *As it tends to reduce latency, the highest baudrate is highly recommended for best performance.*

2.2. Time pulse

If the GPS is able to output a time pulse logic output, then you should connect it on the IG-500E Sync In or ODO In pins in order to synchronize the IG-500E with GPS data.

3. NMEA messages requirements

All of these messages should be configured on the GPS according to the IG-500E requirements. Some messages are strictly necessary, others are only optional.

Do not interleave other protocol messages or binary messages between the NMEA messages. Do not send messages faster than 10Hz as it could compromise the device performance.

3.1. Required messages

GPGGA

This message provides the latitude, longitude, altitude information as well as the vertical velocity and the number of satellites used for the navigation solution.

Required rate: 5 or 10Hz.

GPRMC

This frame is required for ground velocity and ground course.

If the GPS supports decimal seconds output time stamp, it can be configured to output messaged at up to 10Hz for best accuracy. If the GPS receiver only provides an integer seconds value, then 1Hz output frequency should be used.

Required rate: 5 or 10Hz.

GPZDA

This frame is used for date and time information, as well as UTC time synchronization.

Required rate: 1Hz.

Note 1 : *ZDA sentences must be sent at the PPS signal frequency.*

Note 2 : *ZDA and PPS signal are required for proper operation. If the PPS is not connected or ZDA frame is not provided by the external GPS, then a lower navigation performance might be expected.*

3.2. Optional messages

GPHDT

If the GPS used is a dual antenna GPS receiver, then the GPHDT provides the GPS True Heading information to the IG-500E.

Required rate: RMC rate.

Note 1 : *As no time information is contained into the HDT frame, this sentence has to be sent exactly at the same output rate as the RMC sentence.*

Note 2 : *HDT is not clearly defined to be send before or after the RMC sentence. User must check if HDT frame is sent before or after the RMC frame and configure the NMEA options accordingly for proper operation.*

GPGSV

This output provides Space Vehicle information to the IG-500E for retransmission. This output is not internally required for the IG-500E, but can be useful for host application.

Output this message at 1Hz to avoid overloading the serial communication and the IG-500E.

4. IG-500E specific configuration with NMEA devices

When the IG-500E is configured to use an external NMEA device, some settings can be set. This chapter will only describe which settings are available and what are they used for. To have more information on how to define a setting on the IG-500E, please refer to Appendix: Low level commands definitions.

You should also read the IG-Devices Serial Protocol Specifications and IG-Devices CAN Protocol Specifications to understand how a specific configuration frame is sent using the IG-500E protocol.

4.1. GPS orientation offset

When you are using a dual antenna GPS receiver, it is not always possible to perfectly place the two antennas in the IG-500E coordinate frame. The GPS heading is therefore not exactly the IG-500E heading.

It is then possible to configure an offset by setting the heading offset, or the rotation matrix that passes from the GPS coordinate frame to the IG-500E coordinate frame.

4.2. GPS antenna lever Arm.

This option is not specific to NMEA GPS receivers, but, it is important to note that when you are using a dual antenna system, the GPS lever Arm set in the IG-500E is actually the primary GPS antenna lever Arm (the one used to calculate position and velocity).

4.3. HDT frame order

As explained in section GPHDT, it's possible to configure the HDT frame location with respect to RMC sentence. User should carefully check if the HDT frame is sent before or after the RMC sentence and configure the IG-500E accordingly.

5. Support

Support information

Our goal is to provide the best experience to our customers. If you have any question, comment or problem with the use of your IG-500E, we would be glad to help you, so please feel free to contact us. Please do not forget to mention your IG-500E Device ID (written on your IG-500E's label).

You can contact us by:

- Email : support@sbg-systems.com
- Phone : +33 1 80 88 45 00

6. Appendix: Low level commands definitions

6.1. Introduction

The NMEA module accepts the following specific commands. These commands are encapsulated into the generic external module configuration frames. See the IG-Devices Serial Protocol Specifications and IG-Devices CAN Protocol Specifications for more information about this generic configuration frame.

6.1.1. Data format and endianness

The data format and endianness used in the following frames are the same as in the IG-Devices Serial Protocol Specifications and IG-Devices CAN Protocol Specifications. Please refer to the corresponding documentation for more information about the data types and units used as well as the data order (matrix organization, floating point numbers).

6.1.2. Saving Settings to flash memory

As for any setting, the IG-Devices specific settings should be saved with the protocol standard settings save command.

6.1.3. NMEA Acknowledgment frame

When a command is passed to the IG-500E NMEA module, it can sometimes answer by an acknowledge frame.

An acknowledge is sent by the device as a standard answer, when no specific response is needed. User is informed on how was executed the command, using an error code.

All error codes are listed in the IG-Devices Serial Protocol Specifications and IG-Devices CAN Protocol Specifications. If the error code is SBG_NO_ERROR, the frame represents an acknowledge (ACK), if it's any other error code, the frame is a negative acknowledge (NACK).

This acknowledge frame has the following form:

Field	CMD	DATA
Value	SBG_EXT_CMD_NMEA_ACK (0x00)	Error code (uint8)
Size (bytes)	1	1

6.2. NMEA Options

If the GPS receiver is a dual antenna GPS, or provides true heading output, it is then possible to set the optimal accuracy obtained with the true heading output.

Accuracy field is expressed with $1\,lsb = 10^{-5}\,°$ in terms of standard deviation.

In addition the option field defines if the HDT frame is sent before or after RMC sentence:

```
SBG_NMEA_OPT_HDT_AFTER_RMC      0x0002    If set, HDT frame is time stamped with PREVIOUS RMC data

SBG_NMEA_OPT_HDT_BEFORE_RMC     0x0000    If set, HDT frame is time stamped with NEXT RMC  data
```

SBG_EXT_CMD_NMEA_SET_OPTIONS (0x01)

Field	CMD	DATA		
Value	SBG_EXT_CMD_NMEA_SET_OPTIONS (0x01)	Reserved. Leave to 0 (uint8)	options (uint16)	accuracy (uint32)
Size (bytes)	1	1	2	4

An acknowledge is returned after the transaction.

SBG_EXT_CMD_NMEA_GET_OPTIONS (0x02)

This frame without parameter is used to retrieve the device configuration. The NMEA module should return a SBG_EXT_CMD_NMEA_RET_OPTIONS (0x03).

Field	CMD	DATA	
Value	SBG_EXT_CMD_NMEA_RET_OPTIONS (0x03)	options (uint16)	accuracy (uint32)
Size (bytes)	1	2	4

6.3. Dual antenna orientation offset

6.3.1. Matrix offset

Instead of only a yaw offset, here we have a complete orientation matrix used to define the orientation offset between the dual antenna and the device. This orientation matrix corresponds to the Dual antenna system orientation when the IG-500E is leveled.

SBG_EXT_CMD_NMEA_SET_MATRIX_OFFSET (0x07)

Field	CMD	DATA	
Value	SBG_EXT_CMD_NMEA_SET_ MATRIX_OFFSET (0x07)	Reserved. Leave to 0 (uint8)	Matrix offset 9 x (real32)
Size (bytes)	1	1	36

An acknowledge is returned after the transaction.

SBG_EXT_CMD_NMEA_GET_ MATRIX_OFFSET (0x08)

This frame without parameter is used to retrieve the device configuration. The NMEA module should return a SBG_EXT_CMD_NMEA_RET_MATRIX_OFFSET (0x09)

Field	CMD	DATA
Value	SBG_EXT_CMD_NMEA_RET_ MATRIX_OFFSET (0x09)	Matrix offset 9 x (real32)
Size (bytes)	1	36