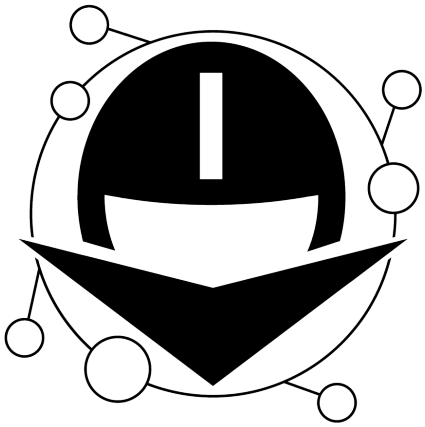
MEX Hardware Manual

Release 1.0

Embention

2024-08-07

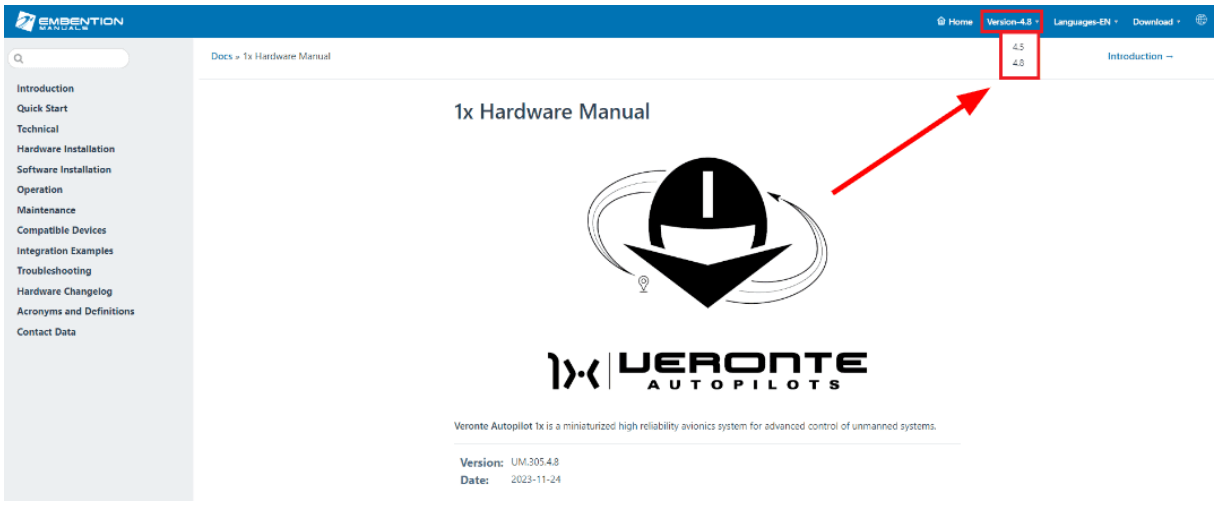
CONTENTS



MEX | VERONTE AVIONICS

MEX is a CAN expander and communication manager, which allows to reduce wires in autonomous vehicles and increase the number of devices. In addition, **MEX** includes a 3 axis magnetometer for orientation.

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



CHAPTER

ONE

INTRODUCTION

Fig. 1: **Veronte MEX**

Veronte MEX stands as a powerful peripheral to ease the reduction of wire in autonomous vehicles at the time it allows to increase the number of devices in the system. It makes possible to relocate and to group sensors, actuators, payloads, motor controllers… enhancing the I/O connectivity in the Veronte Autopilot. Veronte Mex includes a magnetometer, which detects direction and strength of a magnetic field, including the earthly field, which allows to obtain altitude and orientation references. With its easy integration, Veronte MEX becomes a quick solution for increasing connectivity capacity and allowing wiring optimization, especially in large systems.

1.1 Wiring Optimization

It is especially in large vehicles, where wire optimization plays a critical role permitting a significant weight reduction. This upgrade is achieved thanks to the reduction of cable length and because of the added flexibility so the right device can be installed in the right location. Another advantage of the use of Veronte MEX is the robustness of the CAN Bus, being resistant to electromagnetic interferences and permitting the installation of long cables with no signal loss. Furthermore, it includes redundancy with CAN bus isolation, making it fail operational even in case of a CAN bus line break.

1.2 Extended I/O

With the use of Veronte MEX, the data capacity for input and output in Veronte Autopilots is increased in a great manner. The advanced design makes possible to control several peripherals (PWM, RS-232, RS-485, digital output, I2C, analog inputs…) through the CAN Bus. It can be used for both, expanding the I/O capacity in Veronte Autopilots, or for controlling peripherals with a robust communications protocol. In case it is needed, multiple Veronte MEX boards can be installed in the same network for increasing the number of I/O ports or because of system architecture needs.

1.3 Applications

In aviation, a field where weight means such an important agent in design, struggling with wiring is one of the most common issues faced during the vehicle design. With the use of Veronte MEX, not only this issue would be reduced, but a bunch of opportunities for different sensors and payload could arise:

- By adding more I/O interfaces, a more complex payload control can be achieved, improving connectivity.
- Advanced control of actuators and peripherals becomes feasible, being possible to condensate the connection of control, feedback, sensors… in a single board.
- Devices can be installed at long distances from the autopilot with no signal degradation thanks to the robustness of the CAN Bus.
- The internal magnetometer allows to measure differences of altitude and orientation, useful for navigation applications. The magnetometer measurements are sent through RS-232, RS-485 or CAN channels to other devices, like any other variable.

CHAPTER

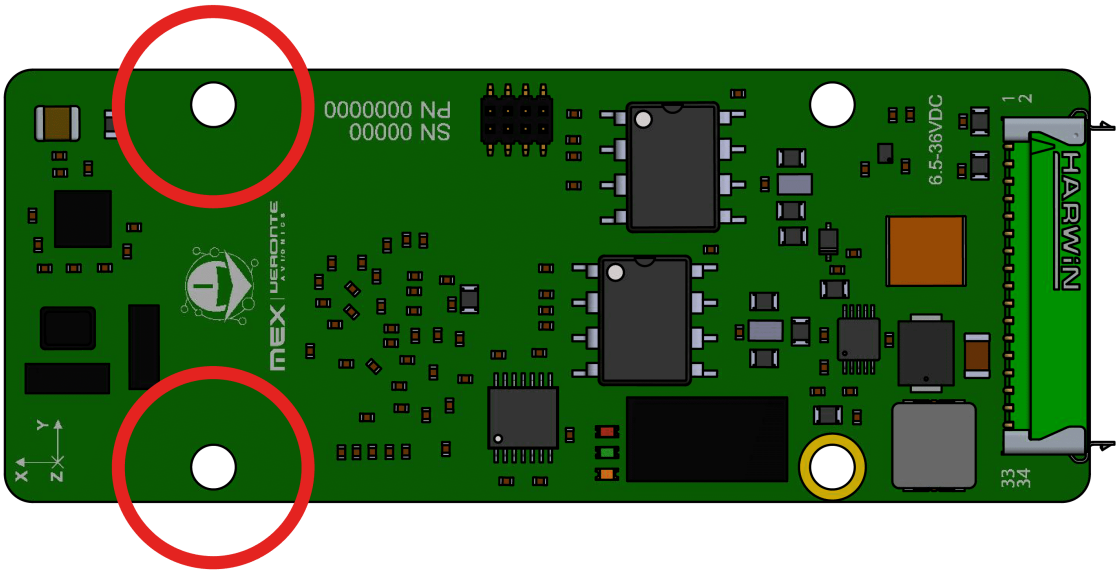
TWO

QUICK START

This document describes how to install and use the MEX, including its technical specifications.

2.1 Warnings

- Disassembling, improper installations or bad connections may invalidate the warranty. Please contact Technical Support if you suspect a faulty or defective component.
- Veronte MEX must not be placed close to magnetic sources. Even though the loss of performance could be recoverable, these magnetic sources will interfere with measurements:
  - Ferrous materials (such as nickel, iron, steel, and cobalt).
  - Magnets or magnetic fields.
  - Electric or elecstronic devices (for example electric motors or antennas).
- Veronte MEX will always produce heat as a by-product of its operation. Keep in mind an adequate heat dissipation on installation.
- To disconnect cables from the connector of the OEM version, a G125 Delatching Tool Separator is recommended, referenced as Z125-9263400.
- Ferrous screws must not be used on the holes close to the magnetometer. Use materials which do not affect magnetic fields (copper, brass, gold, aluminum, some stainless steels, silver,tin, silicon, and most non-metals). These holes are marked on the next figure:



2.2 Requirements

Required items:

- Veronte Link (version 6.12.X or higher).
- MEX PDI Builder (version 6.10.X or higher).
- Veronte Autopilot 1x (version 4.8 or higher).
- 1x PDI Builder (version 6.8.X or higher).
- Veronte Updater (version 6.8.X or higher).

CHAPTER

THREE

TECHNICAL

3.1 Variants

Veronte MEX is offered with two versions: MEX and MEX OEM. The MEX version is protected by an enclosure made of anodized-aluminium. The MEX OEM version is smaller, lighter and has better heat dissipation; but requires mechanical protection when installed.

Fig. 1: **MEX version**

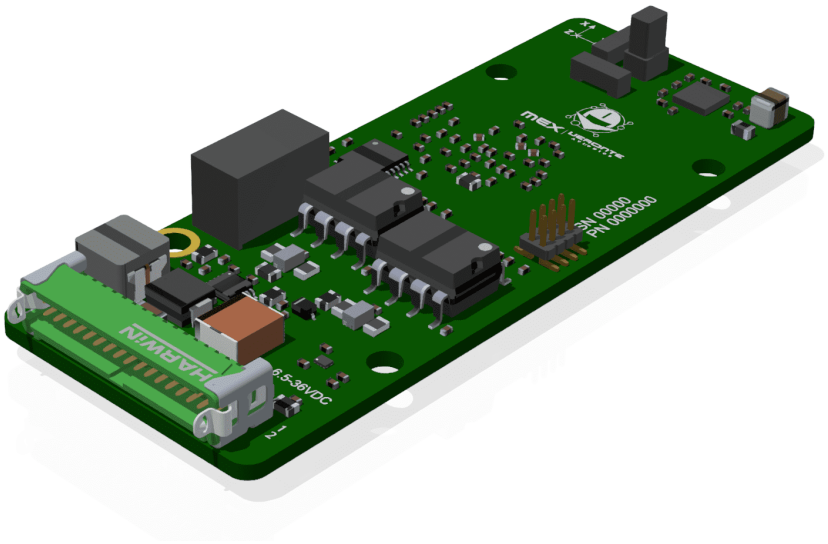
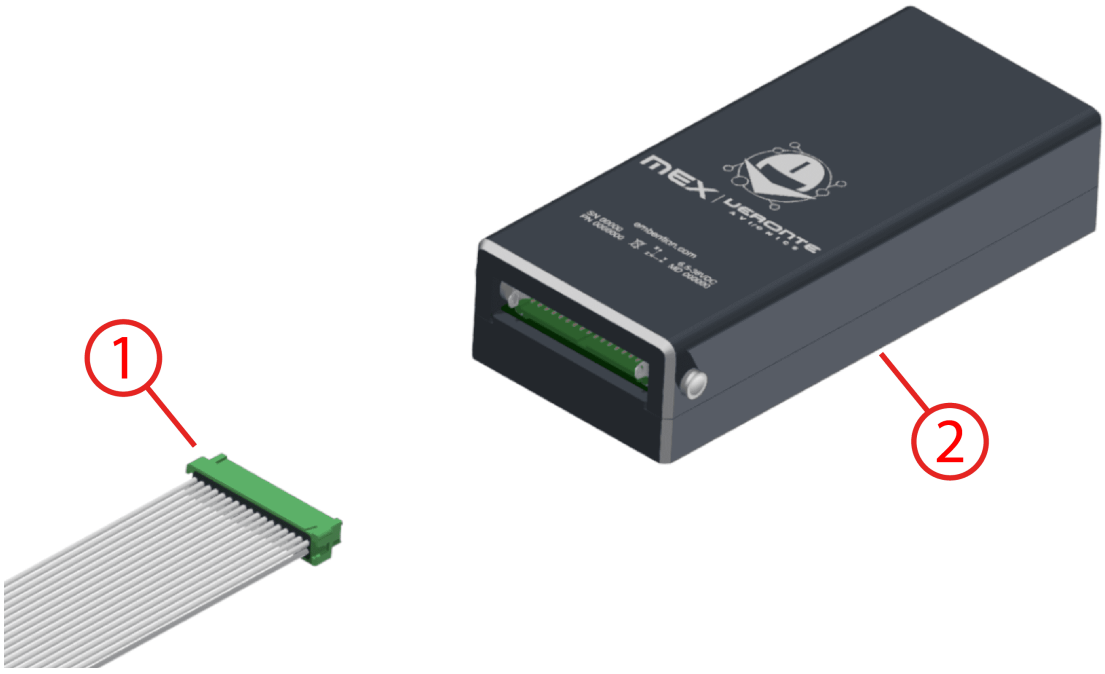


Fig. 2: **MEX OEM version**

3.2 Part List

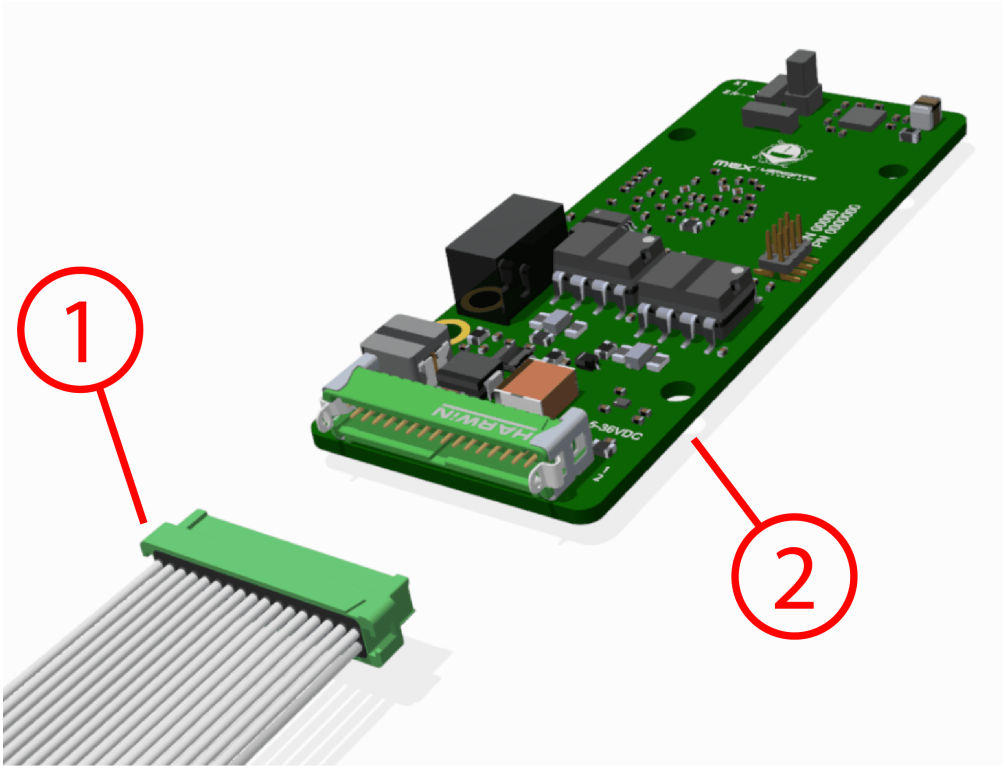
3.2.1 MEX version



1. Cable connector. Embention reference: P006354. Commercial reference: G125-FC13405L0-0450L.

2. MEX.

3.2.2 MEX OEM version



1. Cable connector. Embention reference: P006354. Commercial reference: G125-FC13405L0-0450L.
2. MEX OEM.

3.3 Features

- **Communications**
  - 2x isolated CAN busses
  - 2x RS-232 buses for external devices
  - 1x full-duplex RS-485 interface
  - Connection to PC
  - 1x I2C Digital Bus
  - Able to report internal status via Veronte APP
  - Able to read telemetry coming from third party devices
- **Sensors**
  - 1x magnetometer
  - 1x Temperature sensor, with $\pm 2.7°C$ accuracy

- **Signals**
  - 4x PWM output signals with electrostatic discharge protection (IEC-61000-4-2, level 4), between 10 Hz to 10 kHz
  - 4x analog input signals
  - 2x digital input signals of ECAP, EQEP or GPIO (only as input)
- **Protections**
  - Reverse polarity protection
  - Protection agains short circuits for RS-232 and PWM signals
  - Robust against vibration in the range of an industrial-grade product
- **Electrical**
  - 1x microprocessor unit
  - 2x power supply inputs
  - CAN termination resistor configurable per software
  - 3x leds to report system status

3.4 Magnetometer

Number of sense axes	3
Technology	Magneto-inductive
Resolution	50 nT

3.5 Electrical Specifications

Analog Input 1 (pin AN1)	0-5V
Analog Input 2 (pin AN2)	0-5V
Analog Input 3 (pin AN3)	0-12V
Analog Input 4 (pin AN4)	0-36V
CAN transceivers	Supplied by 5V isolated source

Input voltage/current

- Power input: 6.5V to 36V (DC)
- Two different input voltages possible

CAN

- Complies with CAN Bus 2.0A and 2.0B Standards
- Isolated signals
- Speed up to 1Mbps

RS-232

- Meets the requirements from ITU v.28 standard

- Supports data rates between 9600 and 115200 bps
- Robust against ESD

RS-485

- Supports data rates between 9600 and 115200 bps
- Robust against ESD
- Meets the requirements from ISO 8482 standard
- Voltage level from -7V to 12V

I2C

- Robust against ESD.

PWM Output

- Voltage: 5V
- Robust against ESD
- Frequencies from 10 Hz to 10 kHz
- Robust against ESD

Digital Inputs (ECAP)

- Robust against ESD
- Maximum voltage: 5V

Analog signals

- Robust against ESD

3.6 Mechanical Specifications

Weight	• 69g (with enclosure) • 17g (without enclosure)
Enclosure material	Anodized-aluminium 6061-T6
Fixation of MEX version	2x M3 screws
Fixation of MEX OEM version	4x M2 screws (2 of them must not be ferrous)

3.6.1 Dimensions

MEX version

Veronte MEX is protected by an enclosure made of anodized-aluminium 6061-T6. M3 aluminum or nylon screws are recommended as mounting hardware for better magnetometer performance. Enclosure mounting holes are 4mm depth M3 threaded.

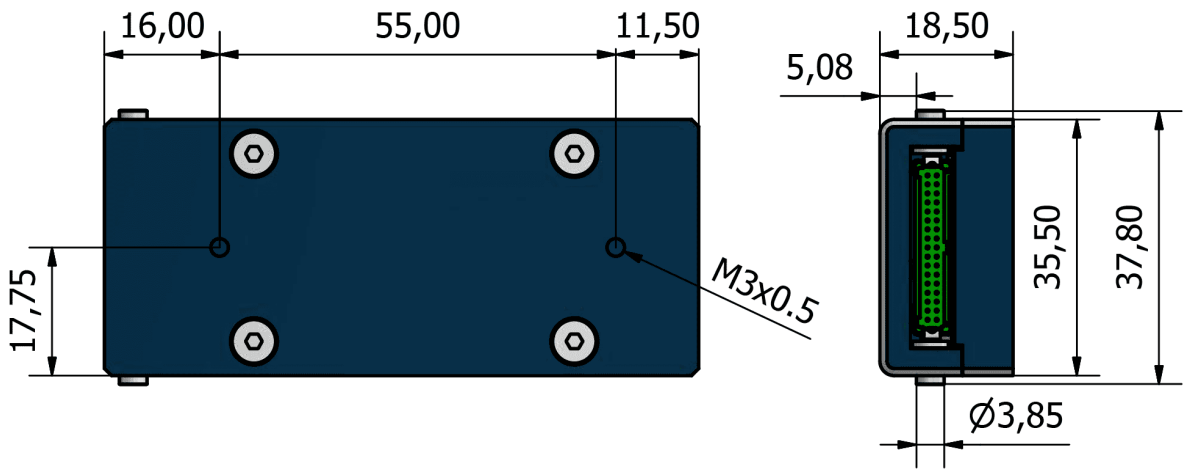


Fig. 3: **MEX dimensions**

MEX OEM version

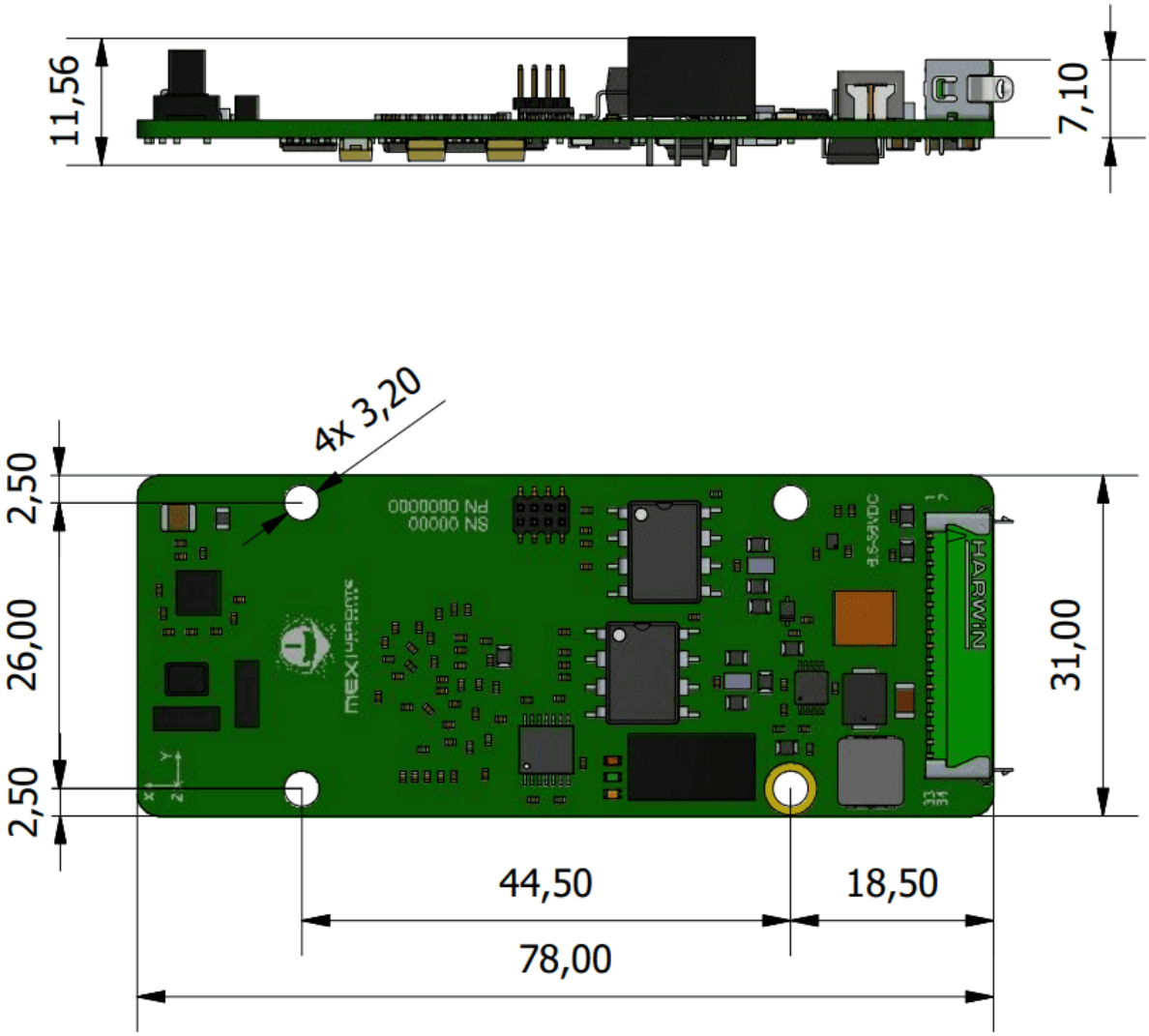


Fig. 4: **MEX OEM dimensions**

3.7 Interfaces

There is only one interface connection, with the two following connectors:

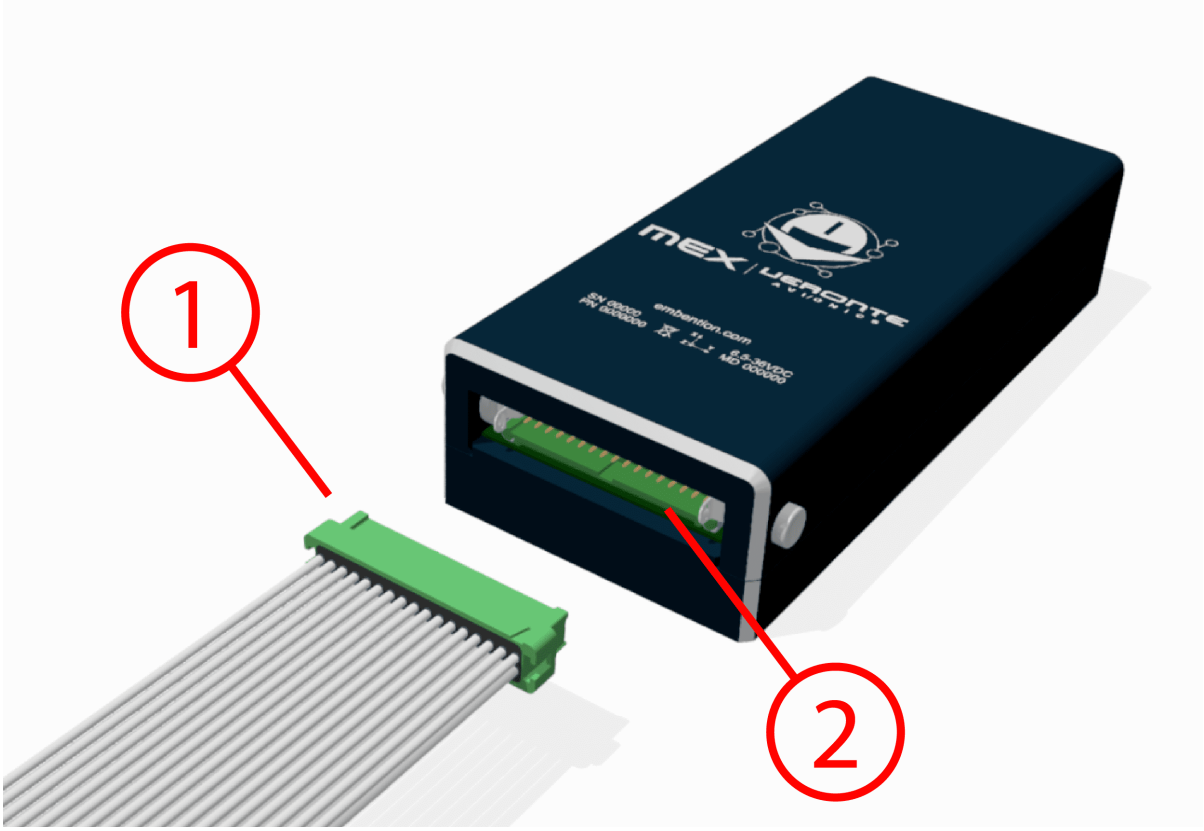


Fig. 5: **Interface connection**

Number	Connector	Embention reference	Commercial reference
1	Female	P006354	G125-FC13405L0-0450L
2	Male	P006723	G125-MH13405L3P

CHAPTER

FOUR

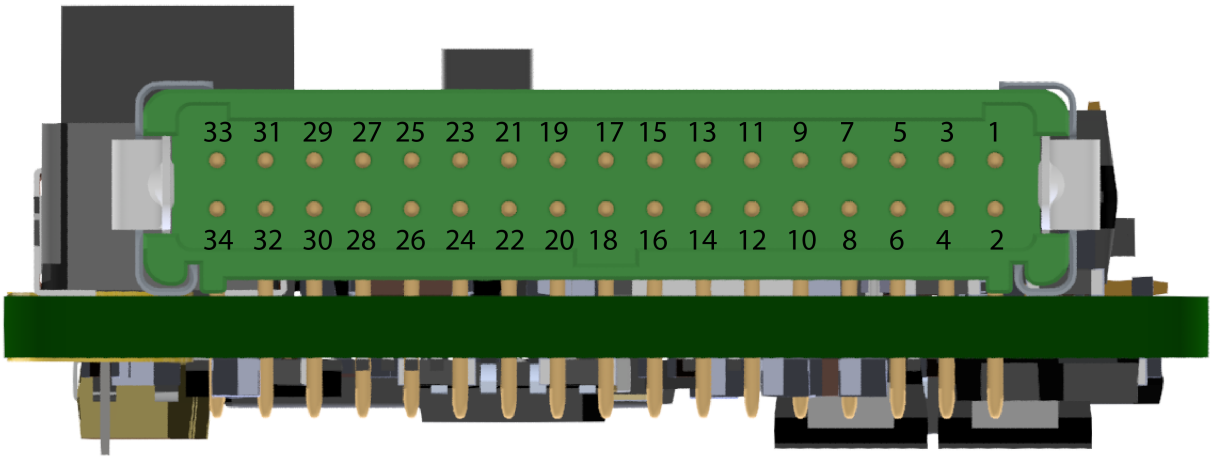
HARDWARE INSTALLATION

Version	Fixation
MEX	2x M3 screws
MEX OEM	4x M2 screws (2 of them must not be ferrous)

Note: To install **MEX** in a vehicle, female and male electrical connectors can be secured with glue to prevent disconnections, such as epoxy or Methyl methacrylate.

4.1 Pinout

Pins are arranged as follows:



PIN Nº	I/O	Comments
1	Power supply 1	Power supply for the main system, redundant with Power supply 2
2	GND	Ground for supply
3	Power supply 2	Power supply for the main system, redundant with Power supply 1
4	GND	Ground for supply

continues on next page

Table 1 – continued from previous page

PIN Nº	I/O	Comments
5	SCL	I2C CLOCK
6	SDA	I2C DATA
7	ANALOG (1) 5V	Analog input 0-5 V
8	ANALOG (2) 5V	
9	ANALOG (3) 12V	Analog input 0-12 V
10	ANALOG (4) 36V	Analog input 0-36 V
11	GND	Ground for supply
12	ECAP 1	ECAP, EQEP or GPIO (only as
13	ECAP 2	input)
14	GND	Ground for supply
15	RS-232 (A) TX	RS-232 A Output
16	RS-232 (A) RX	RS-232 A Input
17	GND	Ground for supply
18	RS-232 (B) TX	RS-232 B Output
19	RS-232 (B) RX	RS-232 B Input
20	CAN B (P)	CAN bus interface. It supports data
21	CAN B (N)	rates up to 1 Mbps
22	CAN A (P)	
23	CAN A (N)	
24	CAN GND	Isolated ground for CAN bus
25	PWM 1	PWM/DIGITAL output /DIGITAL
26	PWM 2	input signal (0-5V)
27	PWM 3	
28	PWM 4	
29	GND	Ground for supply
30	OUT RS-485 (P)	Non-inverted output from RS-485 bus
31	IN RS-485 (N)	Inverted input to RS-485 bus
32	OUT RS-485 (N)	Inverted output from RS-485 bus
33	IN RS-485 (P)	Non-inverted input to RS-485 bus
34	RS-485 GND	Ground for RS-485

Warning: Each CAN bus is equipped with a 120 Ohm (+/-5%) termination resistor that can be activated and deactivated by SW.

Warning: RS-485 has internal termination resistor with 120 ohms (+/-5%).

Warning: I2C is equiped with internal pull-up resistors.

Note: Pins 1 and 3 are not common.

4.2 Electrical diagram of CAN bus

Veronte MEX requires termination resistance in order to allow the connection of multiple Veronte MEX or other CAN Bus devices to the same line. Considering Veronte Autopilot includes one entrance resistance of 120 Ω, a second resistance needs to be placed at the end of the line (again 120 Ω). This resistance may be placed on the cable or on another PCB.

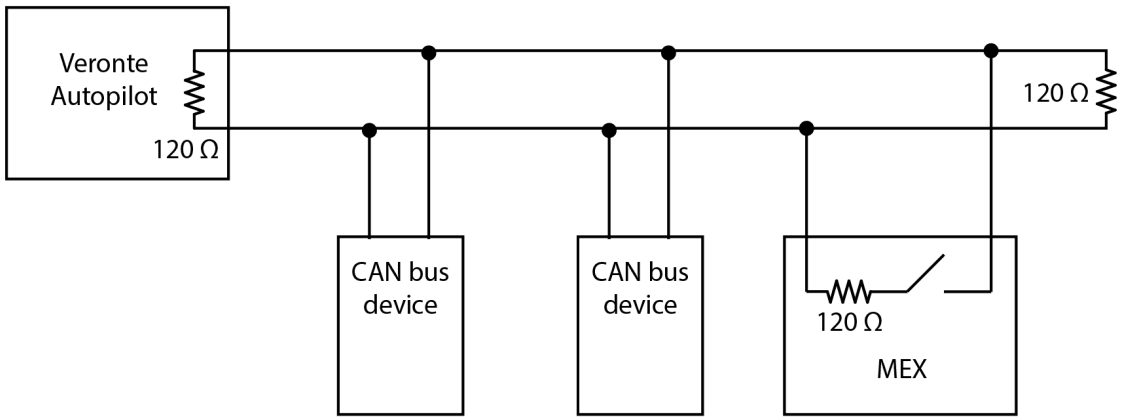


Fig. 1: **CAN assembly diagram example**

Veronte MEX has an internal resistor of 120 Ω, which can be activated by SW. Then, another way to connect multiple CAN Bus devices lies in connecting a MEX to the end of cables, then activating its internal CAN resistor.

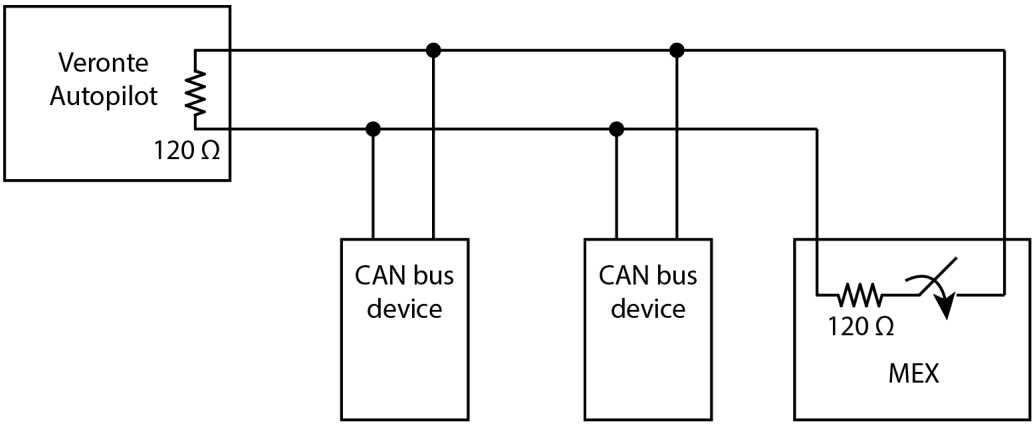


Fig. 2: **Diagram with CAN resistor activated**

CHAPTER

FIVE

SOFTWARE INSTALLATION

There are two ways to establish connection to configure MEX: via **Autopilot 1x** or direct connection.

- Direct MEX connection

  By default MEX can establish VCP communications over its SCI-A and SCI-B ports. Using any of these connection will be possible to connect it to a PC.

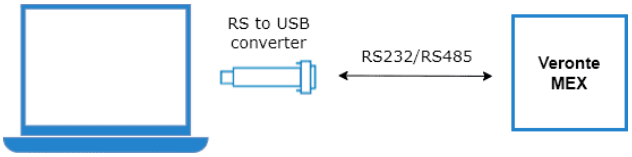


Fig. 1: **Direct MEX connection**

- Via **Autopilot 1x**

  It is usual to have a MEX in a system that does not allow to directly connect to a PC. In that situation, it is possible to configure an **Autopilot 1x** that is connected over CAN with MEX. To establish a connection between an autopilot and MEX, please read CEX/MEX - Integration examples section of the **1x PDI Builder** manual.

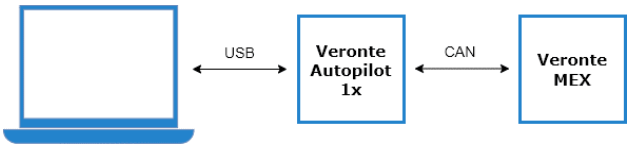


Fig. 2: **MEX connection through Veronte Autopilot**

Once MEX is connected to a computer, read the MEX Software Manual to configure it.

CHAPTER

SIX

MAINTENANCE

6.1 Preventive Maintenance

Apart from cleaning, no extra maintenance is required to guarantee the correct operation of the Veronte MEX.

In order to clean Veronte MEX properly follow the next recommendations:

- Turn off the device before cleaning.
- Use a clean, soft, damp cloth to clean the unit (not for OEM version).
- Do not immerse the unit in water to clean it.

6.2 Software update

In order to update a MEX unit, it is necessary to **re-flash the board**.

Danger: Depending on the MEX variant, flashing can be done directly by the user or not:

- **MEX OEM version**: Users can flash the MEX unit directly.
- **MEX version**: In order to flash the MEX unit, it is necessary to open the enclosure. However, **opening the enclosure will cause the user to lose the guarantee** as it will remove the guarantee sticker.

  Therefore, in order to flash it and not lose the guarantee, the user must contact the support team (create a ticket in the customer's Joint Collaboration Framework; for more information, see Tickets section of the **JCF** manual) to request permission to open the enclosure.

The following items will be needed to update Veronte MEX software:

- **JTAG Probe**
- *Embention Flashing Tool Software*. If the user does not have this tool, please contact the support team by creating a ticket in the customer's **Joint Collaboration Framework** and they will share it.

  For more information on accessing the release and downloading the software, read the Releases section of the **JCF** user manual.
- **Firmware update file** (`.bin` file): The file with the new software version (`.bin` file) will be shared with the customer in the **Joint Collaboration Framework** when it is requested.

The following steps describe the process to re-flash a MEX unit:

1. Connect the PC and the MEX unit via the JTAG probe:

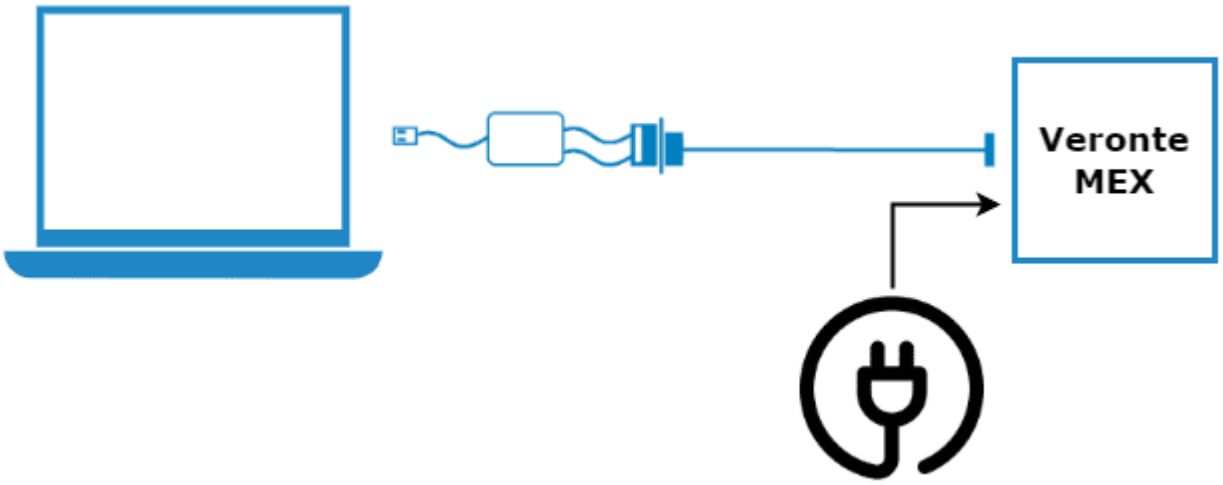


Fig. 1: **PC - MEX connection**

2. On the MEX, connect the JTAG to the 8 pin connector on top of the board. Pin nº 1 is indicated with a white dot:

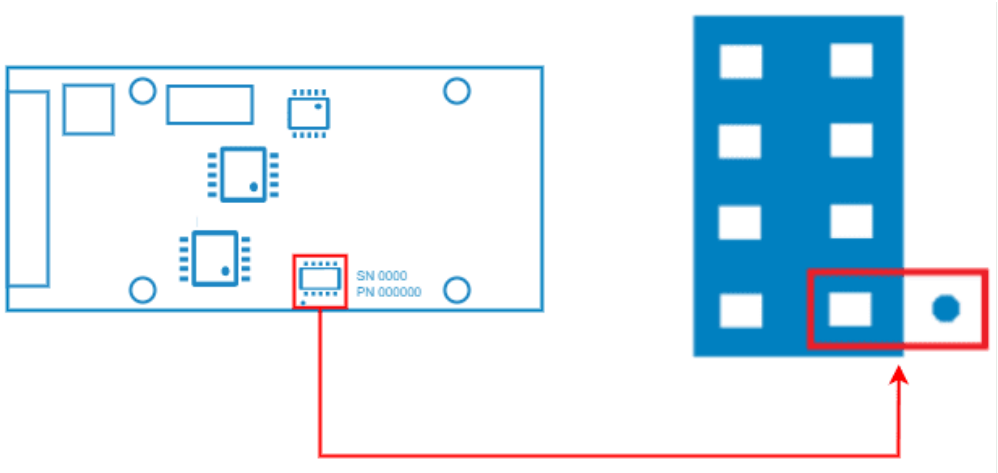


Fig. 2: **JTAG connection**

3. Open the **Flashing Tool** and access it **without logging in**:

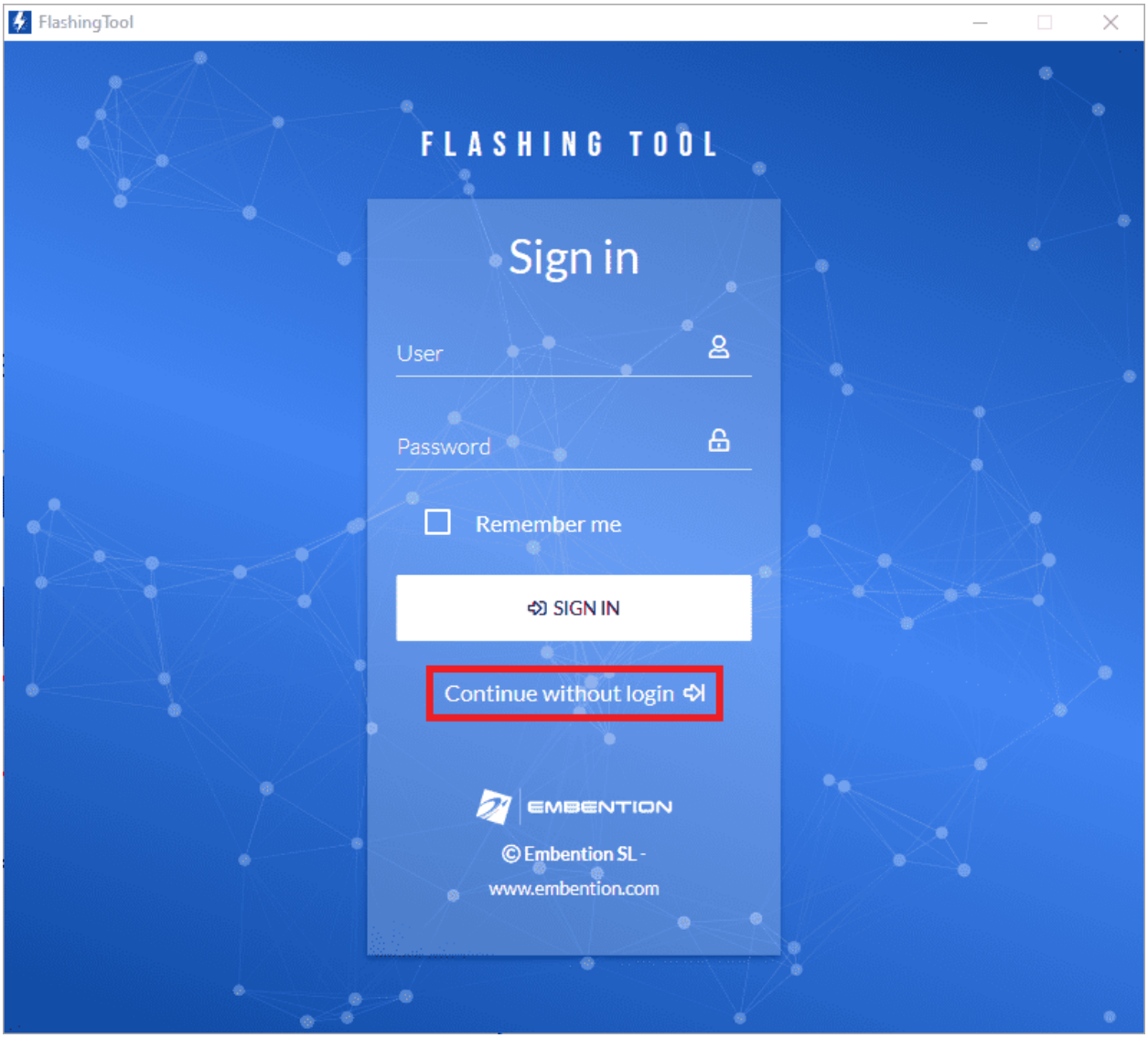


Fig. 3: **Flashing tool - Inital menu**

4. Select the product **MEX**:

Fig. 4: **Flashing tool - Product selection**

5. Select **PRODUCT**, as the flashing method:

Fig. 5: **Flashing tool - Flashing method selection**

Warning: If the JTAG is not connected or if the PC does not recognise it, the following message will appear after selecting PRODUCT:

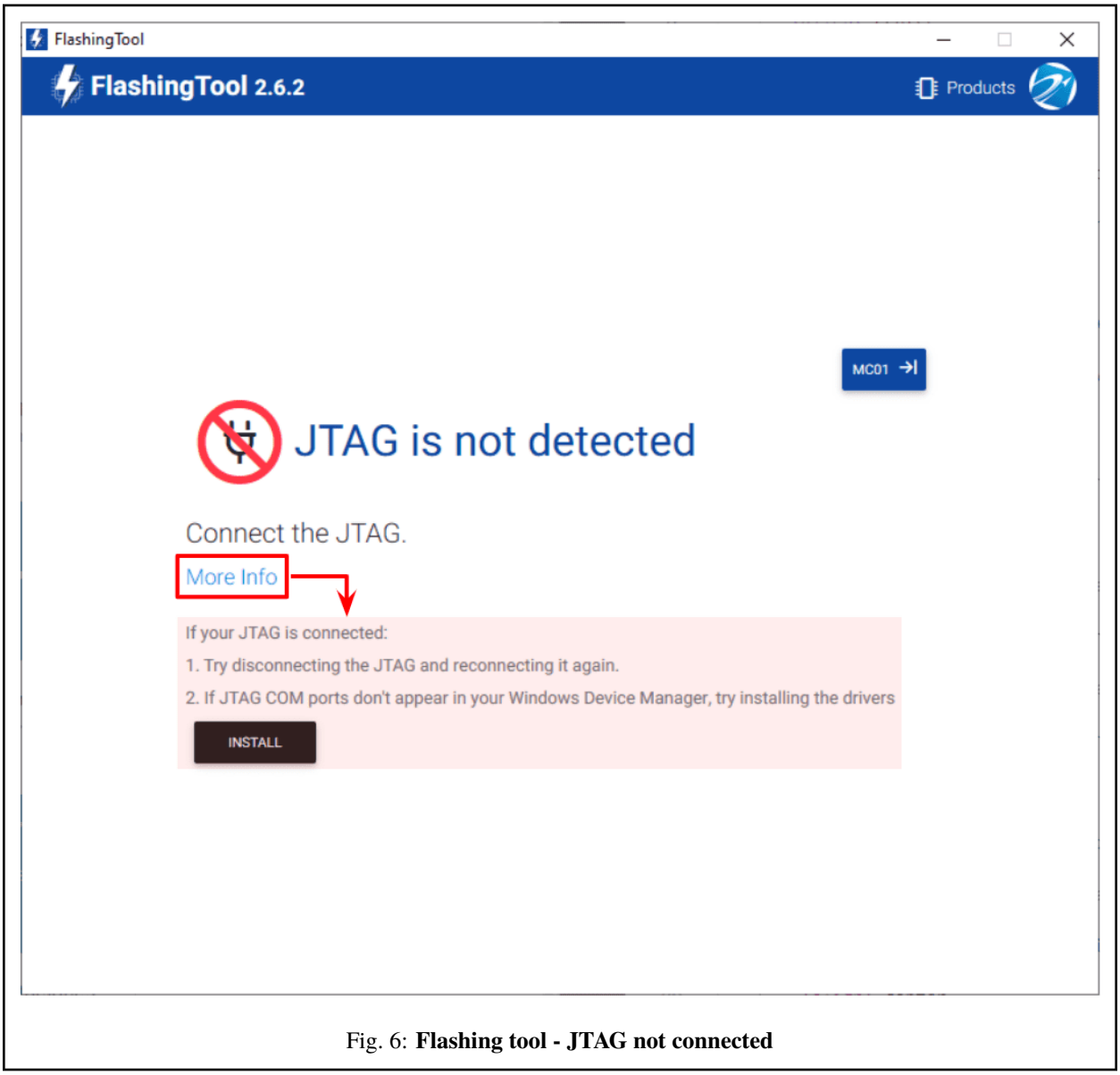


Fig. 6: **Flashing tool - JTAG not connected**

6. Here, select the new firmware file to update the MEX (`.bin` file previously downloaded from the user's Joint Collaboration Framework) and also enter the address of the unit.

Note: **Address = 42000 + S/N**, users can look up the MEX serial number directly in the product.

The MEX address must be in the **range 43000-43999**.

Then, click on '**Flash**':

Fig. 7: **Flashing tool - File and address number**

7. Wait until flashing is complete:

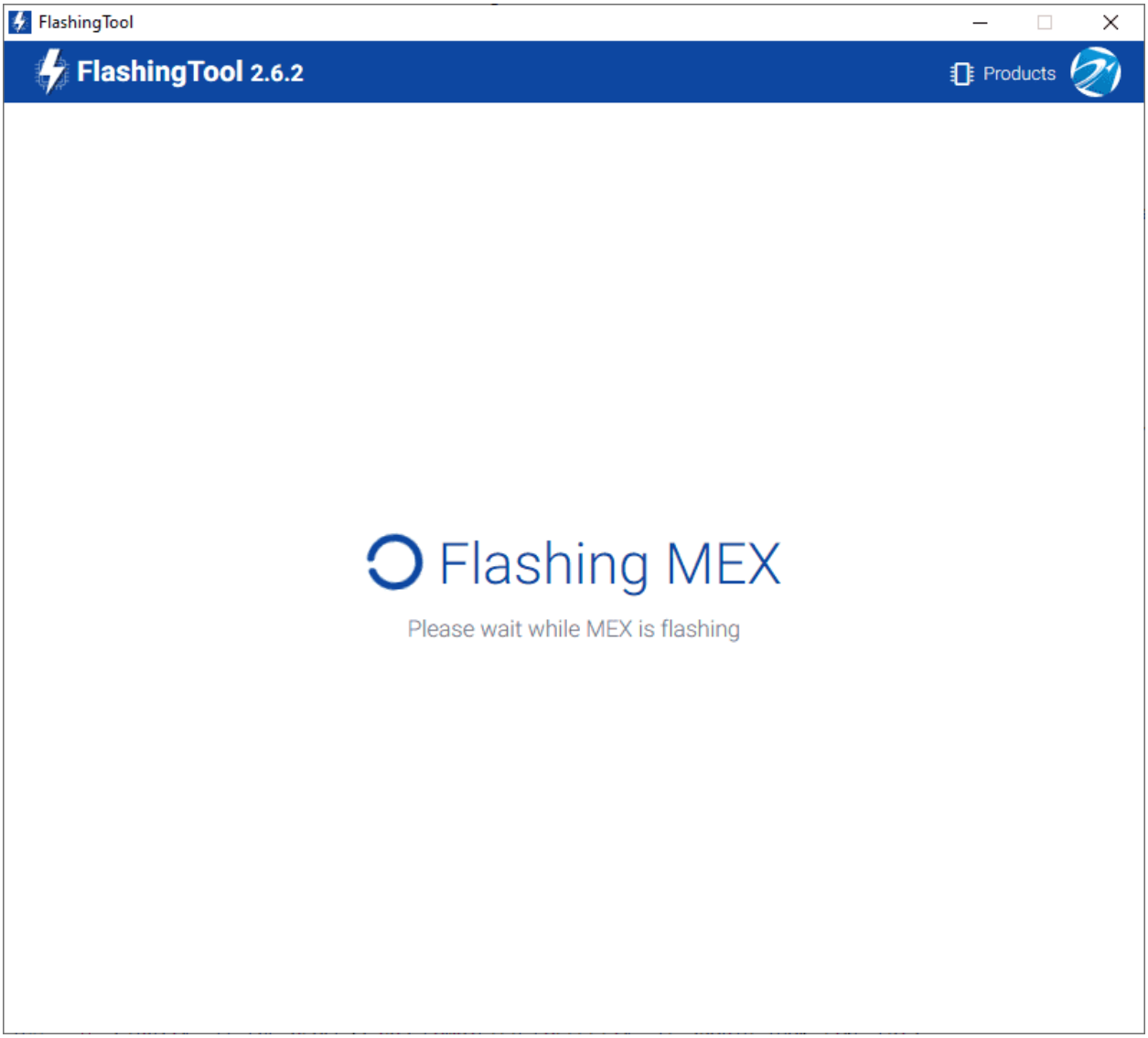


Fig. 8: **Flashing tool - Flashing process**

8. Finally, if the process has completed correctly, it should look like this:

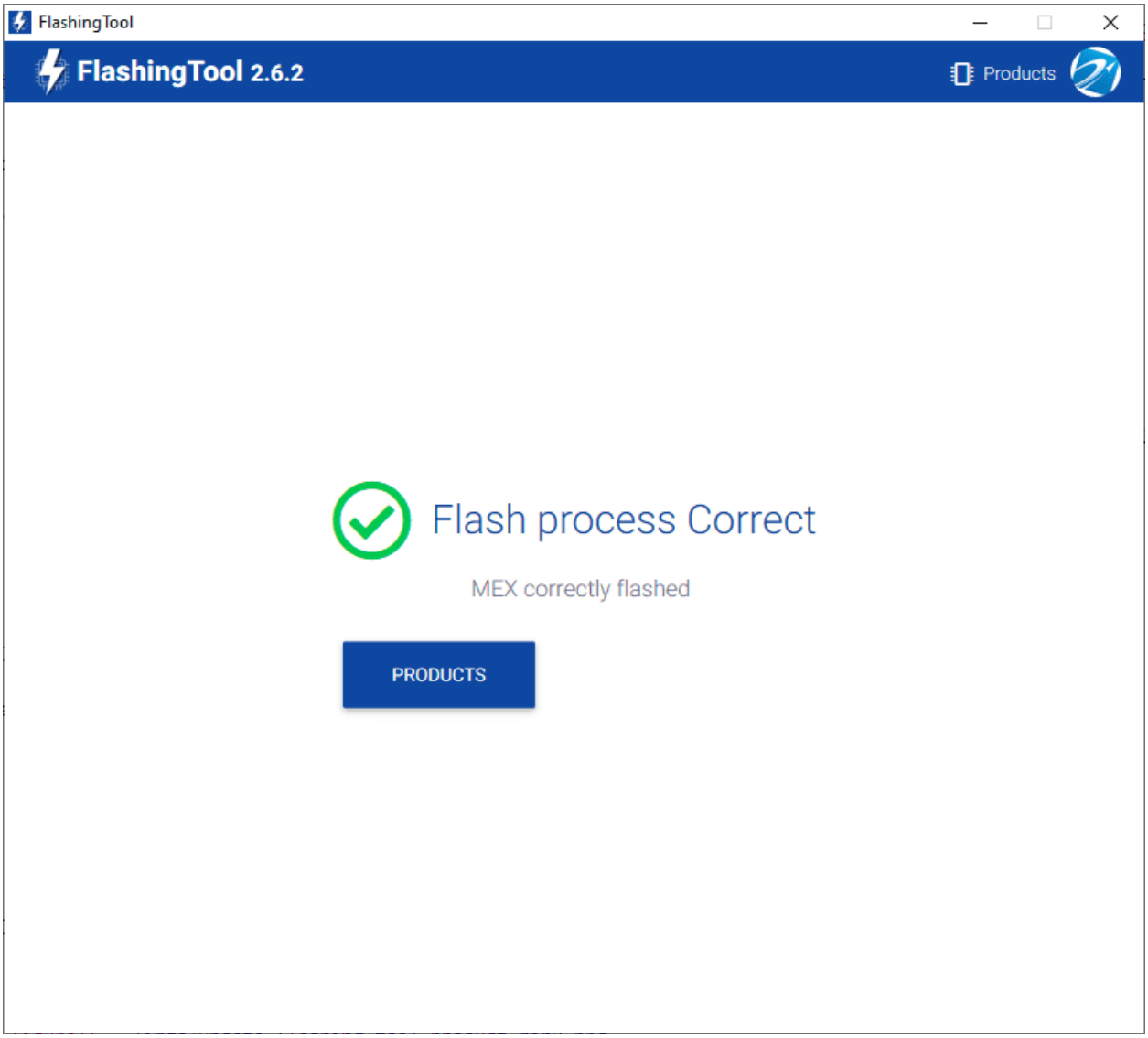


Fig. 9: **Flashing tool - Flashing process correct**

However, if something has gone wrong, the following message appears:

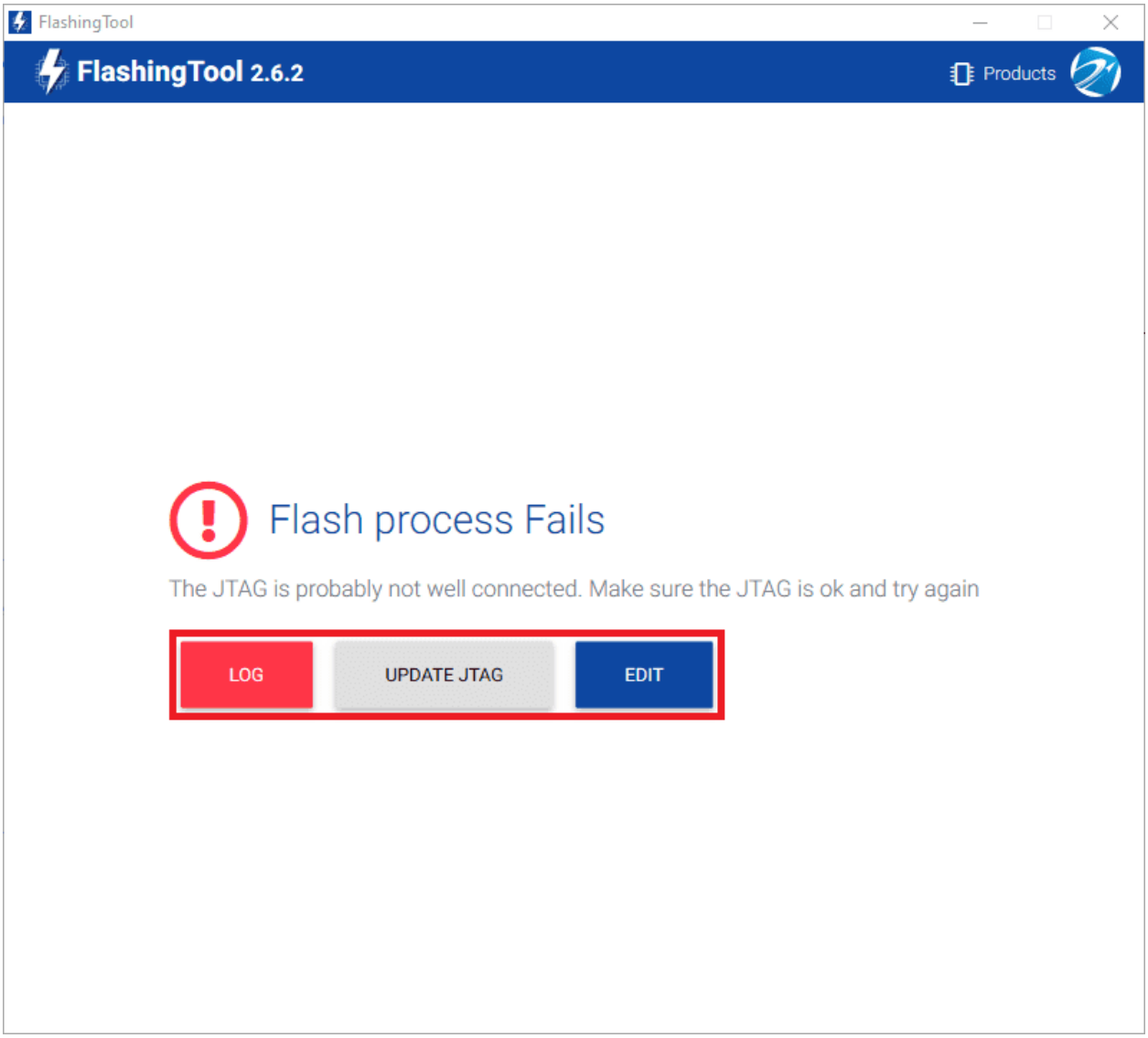


Fig. 10: **Flashing tool - Flashing process fails**

- Re-check the connections, reset MEX unit and try again by pressing '**EDIT**'.
- If this does not solve the problem, it may be necessary to update the JTAG drivers by clicking '**UPDATE JTAG**':

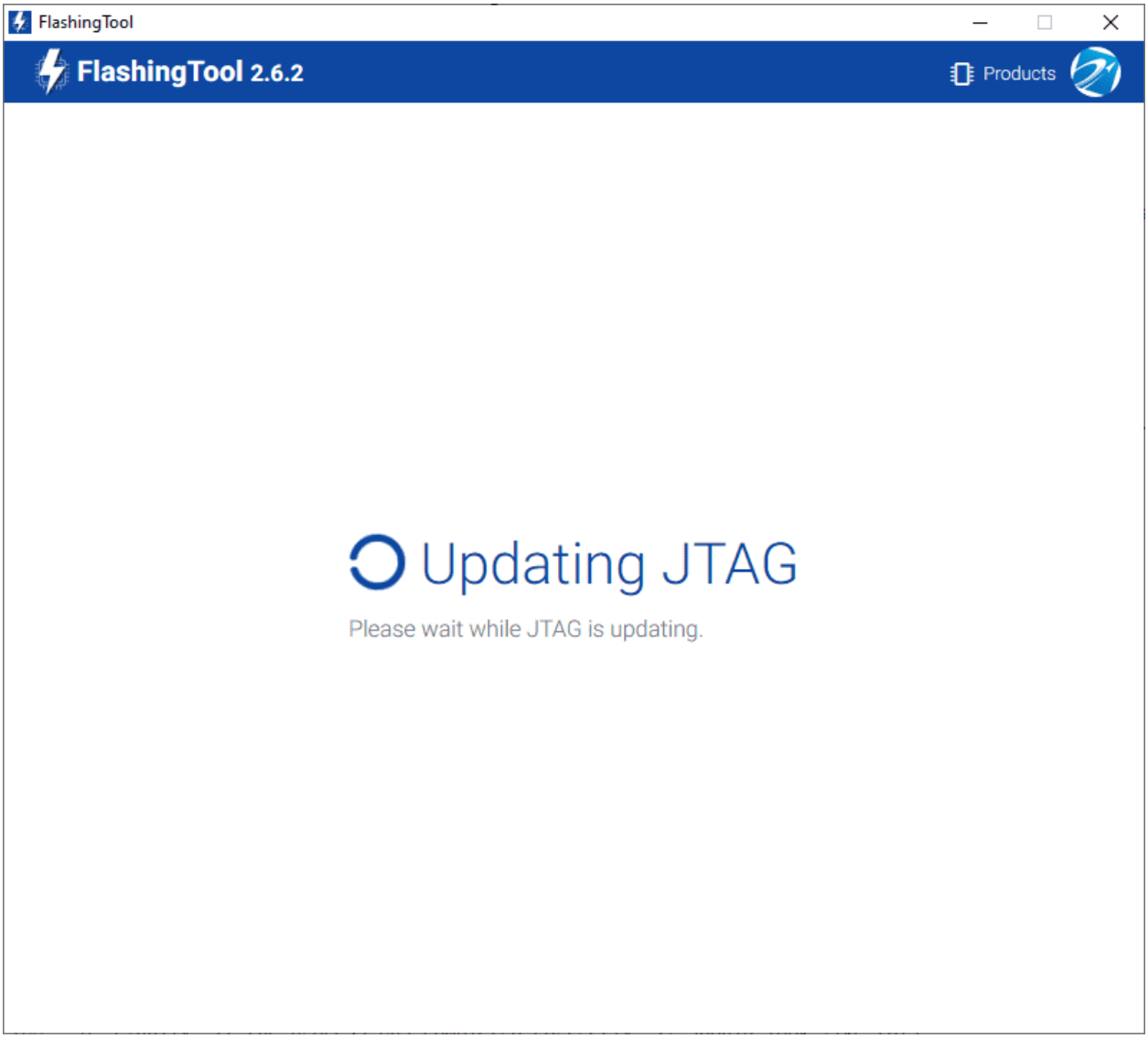


Fig. 11: **Flashing tool - Update JTAG process**

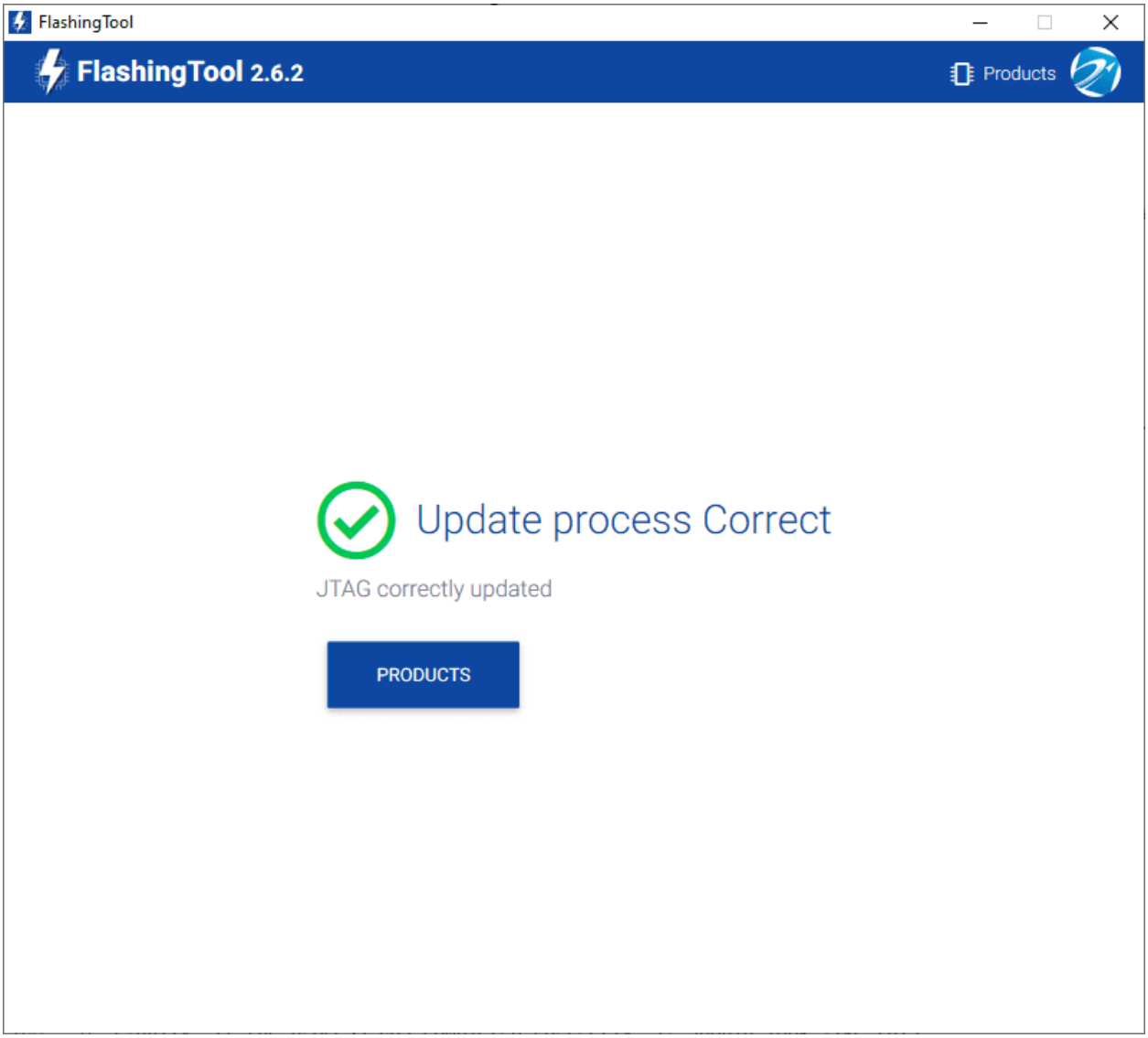


Fig. 12: **Flashing tool - Update JTAG process correct**

- After this, try again to flash the MEX.

  If the failure window still appears, contact support@embention.com and **share the log** displayed by pressing '**LOG**' with the support team:

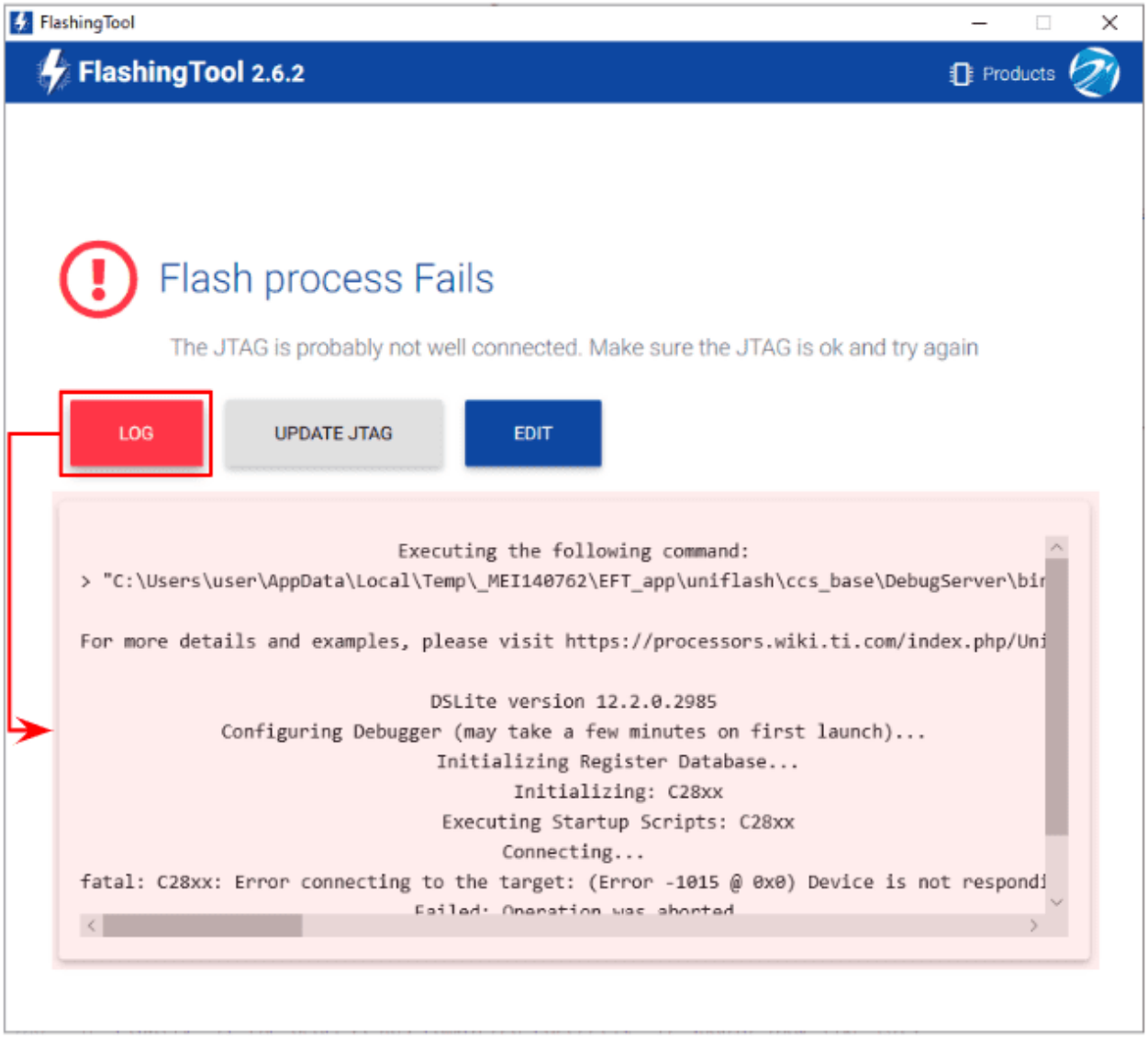


Fig. 13: **Flashing tool - Log**

CHAPTER

SEVEN

INTEGRATION EXAMPLES

Examples of how to set up a configuration for MEX can be seen in Integration examples section of the **MEX PDI Builder** user manual.

7.1 Veronte products

This section explains how to integrate MEX with Veronte products.

7.1.1 Autopilot 1x connection

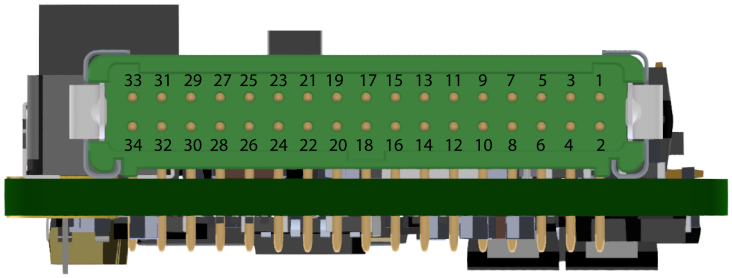


Fig. 1: **Connector for MEX**

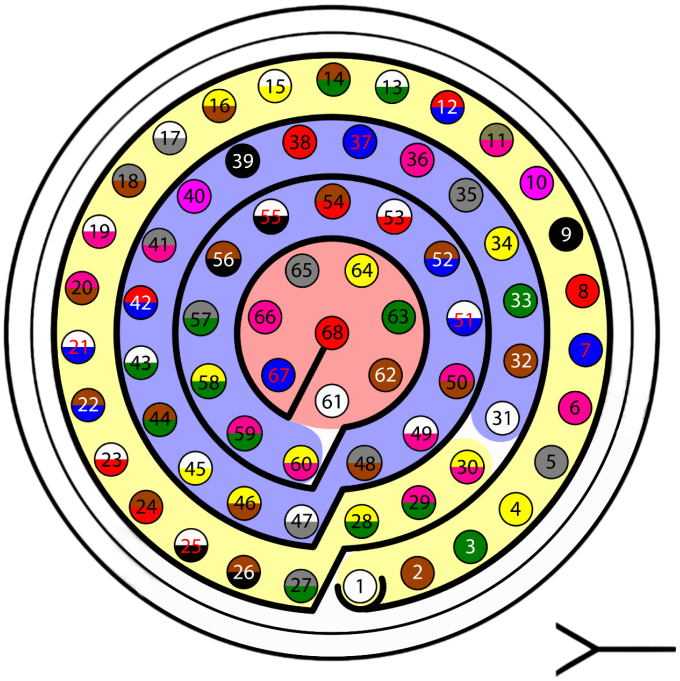


Fig. 2: **Connector for Autopilot 1x - HEW.LM.368.XLNP (frontal view)**

For proper operation, the connection between MEX and Autopilot 1x pins should be like this:

Autopilot 1x			**MEX**	
PIN Nº	**Signal**	**Color**	**PIN Nº**	**Signal**
25	CANA_P	White-Black	22	CAN(A) P
26	CANA_N	Brown-Black	23	CAN(A) N
28	CANB_P	Yellow-Green	20	CAN(B) P
29	CANB_N	Pink-Green	21	CAN(B) N
30	GND	Yellow-Pink	24	CAN GND

Note: If only CAN A or CAN B has been configured in the software for communications, only the corresponding pins must be connected.

Important: Integration is also possible by connecting CAN A of the Autopilot 1x to CAN B of the MEX and vice versa, i.e. it does not necessarily have to be CAN A-CAN A or CAN B-CAN B.

However, any connections made must be **consistent** with the **configuration** made at software level in 1x PDI Builder and MEX PDI Builder.

CHAPTER

EIGHT

TROUBLESHOOTING

If a mistake was made when building the configuration and the communication with the device has been lost, it is possible to force the device to boot into maintenance mode in order to modify its configuration.

For forcing Maintenance mode, create a loopback on both I2C pins (I2C SCL and I2C SDA signals). When powered, MEX will boot in maintenance mode.

CHAPTER

NINE

ACRONYMS AND DEFINITIONS

BEC	Battery Eliminating Circuit
CAN	Controller Area Network
COM	COMmunications
DC	Direct Current
EQEP	Enhanced Quadrature Encoder Pulse sensor
ESC	Electronic Speed Control
ESD	ElectroStatic Discharge
GND	Electrical ground
GPIO	General Purpose Input/Output
I/O	Input/Output
JTAG	Joint Test Action Group
Mbps	Megabits Per Second
MPU	Micro-Processor Unit
nT	NanoTesla
OEM	Original Equipment Manufacturer
PC	Personal Computer
PCB	Printed Circuit Board
PPM	Pulse Position Modulation
PWM	Pulse Width Modulated signal
RPM	Revolutions Per Minute
RS-232	Recommended Standard 232
RS-485	Recommended Standard 485
SCI	Serial Communications Interface
SDA	Serial DAta line
SN	Serial Number
SW	Software
UART	Universal Asynchronous Receiver Transmitter
VCP	Virtual Communication Portv

CHAPTER

TEN

CONTACT DATA

You can contact Embention in any moment if you need further help and support.

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