IG-500E
Remote IG-Device
Integration Manual

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Revision history

Rev.	Date	Author	Information
2	13. March 2012	Alexis GUINAMARD	Update protocol specifications according to firmware V2.0
1	25. Nov. 2010	Alexis GUINAMARD	First version of this document

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1. Introduction

This manual covers the integration of IG-Devices such as IG-500N or IG-30G with the IG-500E. It explains how a device, that supports the IG-Devices serial protocol, will interface with the IG-500E and how to configure both the IG-500E and the external device. IG-Devices integration with IG-500E is quite straightforward and does not require much configuration.

The IG-Protocol used here allows multiple sensors inputs to be connected on the IG-500E. For example, at the same time, a remote magnetometer, a GPS receiver and an accurate barometer can provide aiding data to the IG-500E.

With the IG-Devices protocol, you can also connect virtually any material to the IG-500E. For example, you can connect a DVL, an USBL and a depth sensor to the IG-500E and fuse data between these three sensors and the IG-500E.

2. Electrical connections requirements

2.1. Serial protocol

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

As the remote sensor can be configured by the IG-500E directly, serial line must support bidirectional communications. In other words, both Tx and Rx pins have to be connected on the IG-500E and on the external IG-Device. If it's not possible, please contact SBG Systems.

Transmission format:

- Default speed : 9 600 bps (max 921 600 bps; higher baudrate is better)
- 8 bits data
- 1 stop bit
- No parity
- No flow control

2.2. Time pulse

If the IG-Device supports a synchronization output pin, then you should connect it to the IG-500E Sync In or ODO In pins in order to synchronize the IG-500E with the remote IG-Device data.

3. Protocol requirements

In order to ease the IG-Device integration, the IG-500E should communicate directly with a pre-configured IG-Device. Before connecting an IG-Device to an IG-500E, you should first connect the external IG-Device to a computer in order to configure it correctly.

The easiest way to do this is to use the provided IG-30G configuration C example that use the sbgCom library. By default, you can find it in the following directory:

C:\Program Files\SBG-Systems\IG-500 SDK\Software Development\Examples

You will find below the configuration needed by the IG-Device to work correctly with the IG-500E.

3.1. General configuration

For best results, please make sure that the IG-Device is configured as describe below. All other settings should be reset to factory default settings.

- Serial Baudrate set to highest possible value in order to reduce latency (minimum 115 200 bps recommended).
- Output mode set to Big Endian with floating point format.
- Continuous/trigger output divider set to 10.
- Attitude computation disabled (on IG-30G).
- Main loop filter frequency set to 100 Hz (on IG-30G)
- Magnetometers soft and hard iron matrix set to identity and offset to null.

3.2. Triggered outputs

Triggered outputs (not continuous output) should be enabled with the following configuration output masks:

- **Channel 1:** triggered by the continuous divider trigger.
  - Time since reset output
  - Calibrated Magnetometer output
  - Raw magnetometer output (optional)
  - Calibrated Accelerometer output (only required during automatic magnetometer alignment)
  - UTC Time reference
  - Baro pressure output
- **Channel 2:** triggered by the new GPS Position, + new GPS velocity + new GPS course
  - Time since reset output
  - GPS position output
  - GPS Navigation output
  - GPS Accuracy output
  - GPS Info output

Note 1: *Trigger channel 1 is only needed if remote magnetometersare used as heading source or pressure sensor for altitude.*

Note 2: *Please refer to the IG-Devices Serial Protocol Specifications for more details.*

Note 3: *If you would like to implement your own IG-Devices Serial Protocol Specifications to connect a hardware other than an IG-500N or IG-30G, please contact SBG Systems.*

3.3. Sync Out pin configuration

If the remote IG-Device supports synchronization output signal, then a synchronization pulse should be sent at the output divider frequency. This will allow the IG-500E to synchronize incoming data with its internal clock.

The falling edge pulse mode is preferable as it generates the smallest delay.

Note: *If your are using an IG-500N or IG-30G that supports a SyncOut signal, don't forget to add a pull-up resistor on the line as the SyncOut pin is open drain.*

4. Aiding Sensors flow chart

The diagram below shows how the aiding sensors of the remote IG-Device are sampled and realigned into the IG-500E coordinate frame. IG-Device remote magnetometer output is temperature compensated, but not calibrated for hard/soft iron effects. In addition, an alignment may be required to get IG-Device coordinate frame consistent with the IG-500E one.

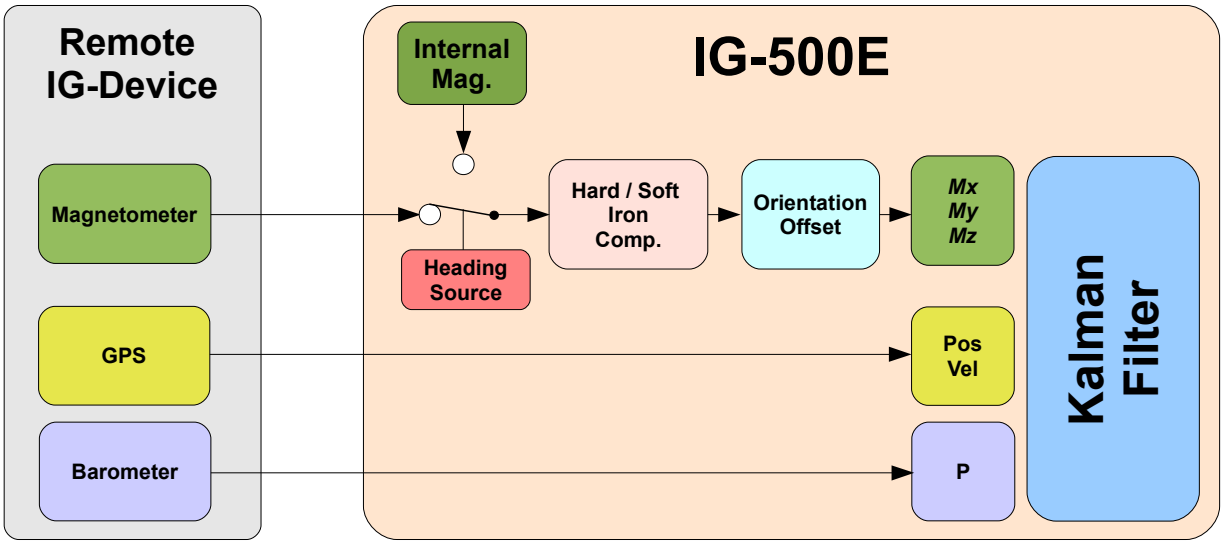

Figure 1: Sensor data flow diagram

As you can see, alignment parameters, as well as the Hard and Soft Iron compensation data are stored into IG-500E memory.

Note 1: *If the calibration and orientation offset parameters are required to be stored in the remote IG-Device, please contact factory for more information.*

Note 2: *For best results, please make sure that the IG-Device magnetometers soft iron matrix is set to identity and that the hard iron offset is set to (0,0,0).*

Note 3: *GPS and barometer give direct data to the IG-500E, so no calibration parameter is stored in one or another device.*

5. IG-500E specific settings and behaviors with IG-Devices

When you configure the IG-500E to accept aiding data from an IG-Device, some specific settings, only related to IG-Devices, become available.

For more details, please have a look at the Appendix: Low level commands definitions.

5.1. Magnetometers management

When the remote magnetometers are used as a heading source, all internal magnetometer outputs are replaced by remote magnetometer outputs.

This behavior affects all outputs linked to the magnetometers:

- Magnetometers Raw Data (if the remote device does not output magnetometers Raw data, this output is set to 0).
- Calibrated magnetometer values
- Mag Calib. Data. : These data are used for magnetometers calibration.

Therefore, when you run a hard and soft iron calibration, the result stored in the IG-500E corresponds to the remote magnetometer calibration.

Note: *When the magnetic source is changed, the magnetic calibration present in IG-500E memory becomes inconsistent with the actual magnetometer used and must be performed again for proper operation.*

5.2. GPS altitude reference

The IG-Device integration does not allow you to configure directly the GPS altitude reference (height above ellipsoid or above mean sea level). Instead of that, user should configure the remote IG-Device to output the desired altitude format.

5.3. IG-Device orientation offset

To work correctly, both the IG-500E and the attached IG-Device should use the same coordinate frame.

When you know exactly the orientation offset between the IG-500E and the remote IG-Device, then, you should use this feature.

6. Warranty and 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 (0)1 80 88 45 00

7. Appendix: Low level commands definitions

7.1. Introduction

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

The basic command operation is derived from the IG-Devices Serial Protocol Specifications. The commands provide access for read/write to several remote IG-Devices specific settings.

7.1.1. 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).

7.1.2. Saving Settings to flash memory

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

7.1.3. IG-Device Acknowledgment frame

When a command is passed to the IG-Device module, it can sometimes answer by an acknowledge.

An acknowledge is sent by the device as a standard answer, when no specific response is needed. User is informed of how were executed the command, with the use of an error code.

All error codes are listed in the IG-Devices Serial Specifications and IG-Devices CAN 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 has the following form:

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

7.2. Commands

7.2.1. Orientation offset

7.2.1.1. Manual orientation offset

Those lower level commands are used to read or write the full orientation offset matrix to the IG-500E.

SBG_EXT_CMD_IG_SET_MATRIX_OFFSET (0x02)

Field	CMD	DATA	
Value	SBG_EXT_CMD_IG_SET_ MATRIX_OFFSET (0x02)	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_IG_GET_ MATRIX_OFFSET (0x03)

This command is used to retrieve the orientation offset between the IG-500E and the remote IG-Device. It has no parameter and its answer should be SBG_ EXT_CMD_IG_RET_ MATRIX_OFFSET (0x04):

Field	CMD	DATA
Value	SBG_EXT_CMD_IG_RET_ MATRIX_OFFSET (0x04)	Matrix offset 9 x (real32)
Size (bytes)	1	36