

QuickGuide
DEMO Interface
VBR & INC Sensors

Rev. 6

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Introduction

The shock and vibration sensor is released with a simple demo GUI for the configuration of the sensor and for a direct analysis on the acquired acceleration data.

It is possible to download the software from the website:

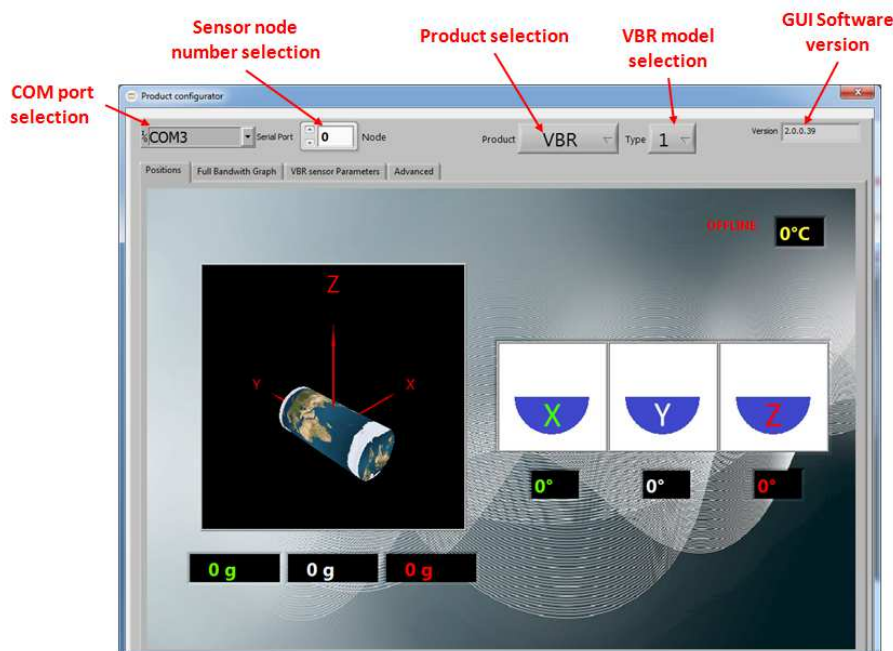
www.datasensing.com

Datasensing → Tools → Sensor Software

VBR Sensor

Main page:

The first page shows you how to get information about inclination and 3D position of the sensor.



First of all it is necessary to select the COM port using the pull-down menu and then select the node number to connect to (*default value "0"*).

The interface automatically detects the presence of a connected sensor and it shows the current values of acceleration and slope.

Note: Do not connect sensors with the same node. (*To change the node number it is needed to connect/switch on the sensors one at a time*).

Acceleration → angle conversion:

Full Scale	Factor
2g	6,1037E-05
4g	1,2207E-04
8g	2,4415E-04
16g	4,8830E-04

Read the acceleration value (Ex. 0x51 command), convert the result into "decimal" and multiply by the factor reported in the table corresponding to the current full-scale (Ex. 2g).

Reading command: x23 x74 x00 x51 x65 Response (x,y,z): x40 xCC x00 x1D x30 x10 xF0

Y axis conversion: **1D30** in decimal is **7472**.

Angle axis Y = (7472 * 0,000061037) * 90 = 41,04616176 → **41°**

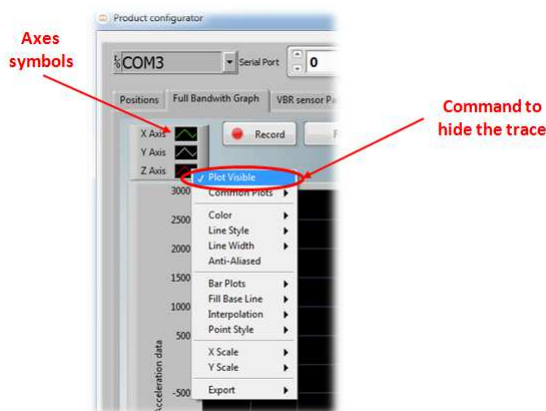
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Acceleration graphic window:

The second window shows the acceleration data of all axes and shows how it is possible to do post-processing on the data.

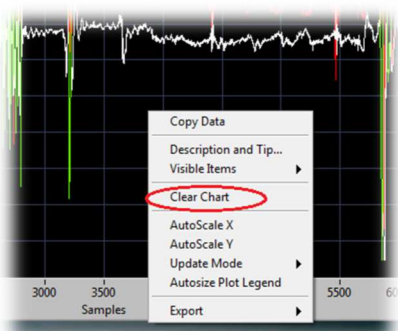


NOTE: By right - click on the axes symbols you access the selection menu: color, visibility, line type, etc.



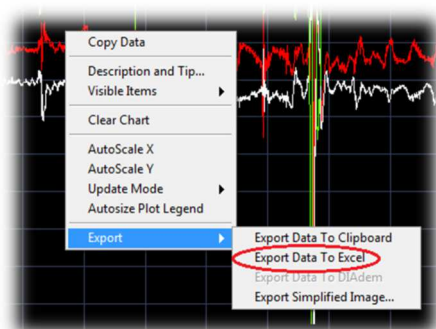
De-selecting the command "Plot visible" it is possible to hide one or more tracks for the axes.

To delete the stored data and start a new recording, simply click with the right mouse button in the graphic field and choose the "*Clear chart*" command from the drop-down menu.

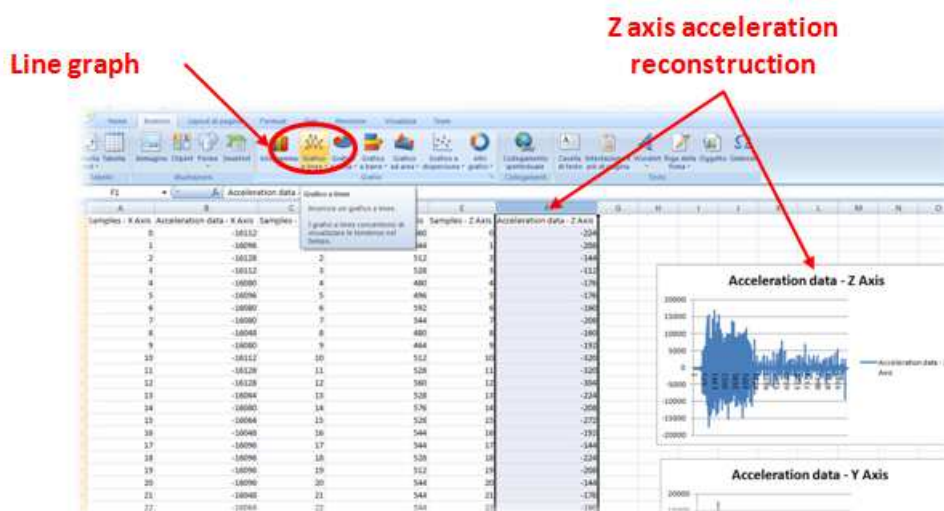


In this way the diagram definitively clears the values previously acquired.

Inside the same menu, it is possible to export the data to EXCEL format for further processing.

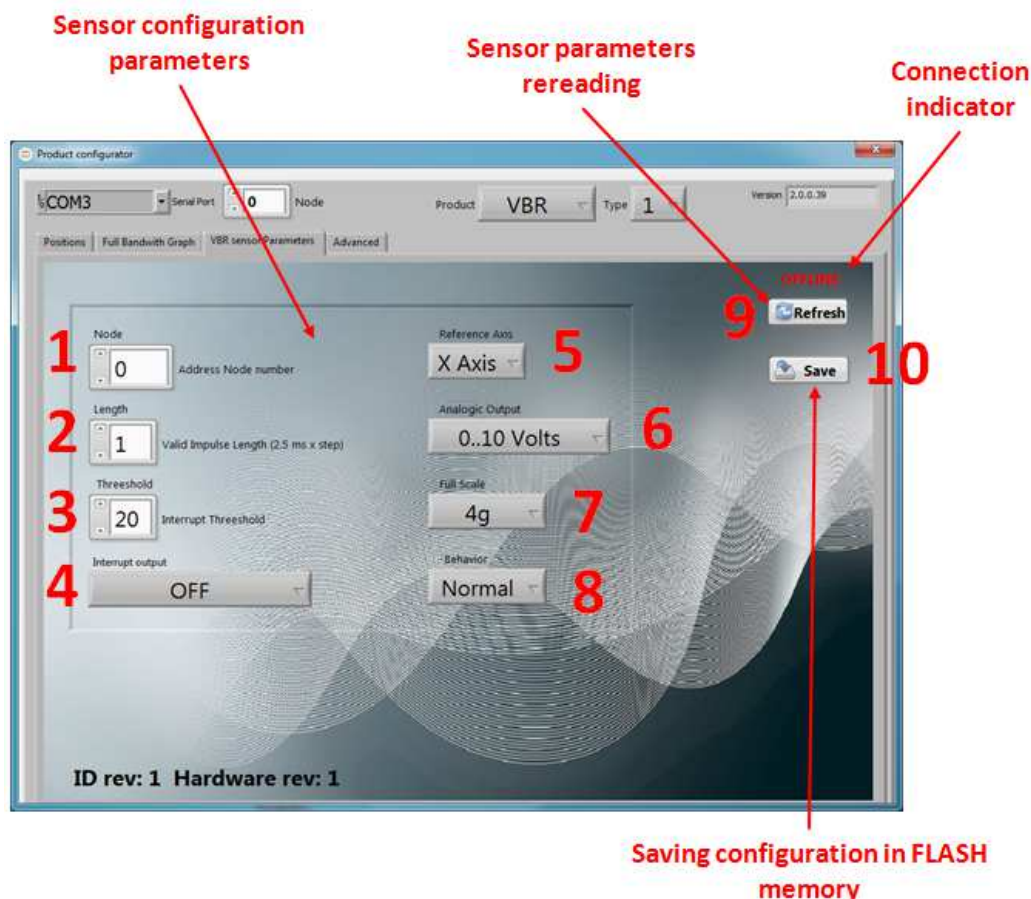


Once EXCEL is active, it is possible to rebuild the same information displayed by the DEMO interface using the graph function.



Configuration and parameter adjustment screen:

The third window allows the configuration of the sensor without the direct sending of the characters packets over serial.



- 1) It allows the assignment of a specific node number to the sensor. In case you access a bus with multiple VBR sensors connected, this command allows you to query and to parameterize only one of the sensors. The factory settings are Node = 0. For this reason, in the first installation, each sensor must be parameterized independently from the other, otherwise you might have an address conflict on the bus (different sensors with the same node number).
- 2) It allow to define the minimum duration (in ms) of the acceleration generating an alarm. The "duration" value is selectable on 128 levels with a step of about 2,5 msec.

Example. To get an alarm from an acceleration that exceeds the "threshold" for a time greater than 30 msec, it is necessary to set the value of "duration" to 12

$$30 \text{ msec} / 2,5 \text{ msec} = 12$$

- 3) It allows to define the minimum threshold (in mg) of the acceleration that triggers an alarm. Since the accelerometer can be programmed with 4 different full scale values (2g, 4g, 8g and 16g) and the threshold value is defined with 128 levels, the resolution step is computed dividing the full scale value by 128:

- 2g → 2000mg / 128 = **15,625** mg
- 4g → 4000mg / 128 = **31,25** mg
- 8g → 8000mg / 128 = **62,5** mg
- 16g → 16000mg / 128 = **125** mg

Example. To get an alarm from an acceleration that exceeds the 2g "threshold" with a full scale value of 4g:
2000mg / (resolution at 4g) = level → 2000 mg / 31,25mg = **64** (decimal)

NOTE: the "red" LED of the sensor is switched on at each "alarm" event.

- 4) It allows to define the interrupt transmission mode generated by the alarm signal. The four possible modes are:

- OFF → no alarm signal generated. The red LED turns on, but the signal is not sent nor to the analog output nor to the RS485 bus
- ON485 → an alarm signal is generated on the RS485 bus
- ON ANALOG → an alarm signal is generated on the analog output
- ON485 + ANALOG → an alarm signal is generated both on the RS485 bus and on the analog output

NB. Using the interrupt on RS485 and selecting a too low alarm threshold value, it could saturate the BUS with continuous sending of alarm packets.

- 5) It indicates which is the reference axis with respect to the acceleration measurement for alarm generation.

- 6) It defines the configuration of the analog output:

- High impedance
- Voltage analog (0 ... 5V or 0 ... 10V)
- Current analog (4 ... 20mA, 0 ... 20mA or 4 ... 24m)

- 7) It allows the definition of the full scale and the relative resolution of the alarm:

- ±2g → 15,625 mg
- ±4g → 31,25 mg
- ±8g → 62,5 mg
- ±16g → 125 mg

- 8) It allows the definition of the analog output functioning mode:

- NORMAL → The analog output does not propagate any alarm and it follows the normal pattern of acceleration both if the interrupt on the analog output is enabled or not.
- TOGGLING → Each acceleration that exceeds the value of "threshold" and "duration", causes the alarm condition and then, the output state is alternately switched between "minimum" and "maximum" value.
- IMPULSE → In this behavior, the analog output is always on the "minimum" value. With each exceeding of the "threshold" and "duration" value, the output is switched to the "maximum" value and kept "high" for at least 5msec and then come back to the "minimum" value.

NB. This behavior limits the frequency of alarm acknowledgment.

Example. Two consecutive alarms with a time interval less than 5msec can't be both reported in the output.

- 9) It request again to the sensor the sending of configuration parameters.

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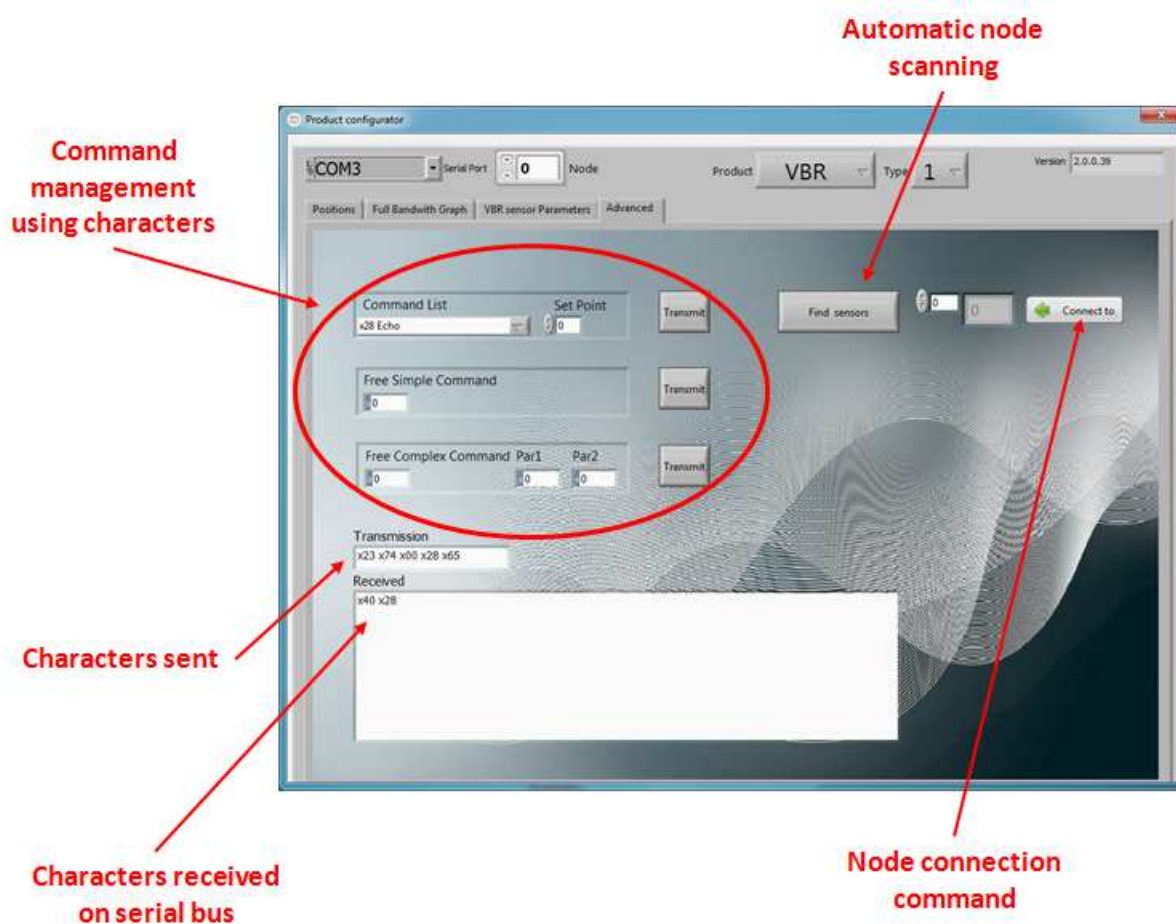
10) It saves the set up configuration in the non-volatile memory of the sensor.

IMPORTANT: if the parameters are not saved, once the sensor will be switched on, the data of the last storage will be automatically uploaded.

“Advanced” window:

In this window it is possible to select and send commands to the sensor and at the same time display the data packet that passes on the serial port.

This functionality is useful to the customer in the implementation phase of its communication software with the sensor because it acts as a dynamic help for single commands.



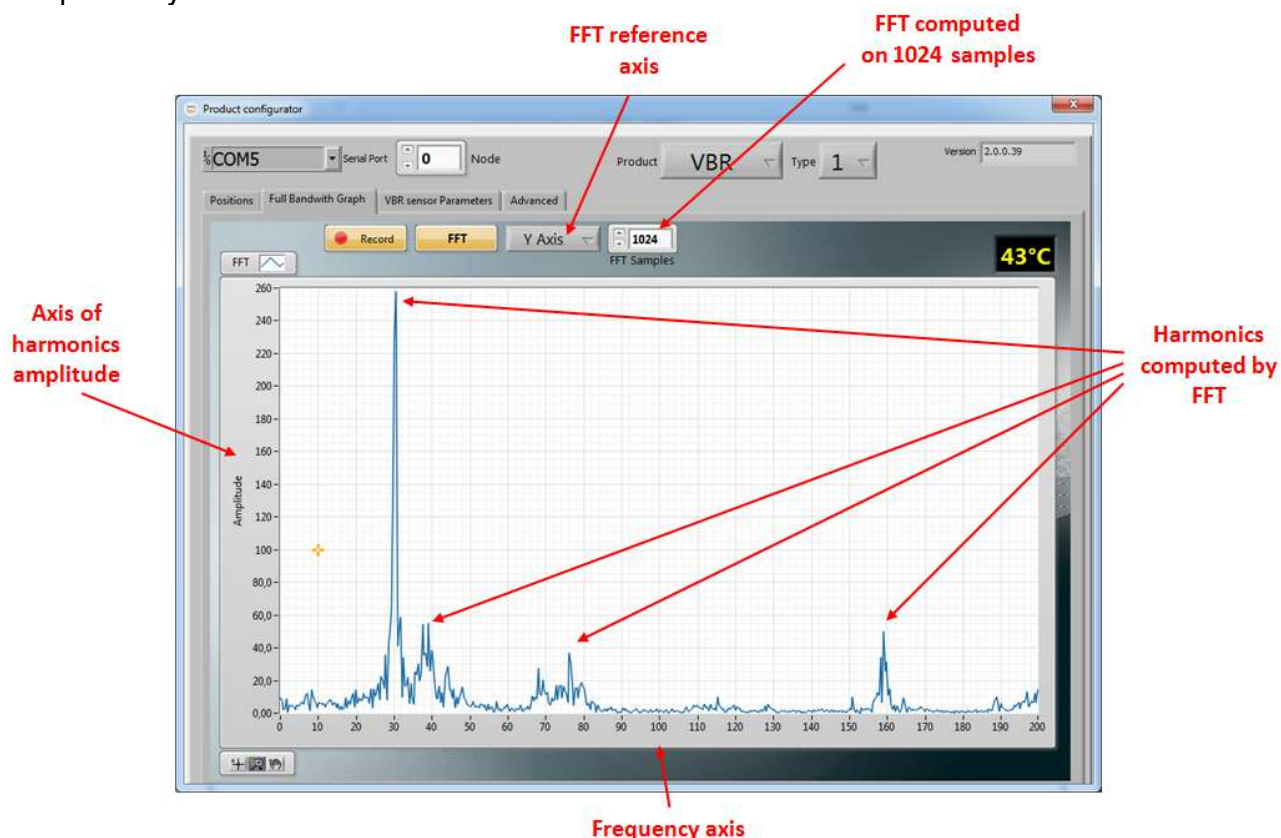
It is shown the packet that has to be transmitted on the RS-485 bus in order to obtain the desired command.

NB: The window of the "received characters" is always listening and if other packets have to be transmitted on the bus, these packets will be always displayed.

VBR - DF Sensor

Main screen

The FFT screen of GUI shows frequency spectrum of the vibration recorded by the sensor computed by means of Fourier transform.



NB: Sensor computes the FFT on 1024 samples whereby, the number of samples of the interface must be set to 1024 in order to get the same frequency resolution as the sensor.

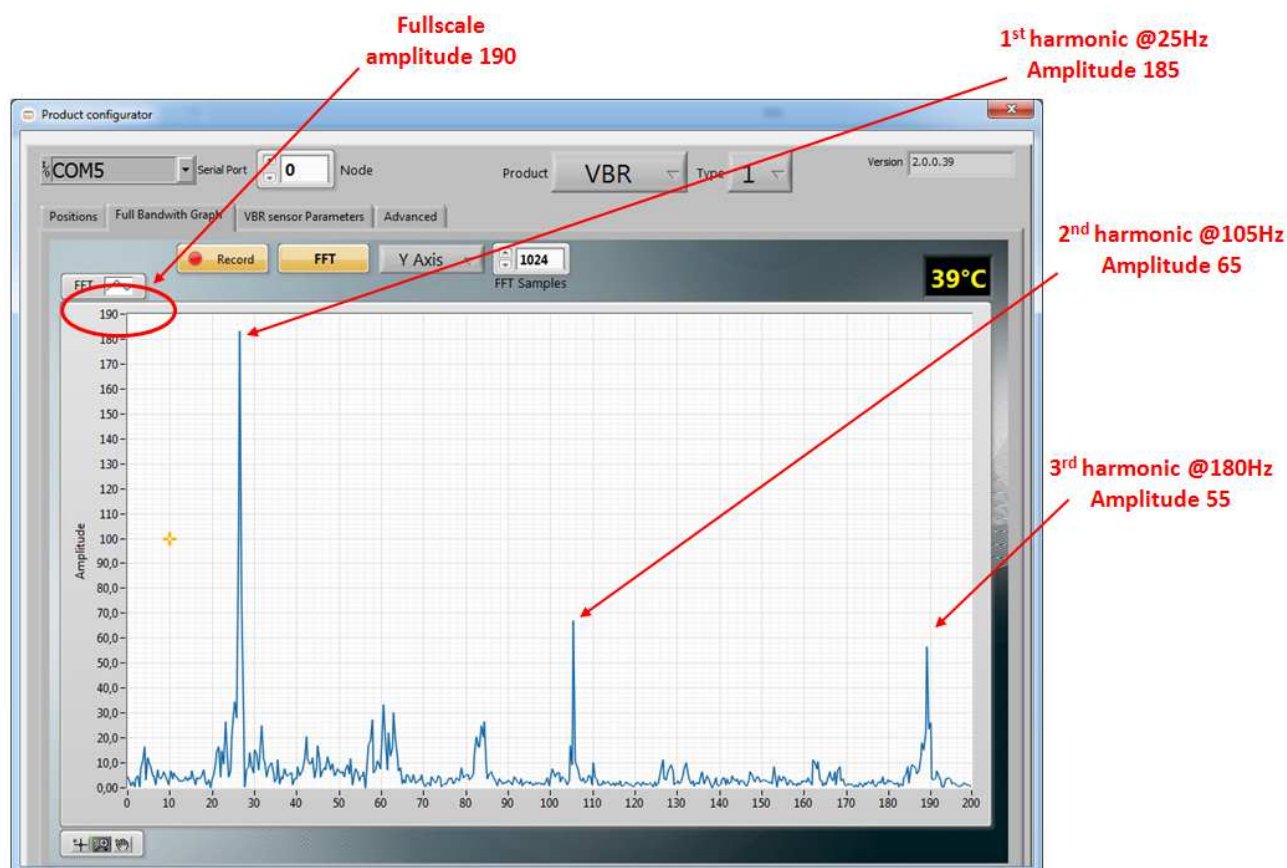
Usage Example

The GUI allows to extrapolate analysis parameters which make more accurate the sensor FFT computation like:

- *Frequency window for the analysis of the FFT (limited by minimum frequency F_MIN and maximum frequency F_MAX)*
- *Intervention amplitude threshold for alarm signaling*

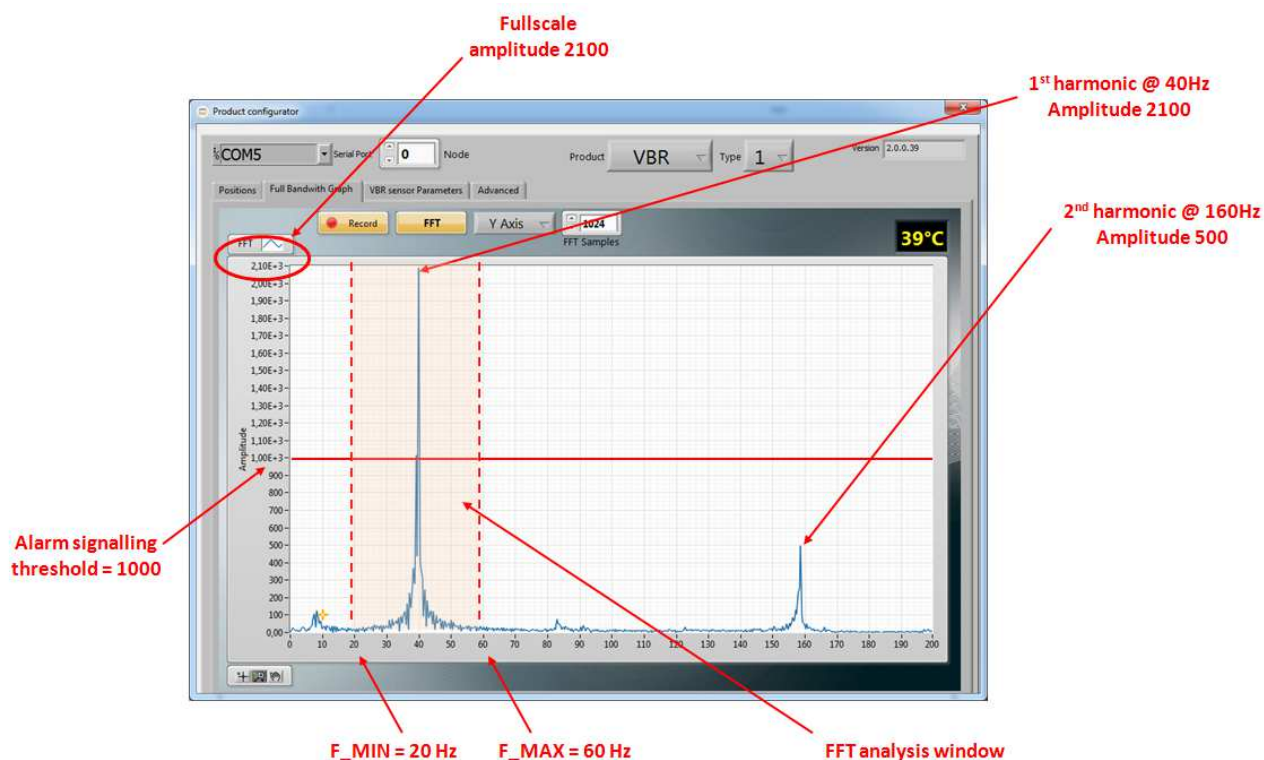
To set the frequency window on which the sensor perform FFT analysis and the intervention threshold for the alarm signalling, it must be first obtain the spectrum in normal operating conditions relate to the system under test (for example, a fan).

In the following example, it is considered a system whose spectrum in normal operating conditions, has three main harmonics whose amplitudes never exceed the value of 190. The fundamental harmonic is next to 30 Hz.



Took the same system in failure conditions, it is possible to establish the following parameters to send to the sensor for alarm triggering relatively to the application:

- Minimum frequency for FFT analysis (F_MIN)
- Maximum frequency for FFT analysis (F_MAX)
- Intervention amplitude threshold



In alarm conditions the fundamental harmonic has shifted at 40Hz and reaches an amplitude of 2100.

With this data, programming the sensor with

- Minimum frequency → 20Hz
- Maximum frequency → 60Hz
- Alarm signal threshold → 1000

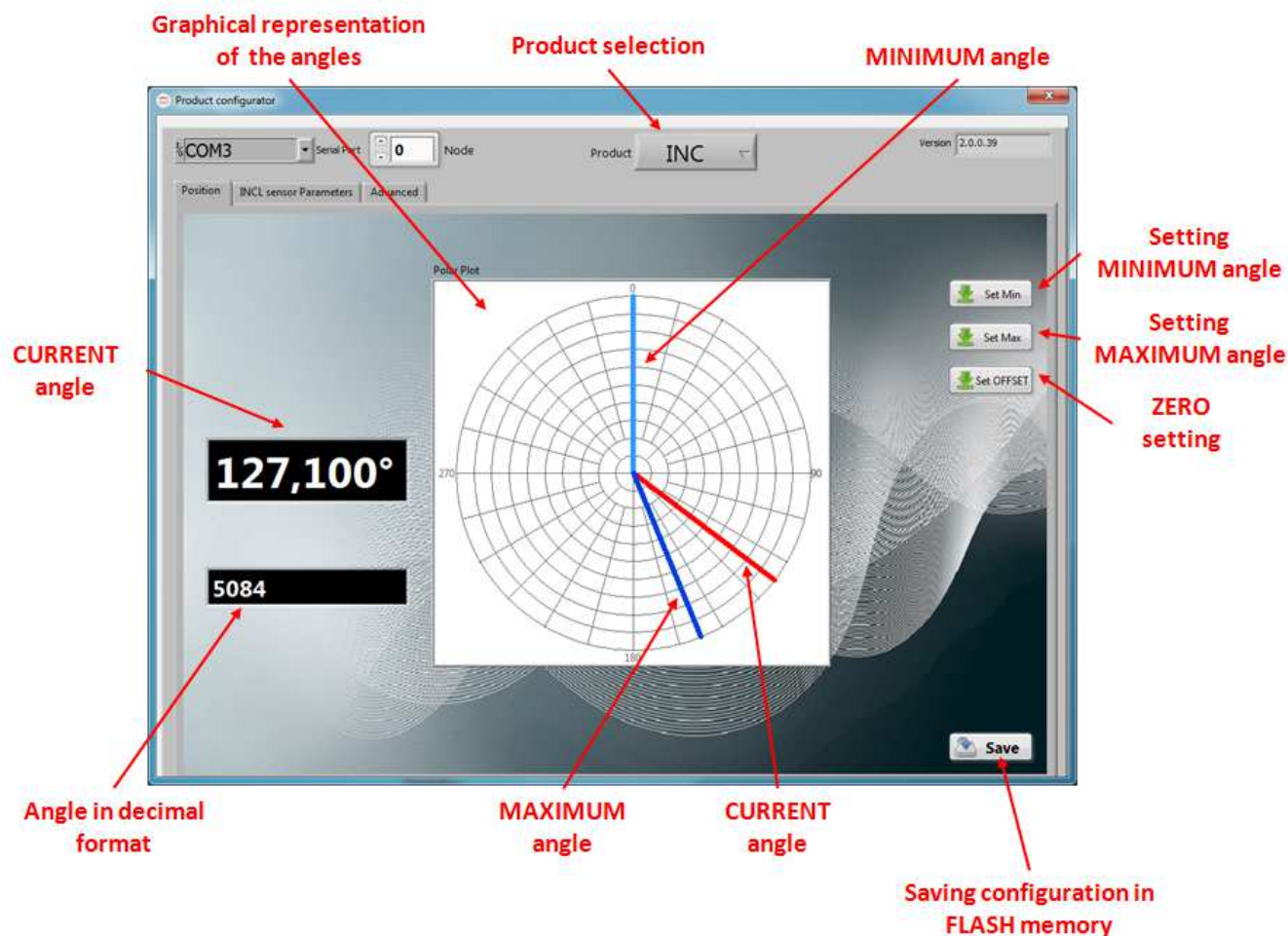
the sensor will produce an alarm on analog output each times it will detect an harmonic of amplitude bigger than 1000 in the frequency band 20Hz - 60Hz.

Alarm state is reported through the switching of analog output from his minimum value to his maximum value.

INC Sensor

Main page:

The first window shows information related to the stored angles and to the current position of the sensor.

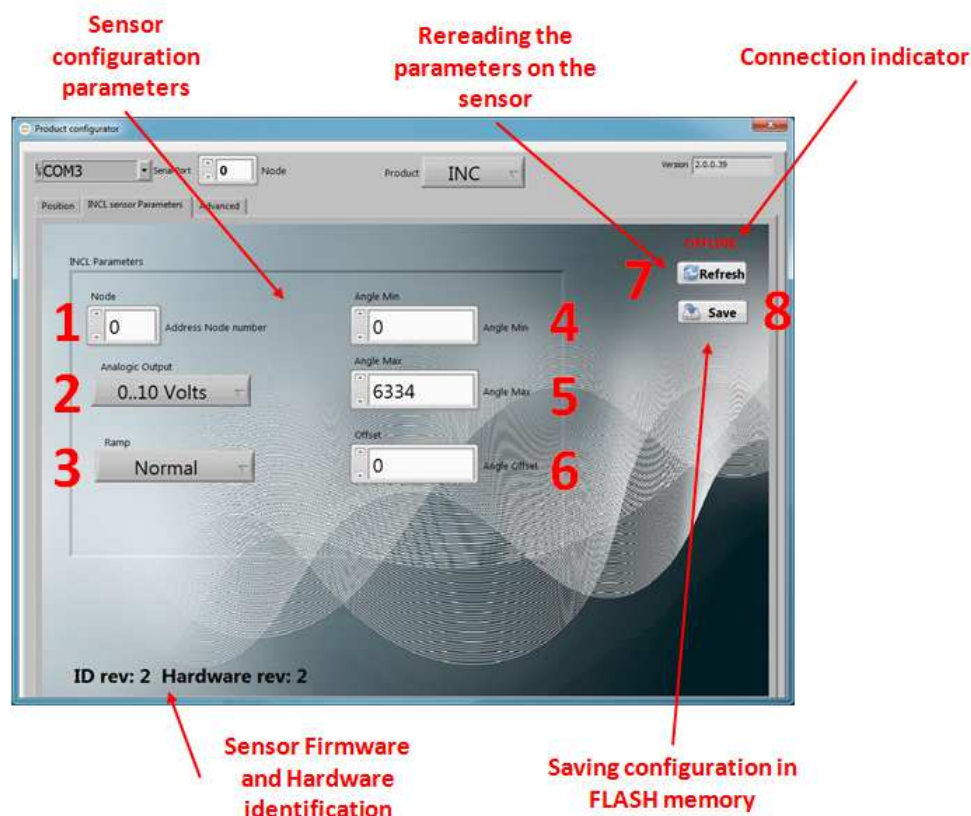


With the minimum and the maximum angle assignment, the sensor scale the analogue output between the two chosen values.

The *offset* value is used to establish the relative ZERO position for the sensor.

Configuration and parameters adjustment window:

This window allows the configuration of the sensor without the direct sending of the packets through the serial.



- 1) It allows the assignment of a specific node number to the sensor. In case you access a bus with multiple INC sensors connected, this command allows you to query and configure only one of the sensors. The factory settings are Node = 0. For this reason, in the first installation, each sensor must be configured independently from the other, otherwise you might have an address conflict on the bus (different sensors with the same node number).
- 2) It defines the configuration of the analog output:
 - High impedance
 - Voltage analog (0 ... 5V or 0 ... 10V)
 - Current analog (4 ... 20mA, 0 ... 20mA or 4 ... 24mA)
- 3) Select the type of analog output slope:
 - NORMAL (ex. 0V .. 10V)
 - INVERTED (ex. 10V .. 0V)

- 4) Selection (in decimal format) of the **minimum** angle position (starting point of the analogue output slope).
- 5) Selection (in decimal) of the **maximum** angle position (starting point of the analogue output slope).
- 6) Selection (in decimal) of the OFFSET position (relative zero sensor).

Conversion between "decimal" angle and "degrees" angle is obtained by multiplying the "decimal" value for the **angular resolution of the sensor: 0.025°**.

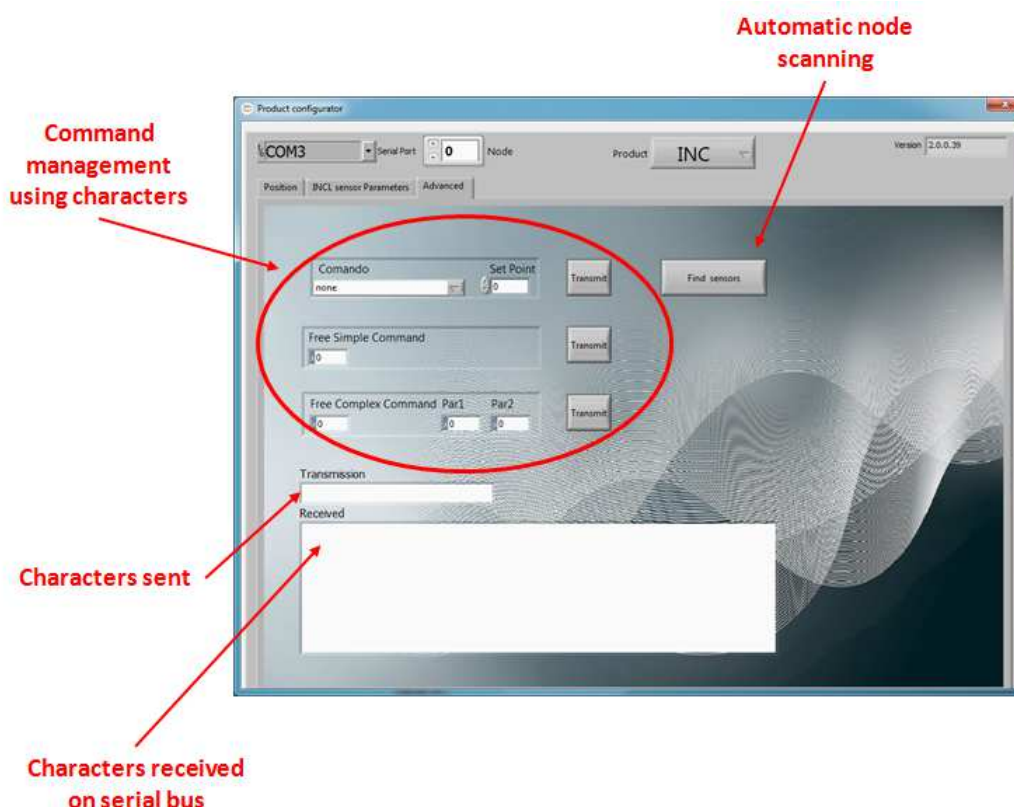
Example:

$$\text{Decimal value} = 5084 \quad \rightarrow \quad 5084 * 0,025^{\circ} = \mathbf{127,100^{\circ}}$$

“Advanced” window

In this window it is possible to select and send commands to the sensor and at the same time display the data packet that passes on the serial port.

This functionality is useful to the customer in the implementation phase of its communication software with the sensor because it acts as a dynamic help for single commands.



It is shown the packet that has to be transmitted on the RS-485 bus in order to obtain the desired command.

Note: The window of the "received characters" is always listening and if other packets have to be transmitted on the bus, these packets will be always displayed.

USB - RS-485:

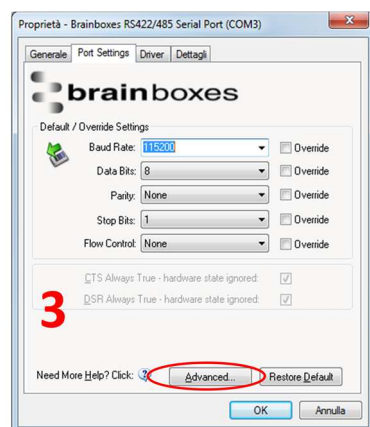
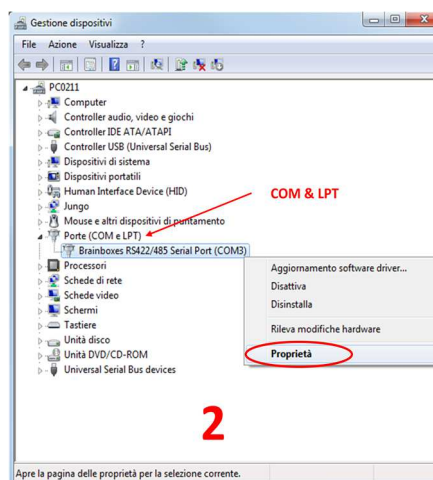
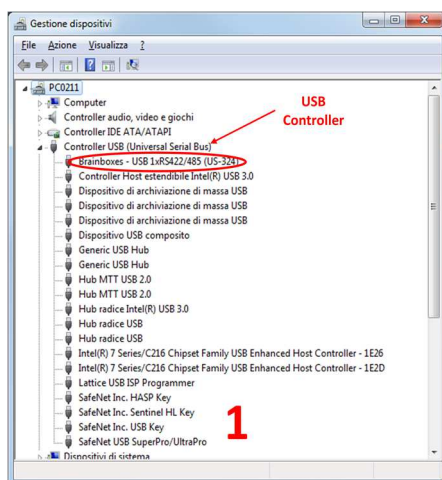
Configuration Example “US-324”:

To connect VBR and INC sensor to a computer, it is possible to use any industrial USB to Serial converter.

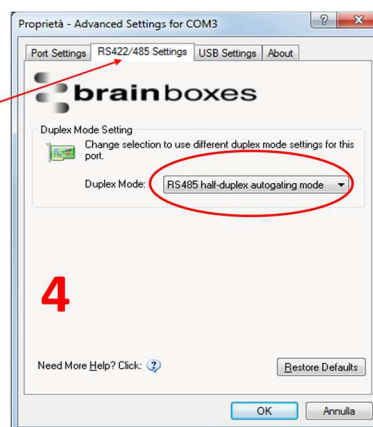
Below it will be reported the configuration example of the USB to RS485 converter **US-324** from **Brainboxes**.



1. Install the driver US-324 and check if the device is correctly installed
2. Open the window “properties” of the new COM port
3. Open “Advanced” settings of the device
4. Select “RS-485 Half Duplex” in Advanced Settings of the COM port



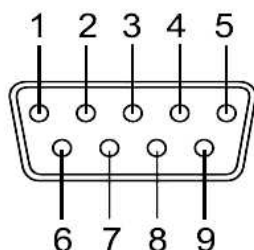
RS422/485
Settings TAB



DB9 Connection example:

In order to obtain an half duplex communication on the **US-324** converter, connect pins as shown in the picture:

<i>DB9 Connections</i>	<i>RS485 cables</i>
1 – 6	RS485 – (B)
2 – 7	RS485 + (A)



- Pin 1 (TXD-) must be shorted with Pin 6 (RXD-) thus connected with RS485 – (B) cable.
- Pin 2 (TXD+) must be shorted with Pin 7 (RXD+) thus connected with RS485 + (A) cable.

Connection example “UPort-1130”:



1. Install the driver of the converter as stated in its user manual.
2. Connect the RS485 cables to the DB9 connector observing the following connections:
 - RS485 + (A) connected to the clamp n° 3 → R+ (D+)
 - RS485 - (B) connected to the clamp n° 4 → R- (D-)

