MEX PDI Calibration

Release 6.12.37

Embention

2024-06-13

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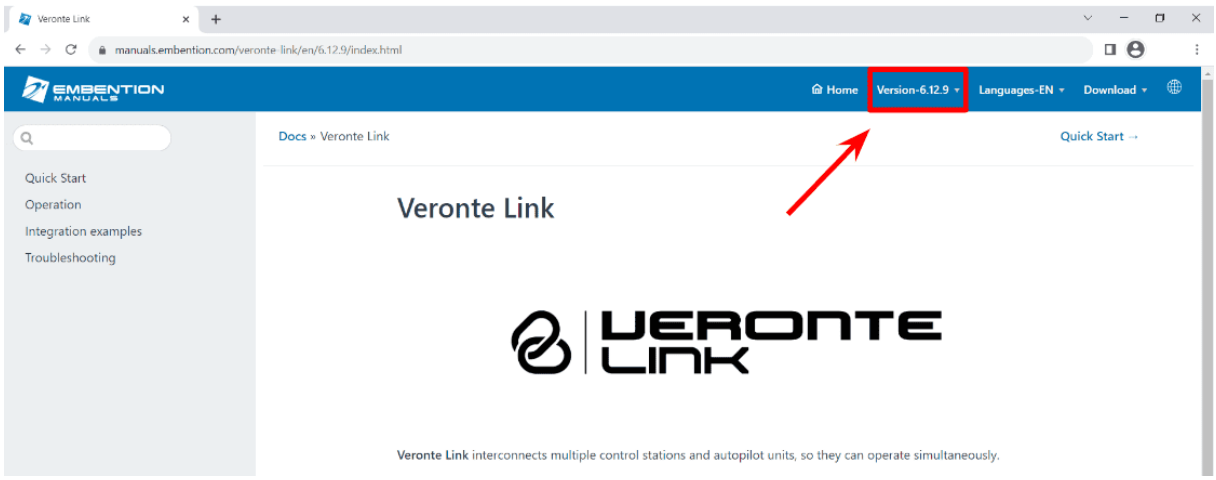
MEX | PDI CALIBRATION

MEX PDI Calibration is an application to calibrate the magnetometer of **MEX**.

Warning: Select your version before reading any user manual for software. The following image shows where to select a version from any Embention user manual.



CHAPTER

ONE

QUICK START

MEX PDI Calibration is the application tool that allows the user to calibrate the magnetometer of the **Veronte MEX**.

Every time **MEX** is employed on a different geographic region, the magnetometer should be calibrated, since the magnetic field changes at each region. In addition, it should be calibrated the first time it is used.

To calibrate a **MEX** magnetometer, first of all download and install **MEX PDI Calibration**.

1.1 System Requirements

Before executing this software, users should check the following sections with the minimum and recommended PC hardware requirements.

Minimum requirements

- CPU: Intel Core i5-8365UE
- RAM: 8 GB DDR4
- STO: 256 GB SSD

Recommended requirements

- CPU: 12th Gen Intel(R) Core(TM) i7-12700H 14 cores up to 4,70 GHz
- RAM: 32 GB
- STO: 1 TB SSD M.2 NVMe PCIe

1.2 Download

Once the **MEX** has been purchased, a GitHub release should be created for the customer with the application.

To access to the release and download the software, read the Releases section of the **Joint Collaboration Framework** manual.

1.3 Installation

To install **MEX PDI Calibration** on Windows just execute the "MEXPDICalibration.exe" file and follow the indications of the *Setup Wizard*. Administrator rights are needed.

Warning: If there is any problem with the installation, please disable the antivirus and the Windows firewall. Disabling the antivirus depends on the antivirus software. To disable the firewall, go to "Control Panel" ⇒ "System and Security" ⇒ "Windows Defender Firewall" and then, click on "Turn Windows Defender Firewall on or off".

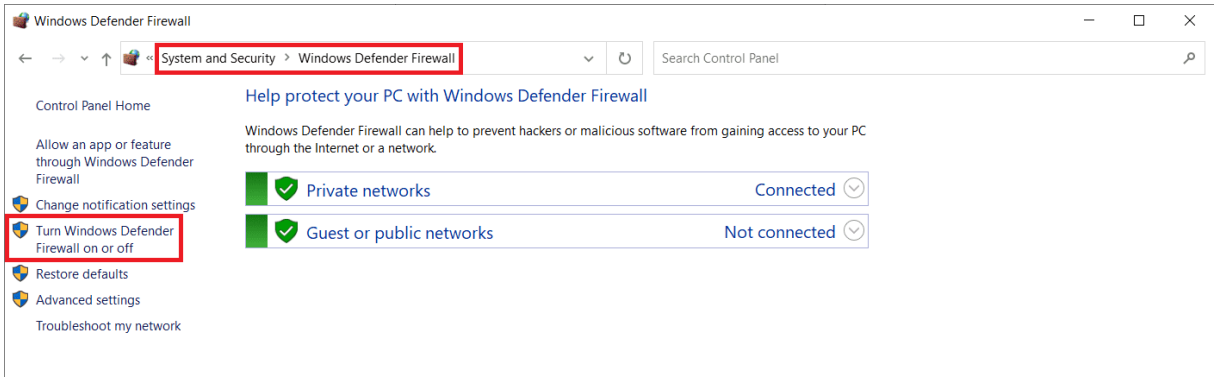


Fig. 1: **Windows Defender Firewall**

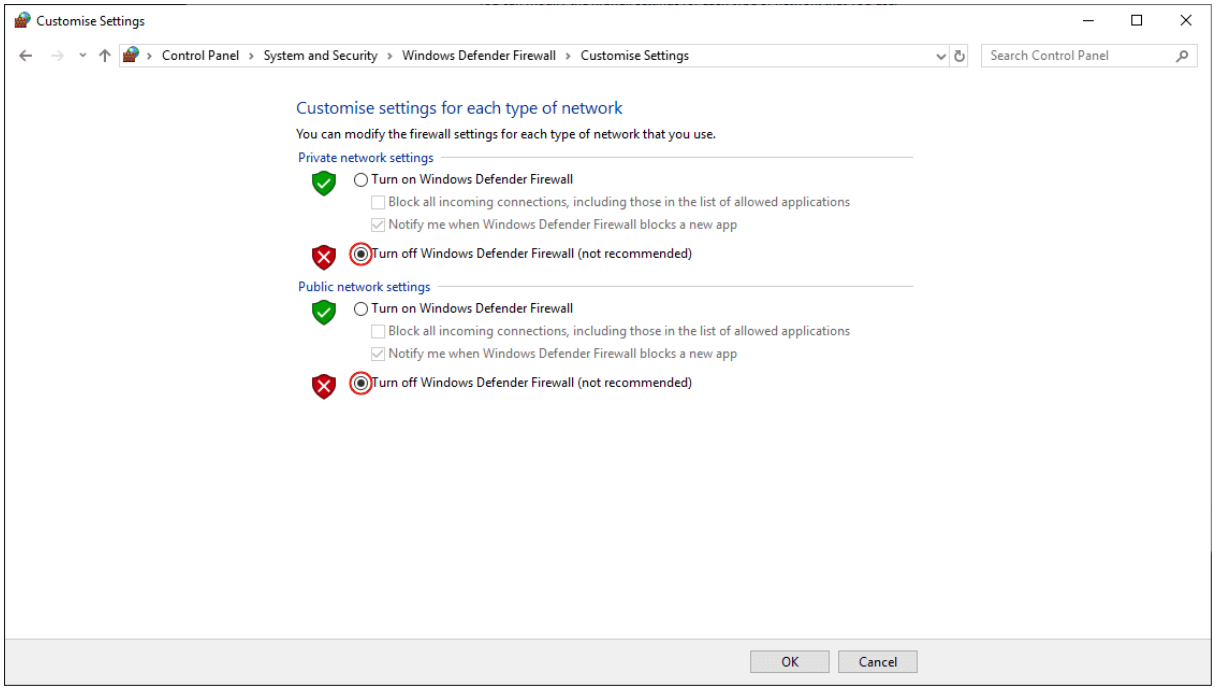


Fig. 2: **Windows Defender Firewall Settings**

CHAPTER

TWO

CONFIGURATION

To calibrate the magnetometer, follow the steps:

2.1 1. Connect MEX to a computer

To establish that connection, use the **Veronte Link** application acording to its user manual.

2.2 2. Create a tunnel communication

1. Open **MEX PDI Builder** and select the connected **MEX** on the marked button.

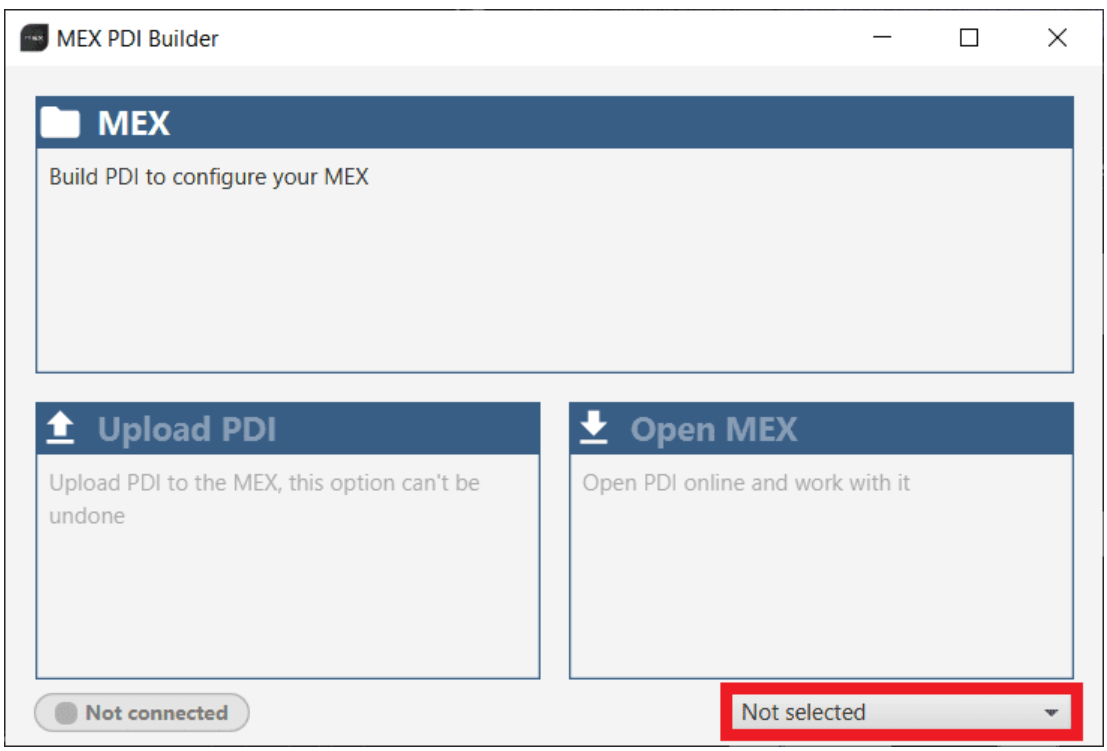


Fig. 1: **MEX PDI Builder**

2. Click on **Open MEX** ⇒  menu ⇒ **I/O Setup panel**, then connect a custom message producer with a tunnel consumer. For more information on custom messages and tunnelling, please refer to the I/O Setup section of the **MEX PDI Builder** user manual.

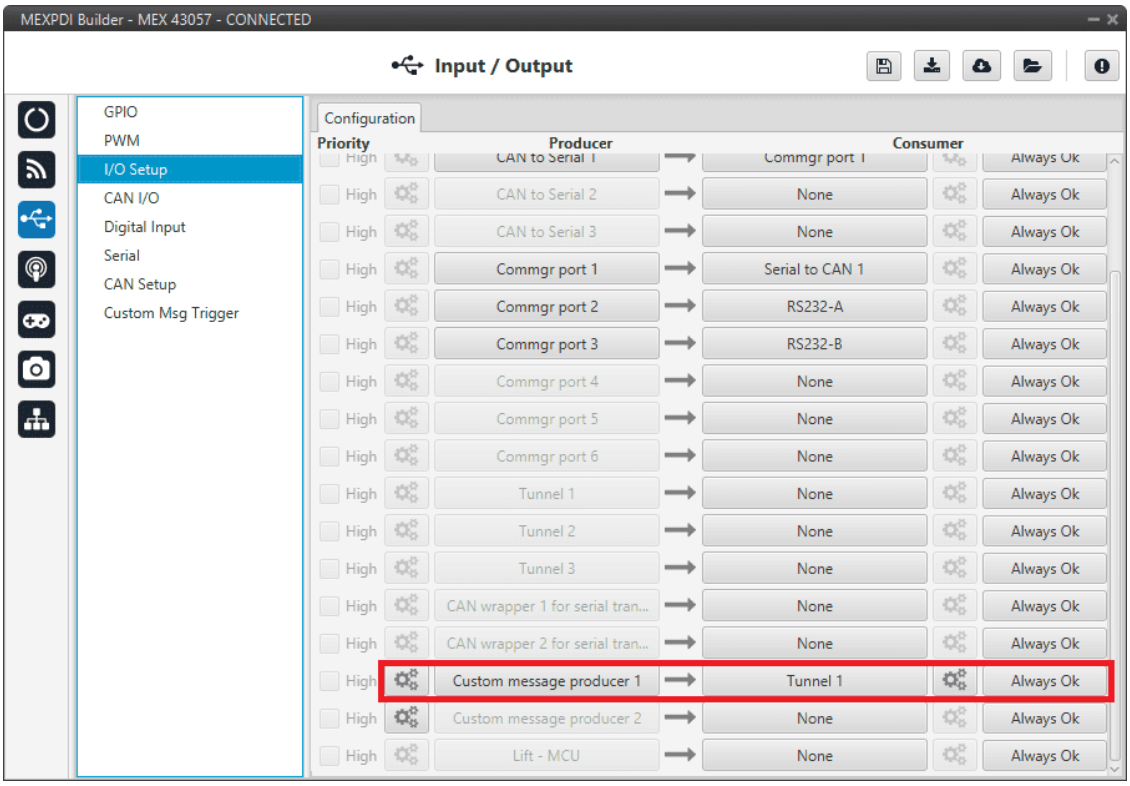


Fig. 2: **I/O Setup - Configuration**

3. Click on the  button of the producer to configure it and then on  to add a message. It must be configured with the following parameters:

- **Endianness**: Mixed endian
- **Period**: 0.25 s
- **Delay**: 0 s

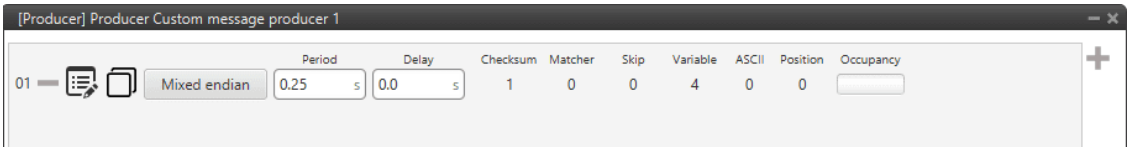


Fig. 3: **Producer Custom Message - Settings**

4. Then, click on  to add the necessary fields to this message. The structure and variables of the message must be the following:

   - **Internal LIS3MDL Magnetometer Raw X in SI, Internal LIS3MDL Magnetometer Raw Y in SI** and **Internal LIS3MDL Magnetometer Raw Z in SI**:

  - **Variable**: *Internal LIS3MDL Magnetometer Raw X in SI / Internal LIS3MDL Magnetometer Raw Y in SI / Internal LIS3MDL Magnetometer Raw Z in SI*
  - **Compression**: Uncompress
  - **Encode/Decode**: 1
- **Sensor-Internal Magnetometer (LIS3MDL)**:
  - **Variable**: *Sensor-Internal Magnetometer (LIS3MDL)*
  - **Compression**: Uncompress
- **CRC (crc16veronte)**:
  - **Type**: Polynomial
  - **Endianness**: Little endian
  - **Crc-Preset**: crc16veronte
  - **BackFrom**: 12
  - **BackTo**: 0
  - **Binary mode**

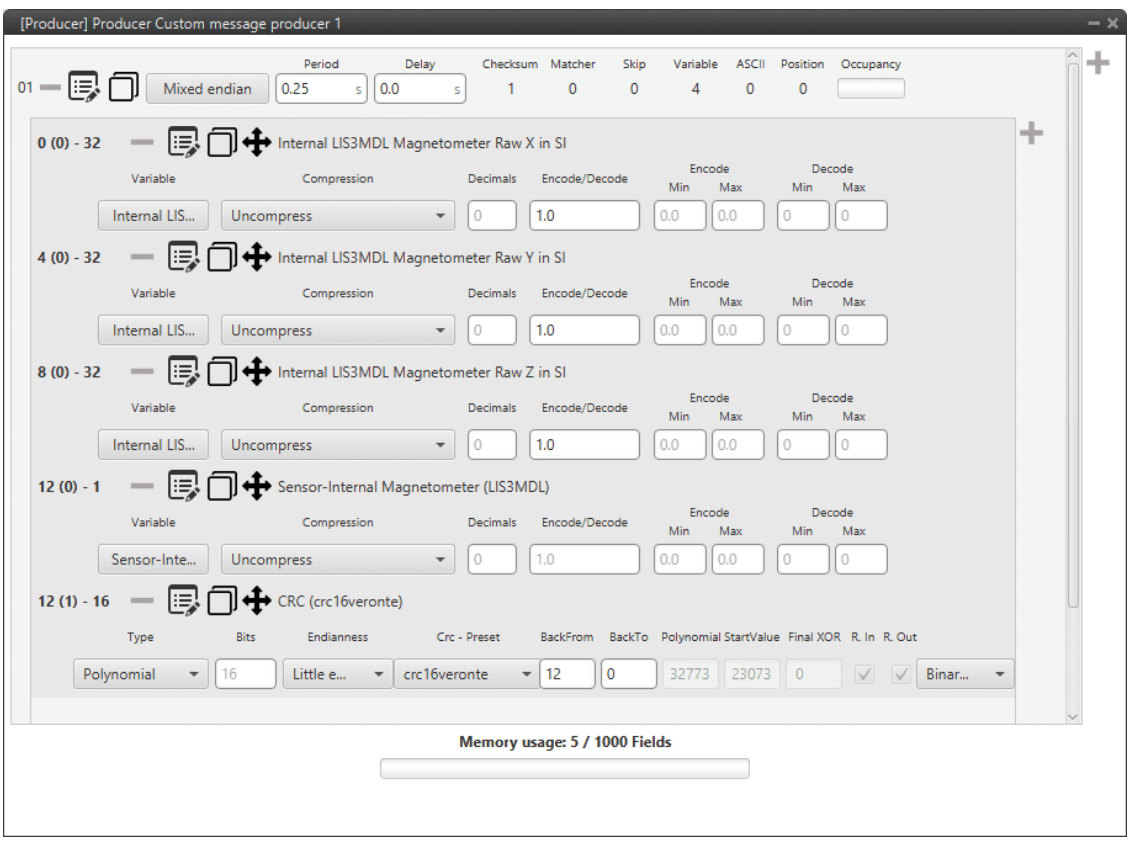


Fig. 4: **Producer Custom Message - Configuration**

5. The tunnel consumer requires the following configuration:
   - **Veronte ID**: App 2
   - **Parser**: No protocol

- **Destination tunnel**: Tunnel producer 1
- **Time between messages**: 0.1 s
- **Bytes to send**: 15 bytes

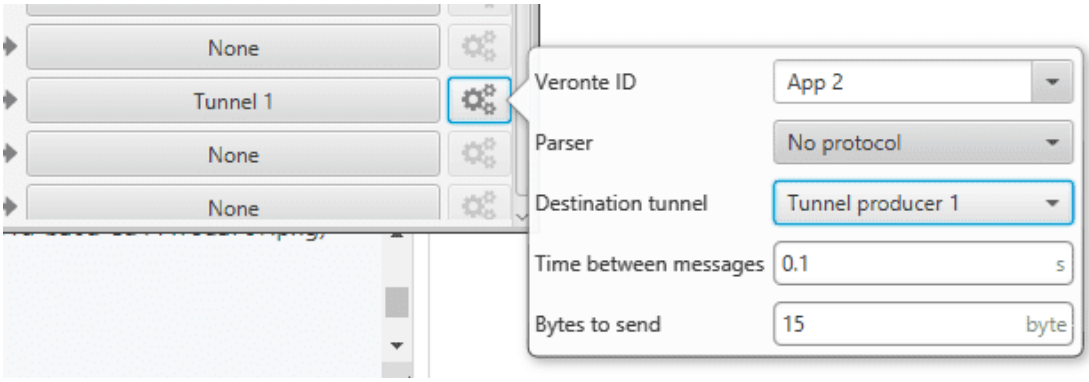


Fig. 5: **Consumer Tunnel - Configuration**

6. Finally click on  to save the configuration in **MEX**.

Note: For further information about **MEX PDI Builder**, please visit the MEX PDI Builder User Manual.

CHAPTER

THREE

OPERATION

Once the configuration is completed, open **MEX PDI Calibration** and select the connected **MEX** on the marked button.

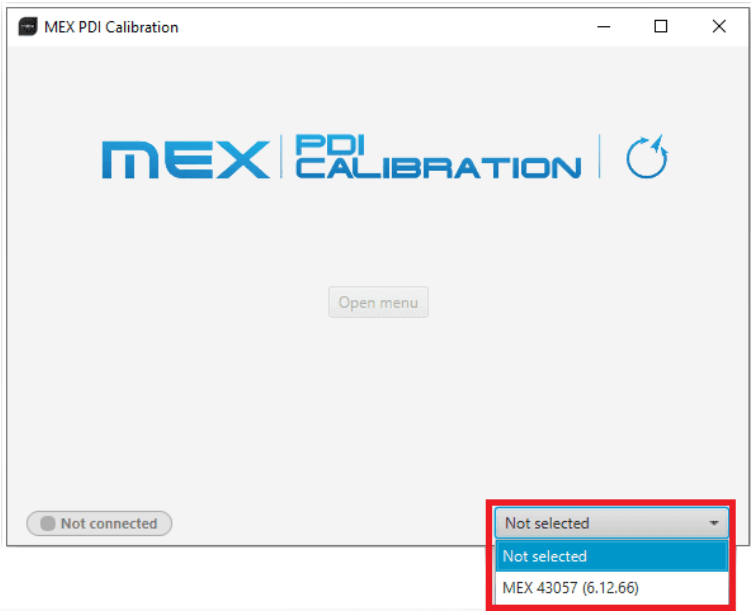


Fig. 1: **Select device**

Warning: If no unit is connected, e.g. when working offline, it is not possible to access the menus of the MEX PDI Calibration software.

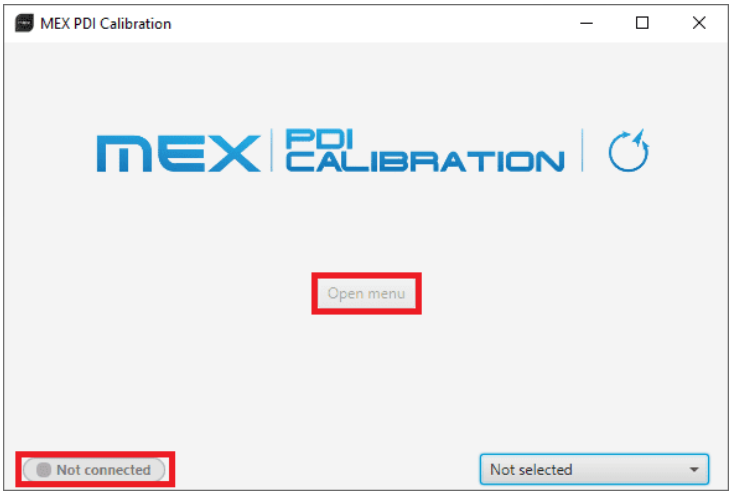


Fig. 2: **MEX PDI Calibration - Device not connected**

If MEX unit is correctly connected, the user can access the software by clicking on *Open Menu*.

Fig. 3: **MEX PDI Calibration**

Note: **MEX** device can appear as *Normal mode*, *Normal mode - Disconnected*, *Maintenance mode* or *Maintenance mode (loaded with errors)*. *Maintenance mode (loaded with errors)* appears when something is wrong in the configuration.

In order to access the *Calibration Menu* and calibrate the magnetometer, **MEX PDI Calibration** first needs to access the MEX configuration by entering in **Maintenance mode**. Then, once MEX PDI Calibration has accessed the configuration, in order to communicate with the MEX unit through the previously configured tunnel, MEX returns to **Normal mode**.

For this reason, the user must accept the confirmation panel shown below after clicking *Open Menu*.

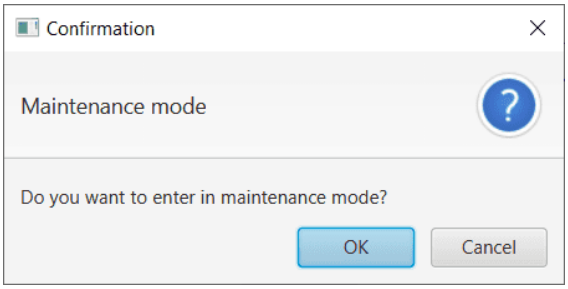


Fig. 4: **Maintenance mode - Confirmation Panel**

When exiting from the *Calibration Menu*, the following message will appear asking to save/export the current calibration:

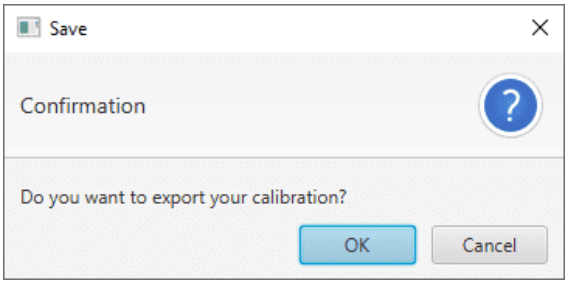


Fig. 5: **Exit - Confirmation Panel**

This will save a folder with the current calibration configurables.

Fig. 6: **Exported calibration**

3.1 Magnetometer Calibration

Magnetometer calibration should be performed once MEX has been installed on the platform, so that the magnetic field during operation is similar to the one measured during calibration.

MEX PDI Calibration interface is the following:

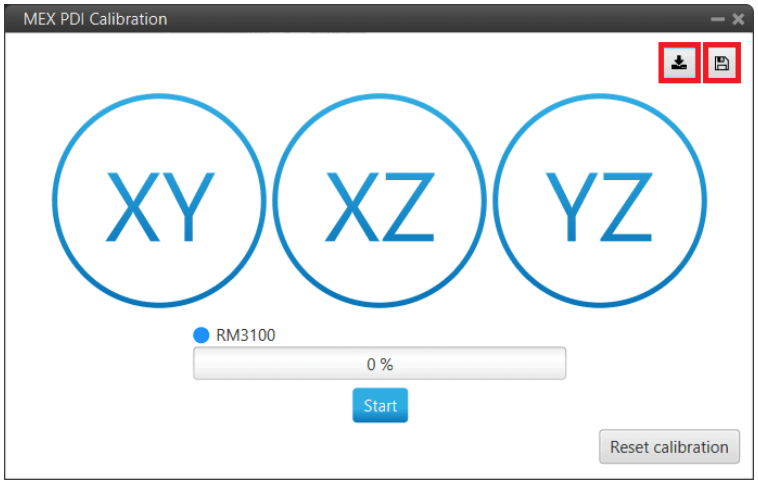


Fig. 7: **Calibration menu**

- **Save calibration**  : Writes the conducted calibration results in **MEX**.
- **Export calibration**  : Stores the conducted calibration results in **the computer**.

In order to perform the calibration process, follow the steps described below.

Click on **Start** to start the calibration process.

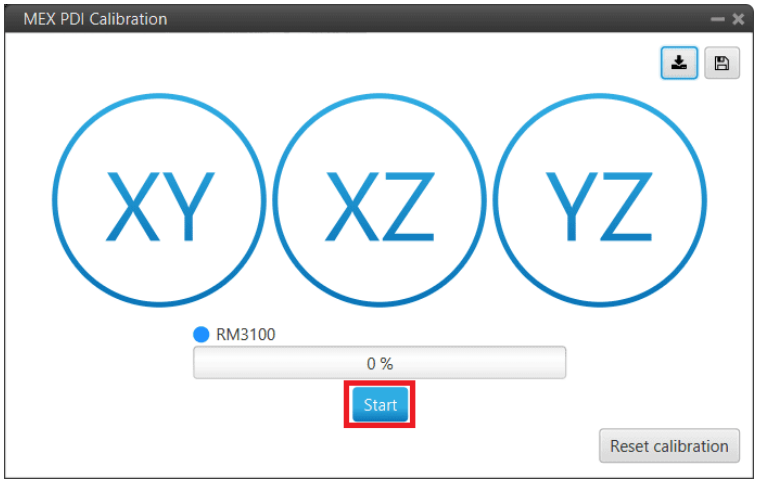


Fig. 8: **Start button**

Immediately, start rotating the **MEX** around each axis. It is important to have approximately the same number of samples for each rotation axis, so rotate the **MEX** around one different axis each 33% (one rotation from 0 to 33%,

another different from 33 to 66 and the last remaining from 66 to 100%).

Note: The order in which the user rotates the MEX about each of the axes does not affect the calibration, this is just an example of how to do it.

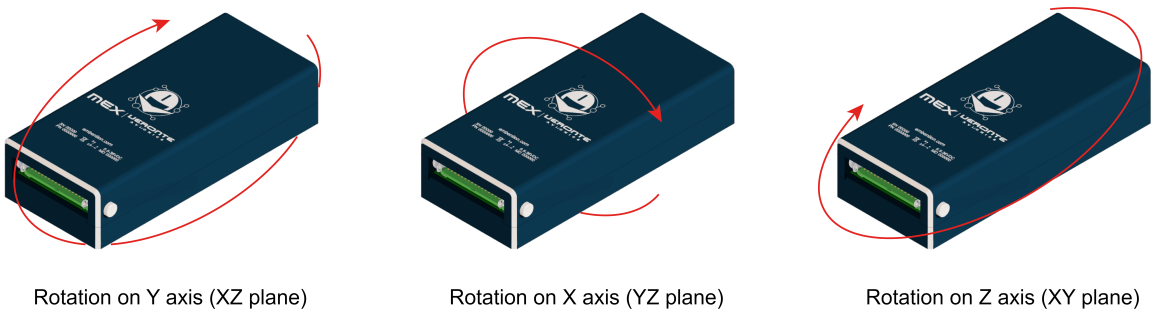


Fig. 9: **Rotation around each axis**

The progress bar will increase according to the number of samples measured and the samples will be drawn on each circle (one circle for each rotation plane).

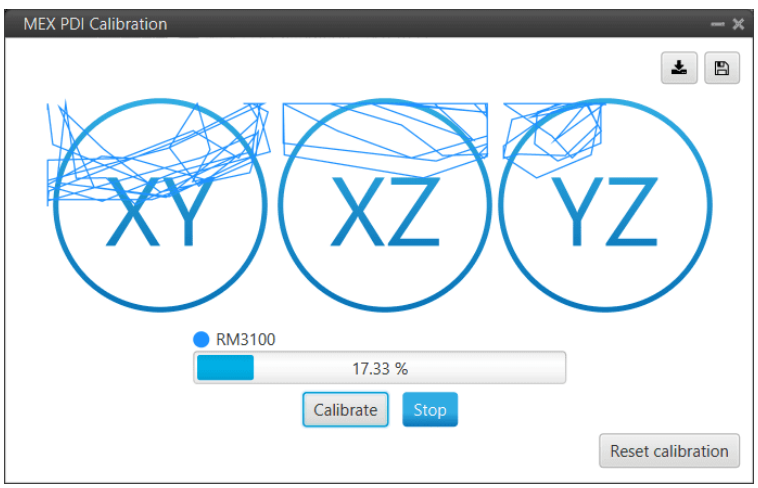


Fig. 10: **Calibration process**

Note: If the user wishes to interrupt the calibration, simply click on the '**Stop**' button.

Once 3 circles have been drawn on the screen and the progress bar reaches the 100%, the calibration process is complete. The following image shows an example of the calibration:

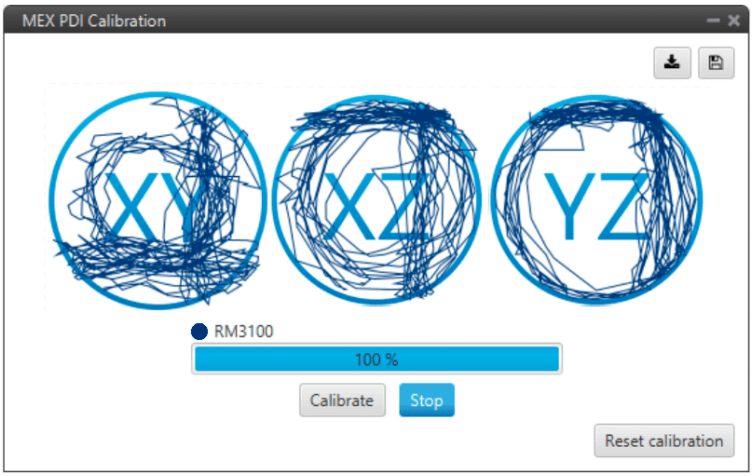


Fig. 11: **Calibration process finished**

Then press the '**Calibrate**' button to save the calibration. The following window will pop up:

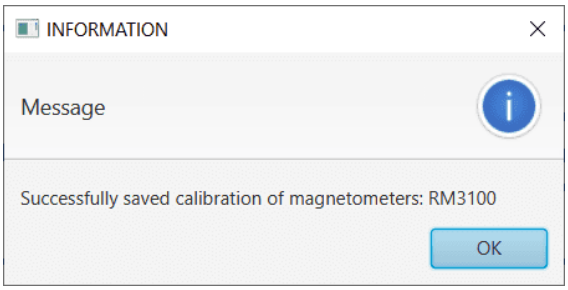


Fig. 12: **Saved Calibration panel**

Then, a colored percentage will indicate the calibration measurements quality:

- **Red (0-39%)**: repeating calibration is recommended.
- **Orange (40-79%)**: acceptable.
- **Green (80-100%)**: optimal.

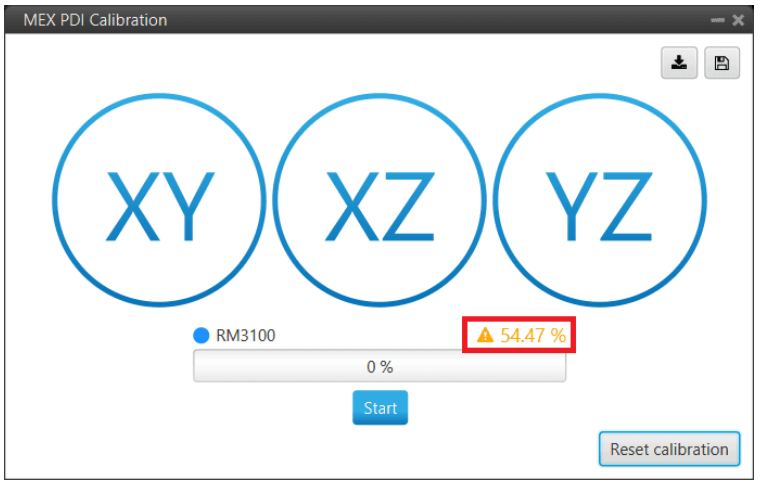


Fig. 13: **Acceptable calibration example**

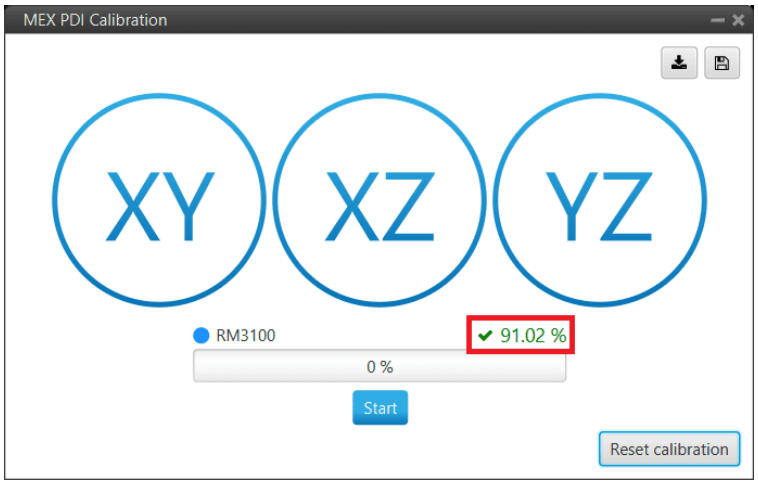


Fig. 14: **Optimal calibration example**

If the calibration is good enough, click on  to save the configuration in **MEX**.

> **Warning:** **MEX** will not be calibrated until  is clicked.

On the other hand, if the calibration is not satisfying, click on **Reset Calibration** to calibrate again.

Important: **Reset Calibration** will delete the current calibration in the connected **MEX**.

CHAPTER

FOUR

TROUBLESHOOTING

4.1 Dispersion error

If the user clicks on the button '*Calibrate*' too soon, the calibration may not have enough samples. Even having enough samples, they may be too similar. Consequently, there is no enough information to properly perform the calibration. This will lead to the following error:

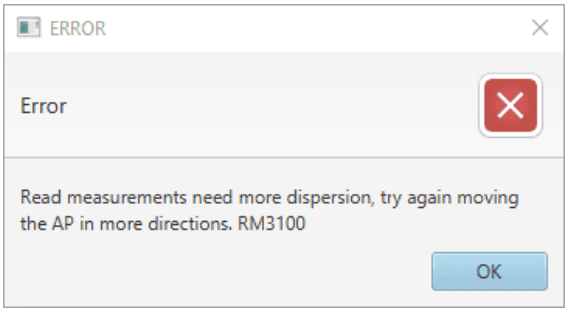


Fig. 1: **Error - More dispersion needed**

In this case, reset calibration and start again.

4.2 Calibration errors

During the calibration process the following errors may appear.

- **Unexpected error warning**

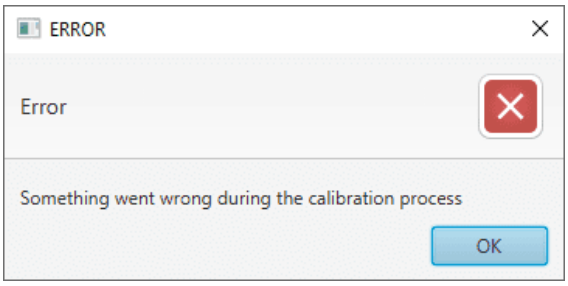


Fig. 2: **Error - Calibration Process Failed**

In this case, reset calibration and start the calibration process again.

- **Calibration not progressing**

  If the calibration process of the magnetometer has been started, but the calibration status bar does not indicate any progress, the configuration of the sensor may be invalid.

  To solve this problem:

  1. Open **MEX PDI Builder**.

     Note: Consult the MEX PDI Builder manual for more details on how to proceed.

  2. Go to Sensors menu → **Magnetometer tab**.
  3. Ensure that the **Magnetometer rotation matrix** is **not** a zero matrix and respects the orthogonality of the axes.

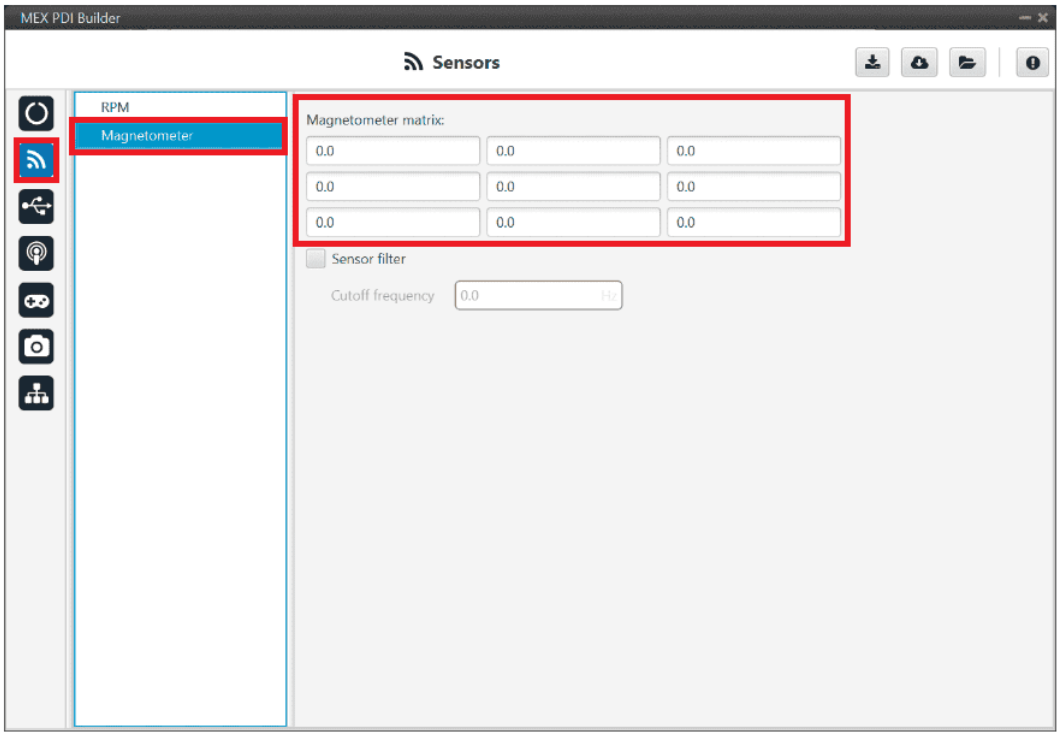


Fig. 3: **MEX PDI Builder - Invalid magnetometer rotation matrix**