MEX PDI Calibration

Release 6.12.37

Embention

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MEX ERLIBRATION

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.								
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\leftrightarrow \rightarrow C $($ manuals.embention.com/vero	onte link/en/6.12.9/index.html	• •						
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٩	Docs » Veronte Link	Quick Start						
Quick Start Operation	Veronte Link							
Integration examples Troubleshooting								
	Veronte Link interconnects multiple control stations and aut	opilot units, so they can operate simultaneously.						

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" \Rightarrow "System and Security" => "Windows Defender Firewall" and then, click on "Turn Windows Defender Firewall on or off". 📽 Windows Defender Firewall × → ✓ ↑ 📽 « System and Security > Windows Defender Firewall v Ö Search Control Panel Q Help protect your PC with Windows Defender Firewall Control Panel Home Windows Defender Firewall can help to prevent hackers or malicious software from gaining access to your PC Allow an app or feature through the Internet or a network. through Windows Defender Firewall 🛛 👽 Private networks Connected 📀 Change notification settings 🤜 Guest or public networks Turn Windows Defender Not connected \odot Firewall on or off Restore defaults Advanced settings Troubleshoot my network Fig. 1: Windows Defender Firewall P Customise Settings \times → 👻 🛧 🔗 Control Panel → System and Security → Windows Defender Firewall → Customise Settings ✓ ^で Search Control Panel م Customise settings for each type of network You can modify the firewall settings for each type of network that you use. Private network settings O Turn on Windows Defender Firewall Ø Block all incoming connections, including those in the list of allowed applications ☑ Notify me when Windows Defender Firewall blocks a new app Turn off Windows Defender Firewall (not recommended) Public network settings Turn on Windows Defender Firewall Block all incoming connections, including those in the list of allowed applications Notify me when Windows Defender Firewall blocks a new app Turn off Windows Defender Firewall (not recommended) OK Cancel Fig. 2: Windows Defender Firewall Settings

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.

MEX PDI Builder		_	×
MEX			
Build PDI to configure your MEX			
Upload PDI Upload PDI to the MEX, this option can't be undone	Open MEX Open PDI online and we	ork with it	
Not connected	Not sel	ected	Ŧ

Fig. 1: MEX PDI Builder

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.

uilder - MEX 43057 - CONNE	CTED	Input / Output		B	* 0	
GPIO	Configuration					
PWM	Priority High Was	Producer CAIN to Serial 1		Commgr port 1	onsumer	Always Ok
I/O Setup CAN I/O	High 🔯	CAN to Serial 2	→	None	00	Always Ok
Digital Input	High 🕸	CAN to Serial 3	-	None	OS I	Always Ok
Serial	High 🕸	Commgr port 1	→	Serial to CAN 1	OS I	Always Ok
CAN Setup Custom Msg Trigger	High 🔯	Commgr port 2	→	RS232-A		Always Ok
Custom Wisg Migger	High 🕵	Commgr port 3	→	RS232-B	¢¢	Always Ok
	High 🔯	Commgr port 4	-	None		Always Ok
	High 🔯	Commgr port 5	→	None	Q0	Always Ok
	High 🔯	Commgr port 6	\rightarrow	None	00	Always Ok
	High 🔯	Tunnel 1	→	None	OC I	Always Ol
	High 🔯	Tunnel 2	→	None	08	Always Ol
	High 🕸	Tunnel 3	-	None	08	Always O
	High 🕸	CAN wrapper 1 for serial tran	→	None	OS I	Always Ol
	High 🕸	CAN wrapper 2 for serial tran	-	None	00	Always Ok
	High 👯	Custom message producer 1	\rightarrow	Tunnel 1	Q ₀	Always Ok
	📃 High 🛱	Custom message producer 2	\rightarrow	None	Q ₀	Always Ol
	High 🕸	Lift - MCU	\rightarrow	None	OC I	Always Ok

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

[Producer] Producer Custom messag	e producer 1									- ×
01 — 📑 🗍 Mixed endian	Period 0.25 s	Delay 0.0 s	Checksum 1	Matcher 0	Skip O	Variable 4	ASCII 0	Position 0	Occupancy	+

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

· · · · · · · · · · · · · · · · · · ·	- ~							
01 - Period Delay Checksum Matcher Skip Variable ASCII Position Occupancy Mixed endian 0.25 s 0.0 s 1 0 0 4 0 0	Î +							
0 (0) - 32 — 🗊 🗇 🕂 Internal LIS3MDL Magnetometer Raw X in SI								
Variable Compression Decimals Encode/Decode Encode Decode								
Internal LIS Uncompress								
4 (0) - 32 — 🗐 🗇 🕂 Internal LIS3MDL Magnetometer Raw Y in SI								
Variable Compression Decimals Encode/Decode Min Max Min Max								
Internal LIS Uncompress								
8 (0) - 32 — 📳 🗍 💠 Internal LIS3MDL Magnetometer Raw Z in SI								
Variable Compression Decimals Encode/Decode Min Max Min Max								
Internal LIS Uncompress								
12 (0) - 1 — 📴 🗇 💠 Sensor-Internal Magnetometer (LIS3MDL)								
Variable Compression Decimals Encode/Decode Min Max Min Max								
Sensor-Inte Uncompress 0 1.0 0.0 0 0								
12 (1) - 16 — 📑 🗍 🕂 CRC (crc16veronte)								
Type Bits Endianness Crc - Preset BackFrom BackTo Polynomial StartValue Final XOR R. In R. Out								
Polynomial • 16 Little e • crc16veronte • 12 0 32773 23073 0 V V Binar •								
Memory usage: 57 1000 Fields								

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

•	None	08	ļ		
•	Tunnel 1	Q ₀	Veronte ID	App 2	*
•	None	00	Parser	No protocol	•
•	None	08	Destination tunnel	Tunnel producer 1	•
	, ", ", ", ", ", ", ", ", ", ", ", ", ",		Time between messages	0.1	s
	•		Bytes to send	15	byte



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.

THREE

OPERATION

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

MEX PDI Calibration		_		Х
			(3	
			\smile	
	Open menu			
Not connected		Not selected		
Not connected		Not selected		
		MEX 43057 (6.12.6	6)	

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.



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.

Confirmation	×
Maintenance mode	?
Do you want to enter in maintenance mode?	
ОК	Cancel

Fig. 4: Maintenance mode - Confirmation Panel

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

Save		×
Confirmation		?
Do you want to export your ca	libration?	
	ОК	Cancel

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 E: 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.





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:

	×
Message	
Successfully saved calibration of magnetom	eters: RM3100
	ОК

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 **E** to save the configuration in **MEX**.



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.

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:

ERROR	\times
Error	×
Read measurements need more dispersion, try ag the AP in more directions. RM3100	ain moving
	ОК

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 \rightarrow Magnetometer tab.
- 3. Ensure that the **Magnetometer rotation matrix** is **not** a zero matrix and respects the orthogonality of the axes.

MEX PDI Builder — ×				
ີ Sensors				2 2 5 0
RPM RPM	Magnetometer matrix	Magnetometer matrix:		
Magnetometer	0.0	0.0	0.0	
	0.0	0.0	0.0	
•	0.0	0.0	0.0	
P Sensor filter				
	Cutoff frequency 0.0 Hz			
H				

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