MC01 Hardware Manual

Release 1.0

Embention

2024-06-12

CONTENTS


MC01S
VERONTE
MOTOR CONTROLLERS


MC01B
VERONTE
MOTOR CONTROLLERS

CHAPTER

ONE

INTRODUCTION

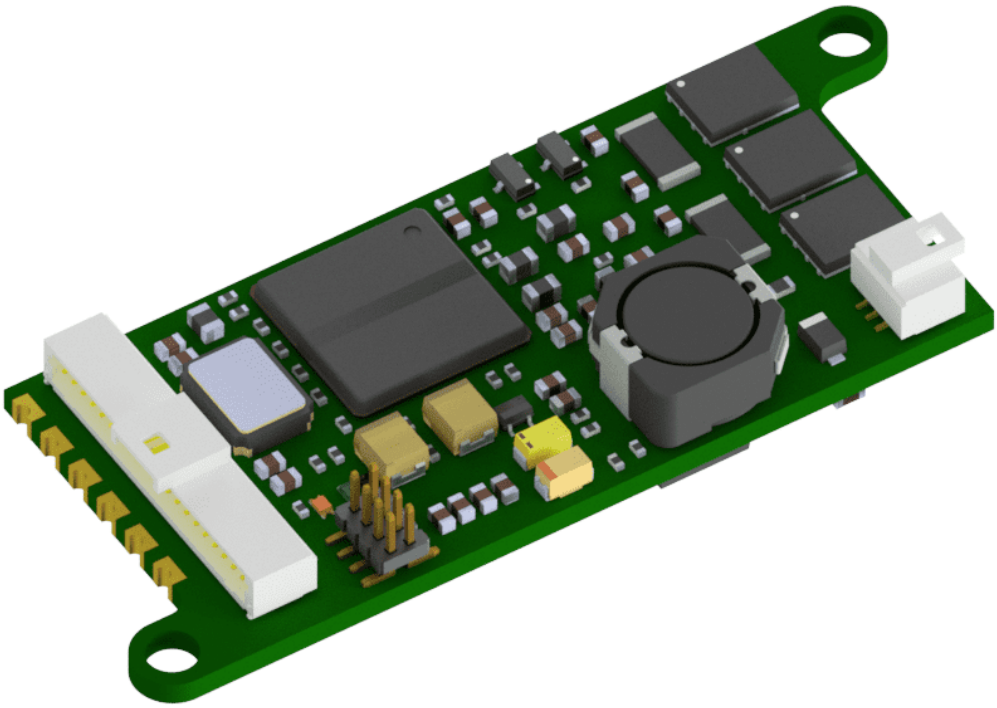


Fig. 1: **Veronte MC01**

Veronte MC01 is a PWM, CAN or I2C-controlled ESC for critical actuator control. With built-in control mechanisms it tracks motor position by reading encoders. The MC01 can control non-critical motors with instruction received from a Veronte Autopilot.

It can be configured for receiving position or speed commands. Embedded PID control algorithms manages motor position as an absolute value or relative to a gyroscope.

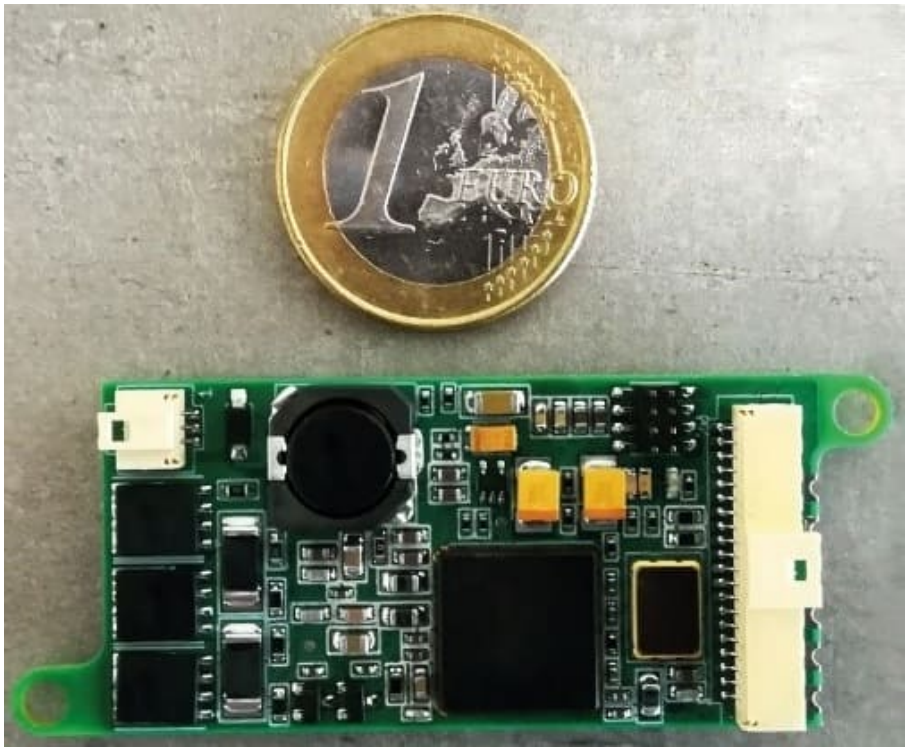


Fig. 2: **Veronte MC01 size comparison**

1.1 Applications

- Precise steering
- Payload control
- Wiring optimization
- Gimbal control

1.2 Vehicles

- Large aircrafts
- High speed UAVs

CHAPTER

TWO

QUICK START

2.1 First steps

The MC01 is connected to Veronte Autopilot, a battery and a motor according to the following diagram:

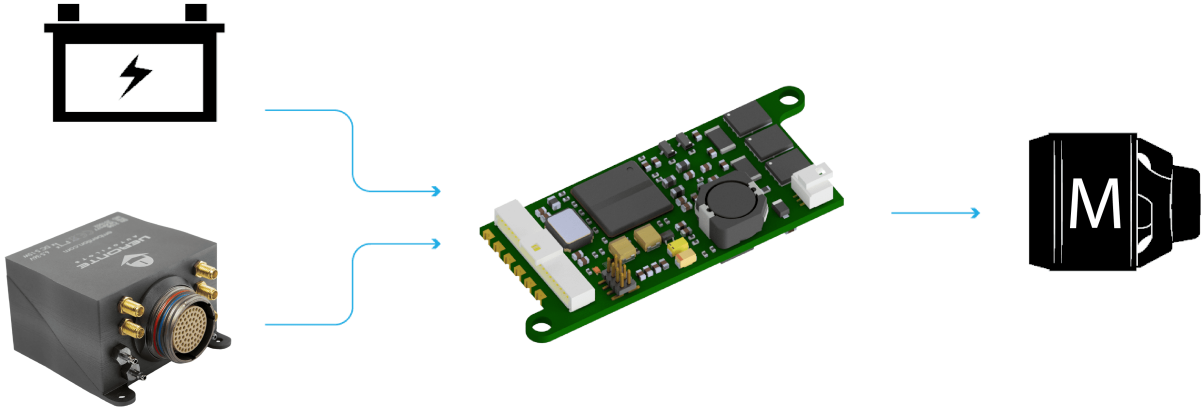


Fig. 1: **General diagram**

To obtain more details about electrical connections, read the *Pinout/Connections* section.

Software installation and configuration is explained in the *Software Installation* section.

2.2 Warnings

The MC01 brushless variant has stablished a maximum intensity, which can be configurated in the Heartbeat and intensity limit section in the MC01B PDI Builder manual. In case of overpassing the Maximum intensity during the stablished period, the MC01 will whut down. **Do not** use the MC01 to control critical motors, for example to produce propulsion or lift forces.

2.3 Requirements

To use the Veronte MC01, the following items are required at least:

- SPI enconder in the motor (from -12 to 12V).
- Power supply (up to 24 V DC and 3 A).
- One of the following interfaces to control the motor speed:
  - PWM
  - CAN
  - I2C
- A 120 Ω resistor.
- A Veronte Autopilot.

CHAPTER

THREE

TECHNICAL

3.1 Variants

Veronte MC01 has to variants or versions. Both have the same hardware, nonetheless the software is different.

- **MC01B - Brushless variant**: for brushless motors.
- **MC01S - Stepper variant**: for stepper motors.

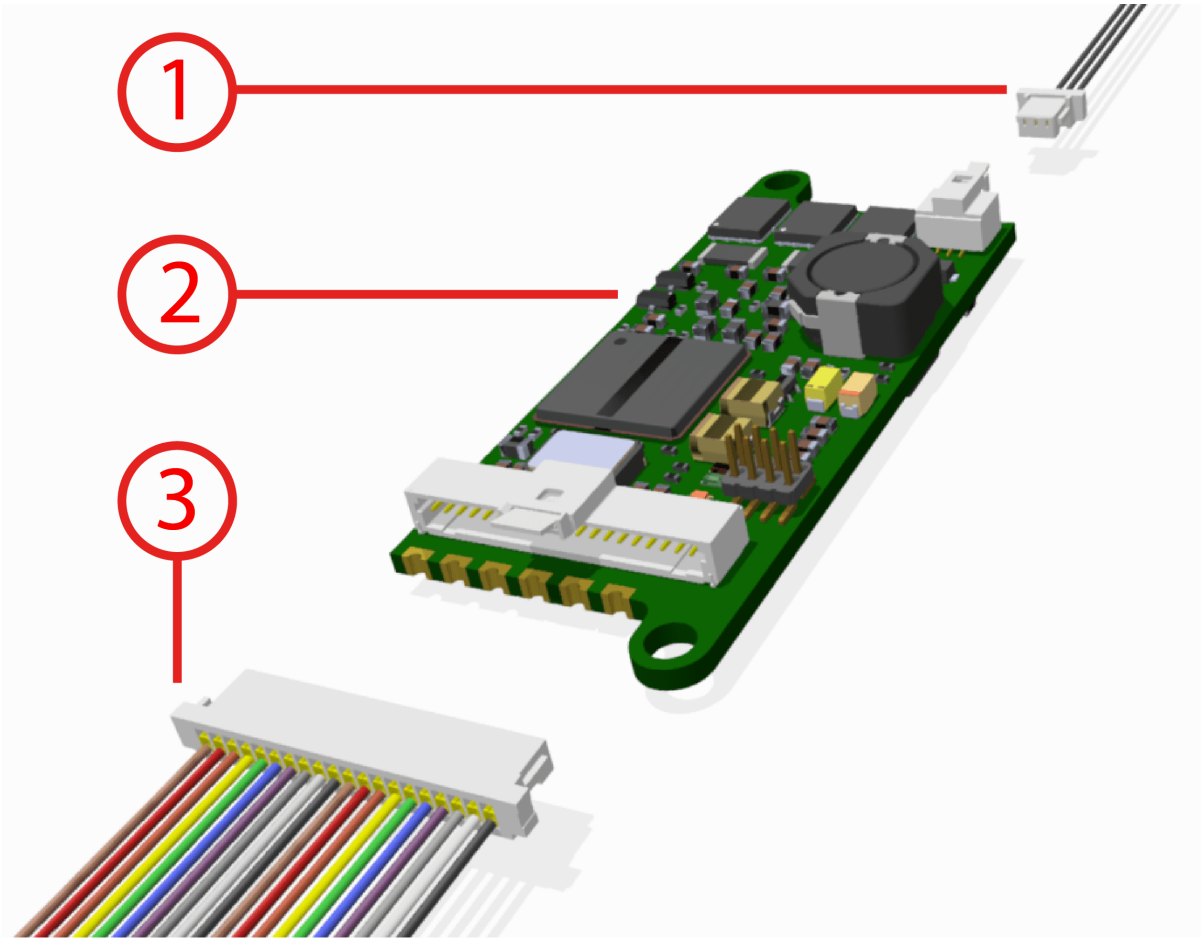
3.2 General features

- **Compact design**
- **Lightweight**
- **Low energy consumption**
- **Very quick reaction**
- **Support for encoders**
- **Gyro-stabilisation**
- **Control algorithm**: Proportional Integral Derivative (configurable gains)
- **Dimensions**: 60x25x15mm
- **Weight**: 10g
- **Redundant Isolated CAN Expansion**
  - 2x CAN for critical actuators - two wires each one
  - No power wires required (optional)
- **Auxiliary Power Outputs**
  - 1x 5V DC
  - 1x 3.3V DC
- **Embedded Sensors**
  - Input voltage
  - Board temperature
- **Communication buses**
  - 1x CAN

  - 1x I2C

- **Input / Output**
  - 4x GPIO (on/off)
  - 2x PWM / ECAP
- **Supported encoders**
  - SPI Differential
  - SPI
  - Digital (ECAP and EQEP)

3.3 Part List



Number	Description	Commercial reference
1	Connector with 3 pins	S1SS-03-28-GF-07_00-L
2	Veronte MC01 controller	
3	Connector with 20 pins	S1SS-20-28C-GF-11_00-L

3.4 Dimensions

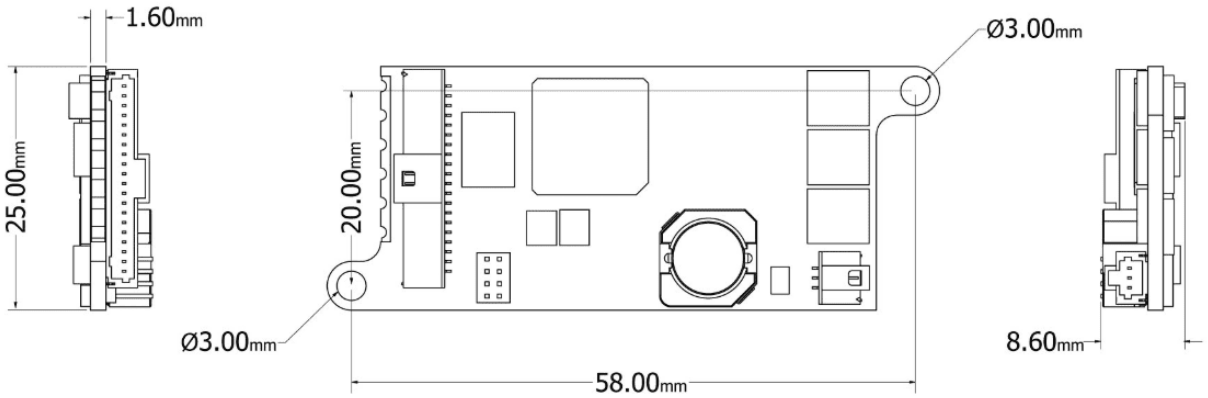


Fig. 1: **Veronte MC01 board dimensions**

3.5 Electrical specifications

- **Motor**
  - Voltage: same as input. 3-phase brushless interface.
- **EQEP encoder**
  - 32-bit QEP channels.
- **PWM/ECAP**
  - Maximum voltage: 3.3V.
  - Maximum input current: 2.5 mA.
  - Sampling rate: up to 1 micro s.
- **Auxiliary 3.3V output**
  - Non-protected output - Light loads.
- **Auxiliary 5V output**
  - Non-protected output - Light loads.
- **CAN**
  - Complies with standards.
  - Non-Isolated.
  - Speed up to 1 Mbps.
- **I2C**
  - 3.3V Signals up to 400 KHz.
- **Power Input**
  - Vmax = 24V DC.

  - IMax: 3A. Depends on the motor.
  - Inom: 0.3A (motor not working).
  - Typical Input Current: 1.5A.
- **SPI encoder**
  - Maximum and minimum voltage: +12 to -12V.
- **Addon for isolated CAN transceivers - New board soldered**.

3.6 Interfaces

The only connections required are the connectors shown in the *Part List section*.

CHAPTER

FOUR

HARDWARE INSTALLATION

4.1 Assembly

Two M3 screws are recommended to assemble mechanically the MC01 to a frame. Its fixation holes do not have thread, then it is necessary to use more than 2mm as thread depth.

4.2 Pinout/Connections

4.2.1 20 Pin Connector

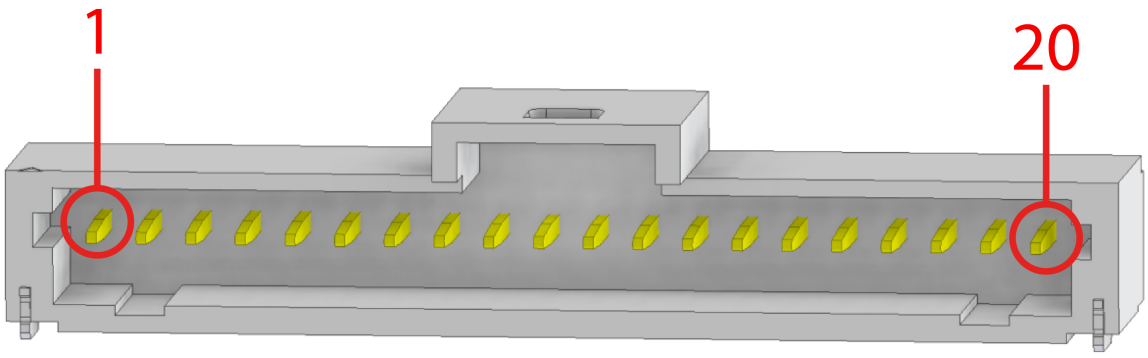


Fig. 1: **Allocation pin numbers**

Number	Colour	Inputs	Use
1	Brown	EQEP1L	EQEP Encoder
2	Red	EQEP1S	EQEP Encoder
3	Orange	EQEP1B	EQEP Encoder
4	Yellow	PWM1/ECAP	PWM/ECAP
5	Green	EQEP1A	EQEP Encoder
6	Blue	3.3V	Output Power
7	Purple	PWM2/ECAP	PWM/ECAP
8	Gray	CAN (N)	CAN negative
9	White	CAN (P)	CAN positive
10	Black	GND	Ground
11	Brown	SDA	I2C
12	Red	SCL	I2C
13	Orange	INPUT POWER	Voltage supply
14	Yellow	5V	Output Power
15	Green	MISO+	SPI Encoder
16	Blue	MISO-	SPI Encoder
17	Purple	CLK-	SPI Encoder
18	Gray	CLK+	SPI Encoder

The encoder information is received as a differential signal between MISO+ and MISO-, with a differential clock signal between CLK+ and CLK-.

4.2.2 3 Pin Output Connector

The 3 pin connector has the power outputs for motor power supply, each pin corresponds to a phase (A, B and C).

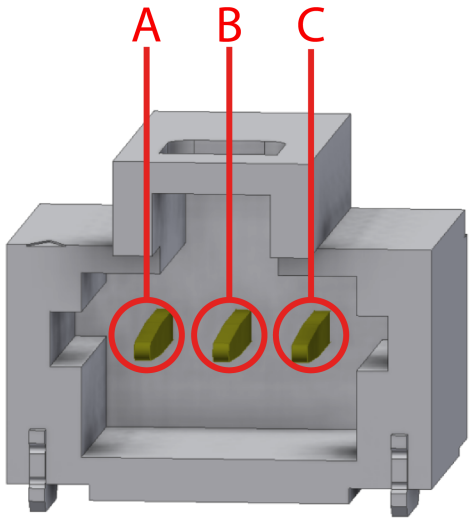


Fig. 2: **Allocation pin phases**

4.3 CAN Assembly

A 120 Ohm resistor is required to connect via CAN a MC01 With a Veronte Autopilot. The following figure describes how to assembe the CAN connection with more devices.

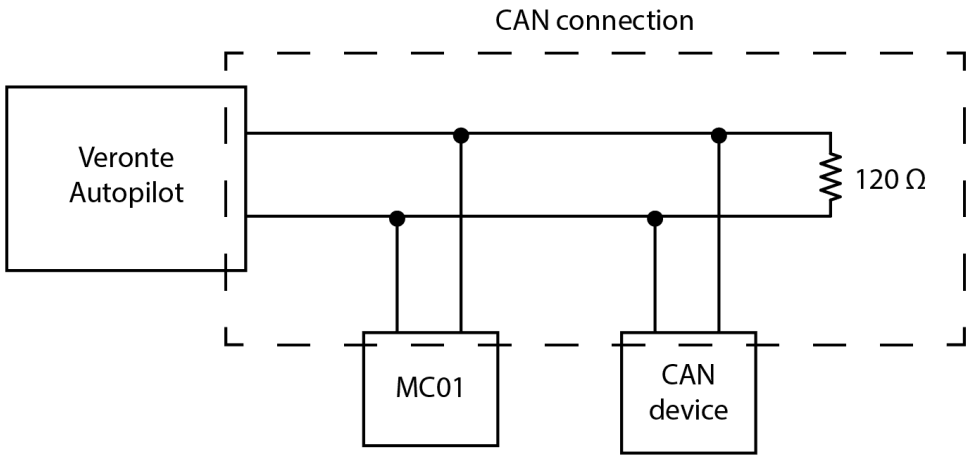


Fig. 3: **CAN circuit**

CHAPTER

FIVE

SOFTWARE INSTALLATION

MC01 is configured with a computer via CAN. Since there is normally no direct connection to a PC via CAN, an **Autopilot 1x** is used as a tunnel to connect via CAN to the MC01 and via USB, RS-232 or RS-485 to the PC.

To configure a **Veronte device** (CEX, MEX, 1x or 4x) and control the **MC01**, use its respective PDI Builder. An example can be found in the MC01 - Integration examples section of the **1x PDI Builder** user manual.

The physical connections can be summarized with the following diagrams (including power supply):

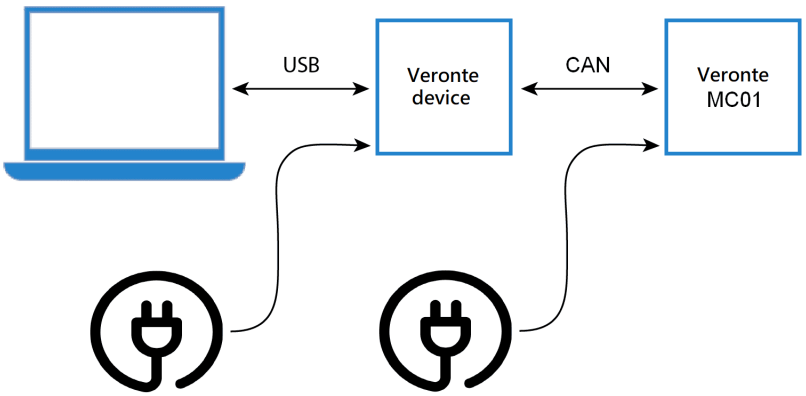


Fig. 1: **USB connection**

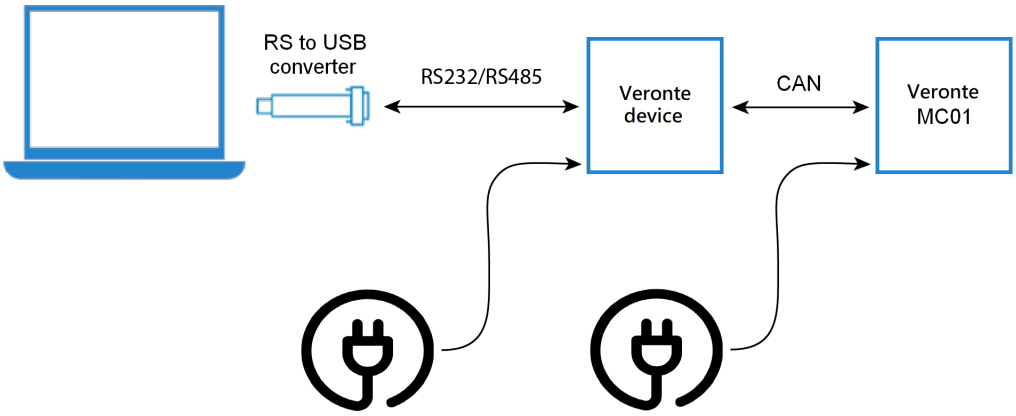


Fig. 2: **Serial connection**

To install the required software and configure **Veronte MC01**, read the MC01 Software Manual.

CHAPTER

SIX

MAINTENANCE

Apart from cleaning, no extra maintenance is required to guarantee the correct operation of the MC01.

In order to clean MC01 properly follow the next recommendations:

- Turn off the device before cleaning.
- Use a clean, soft and dry cloth to clean carefully the unit.
- Do not immerse the unit in water to clean it.

6.1 Software update

In order to update a MC01B/S unit, it is necessary to **re-flash the board**.

The following items will be needed to update Veronte MC01 software:

- **JTAG Probe**
- *Embention Flashing Tool Software*: If the user does not have this tool, please contact support@embention.com and the support team will share it through the **Joint Collaboration Framework**.

  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 MC01B/S unit:

1. Connect the PC and the MC01B/S unit via the JTAG probe:

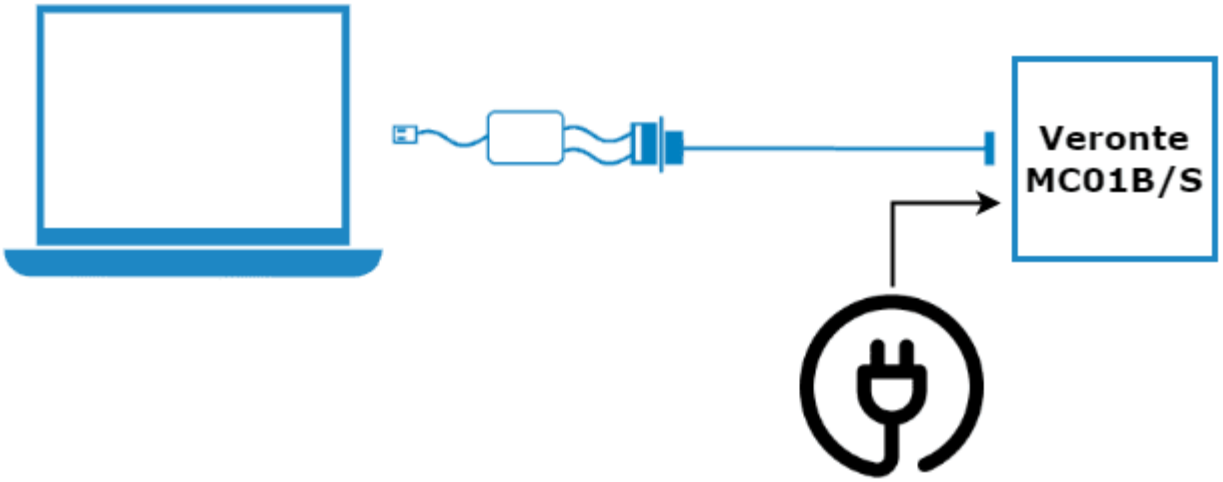


Fig. 1: **PC - MC01B/S connection**

2. On the MC01B/S, connect the JTAG to the 8 pin connector on top of the board. Pin nº 1 is indicated with a white dot:

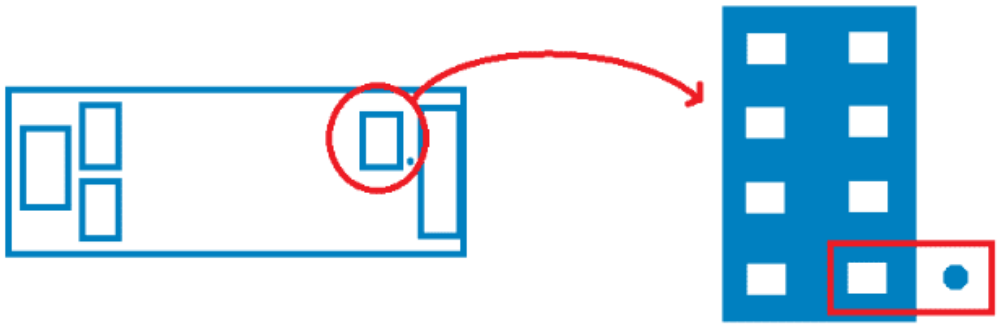


Fig. 2: **JTAG connection**

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

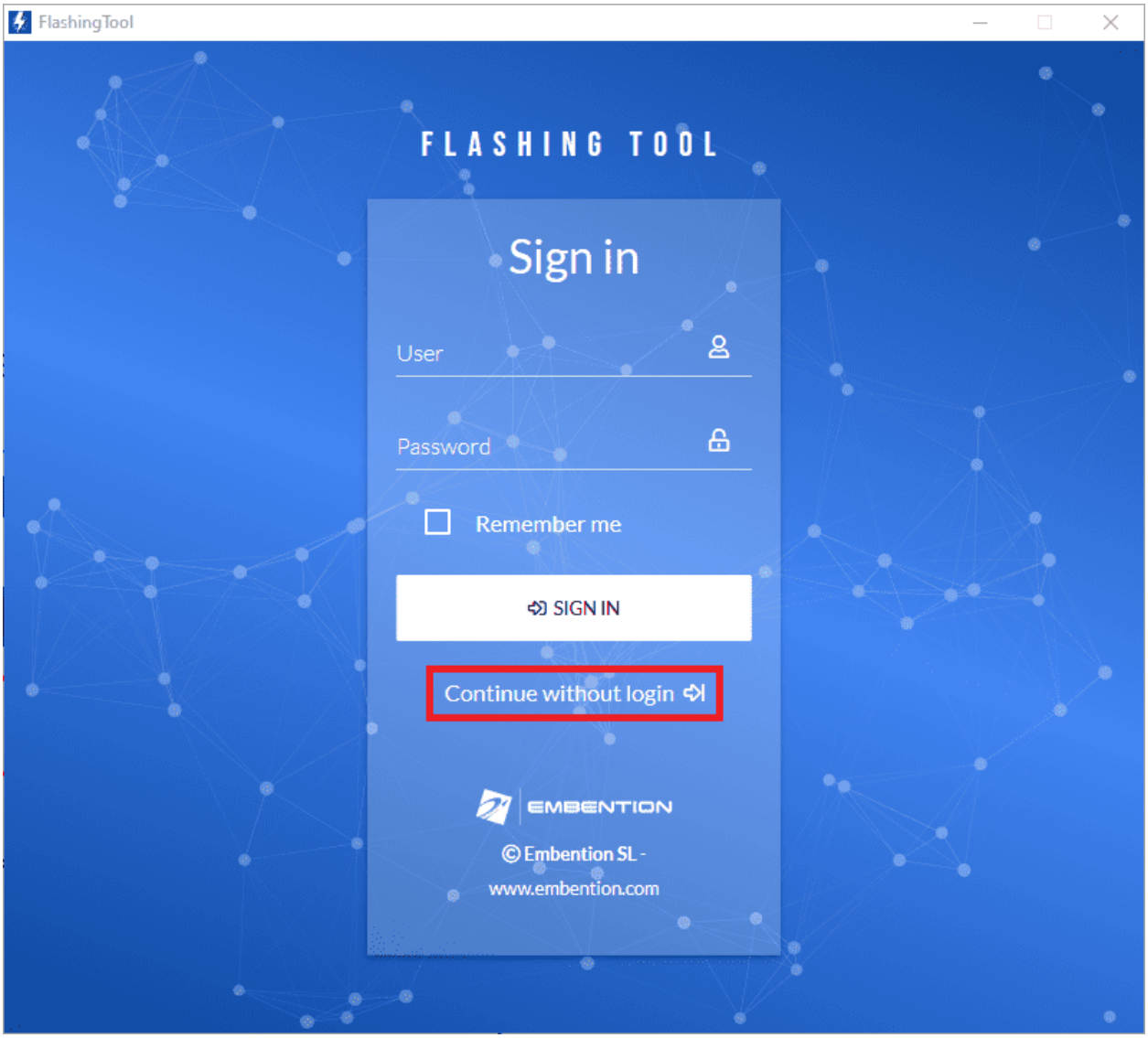


Fig. 3: **Flashing tool - Inital menu**

4. Select the product **MC01** or **MC01_Stepper**:

Note: MC01 for MC01B product, and MC01_Stepper for MC01S product.

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

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

Note: Although in this example the MC01 has been selected, the procedure is the same for the MC01_Stepper.

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:

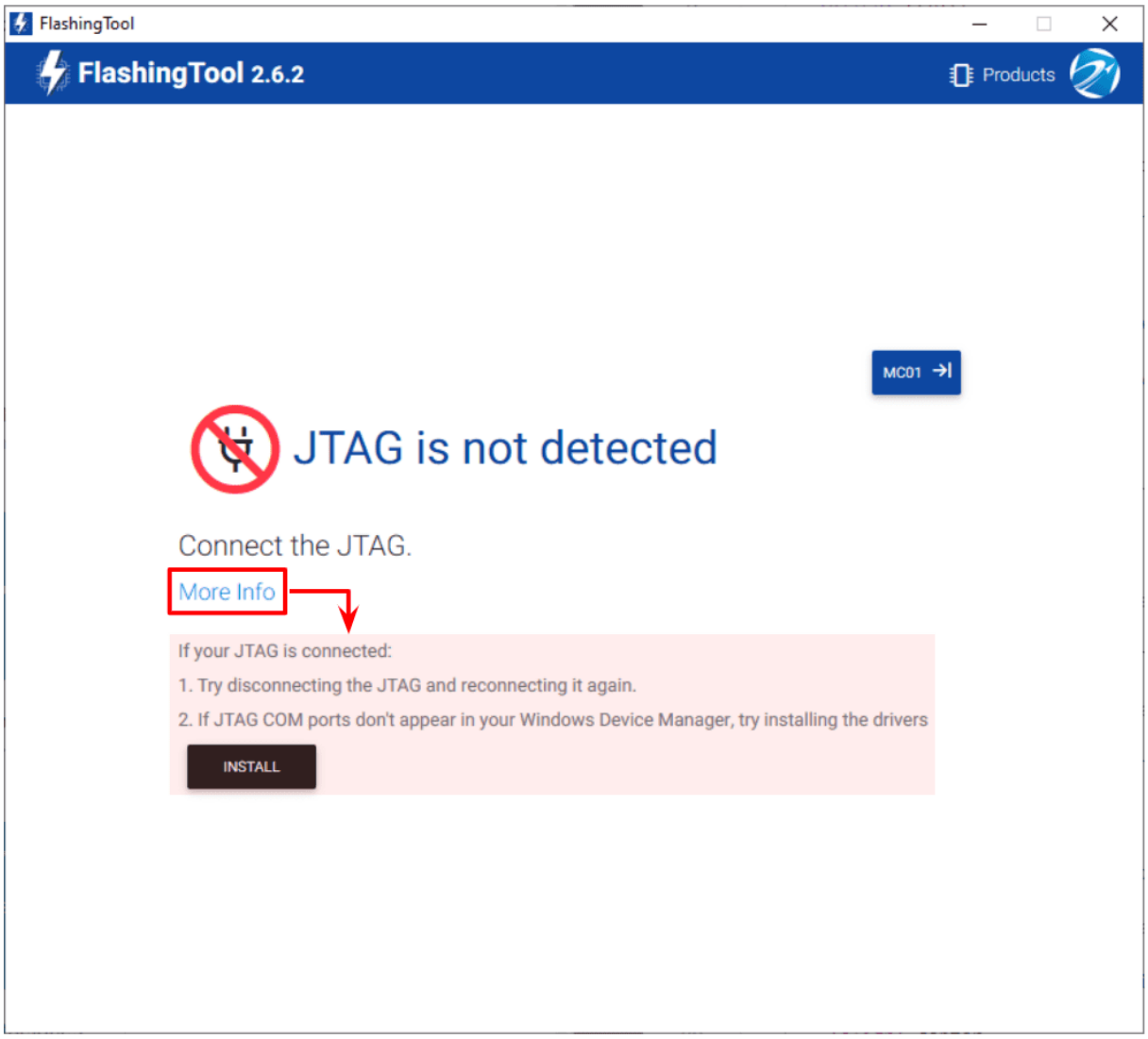


Fig. 6: **Flashing tool - JTAG not connected**

6. Here, select the new firmware file to update the MC01B/S (`.bin` file previously downloaded from the user's Joint Collaboration Framework) and also enter the address of the unit.

Note: **Address = 30000 + S/N**, users can look up the MC01B/S serial number directly in the product.

The MC01B/S address must be in the **range 30100-31999**.

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

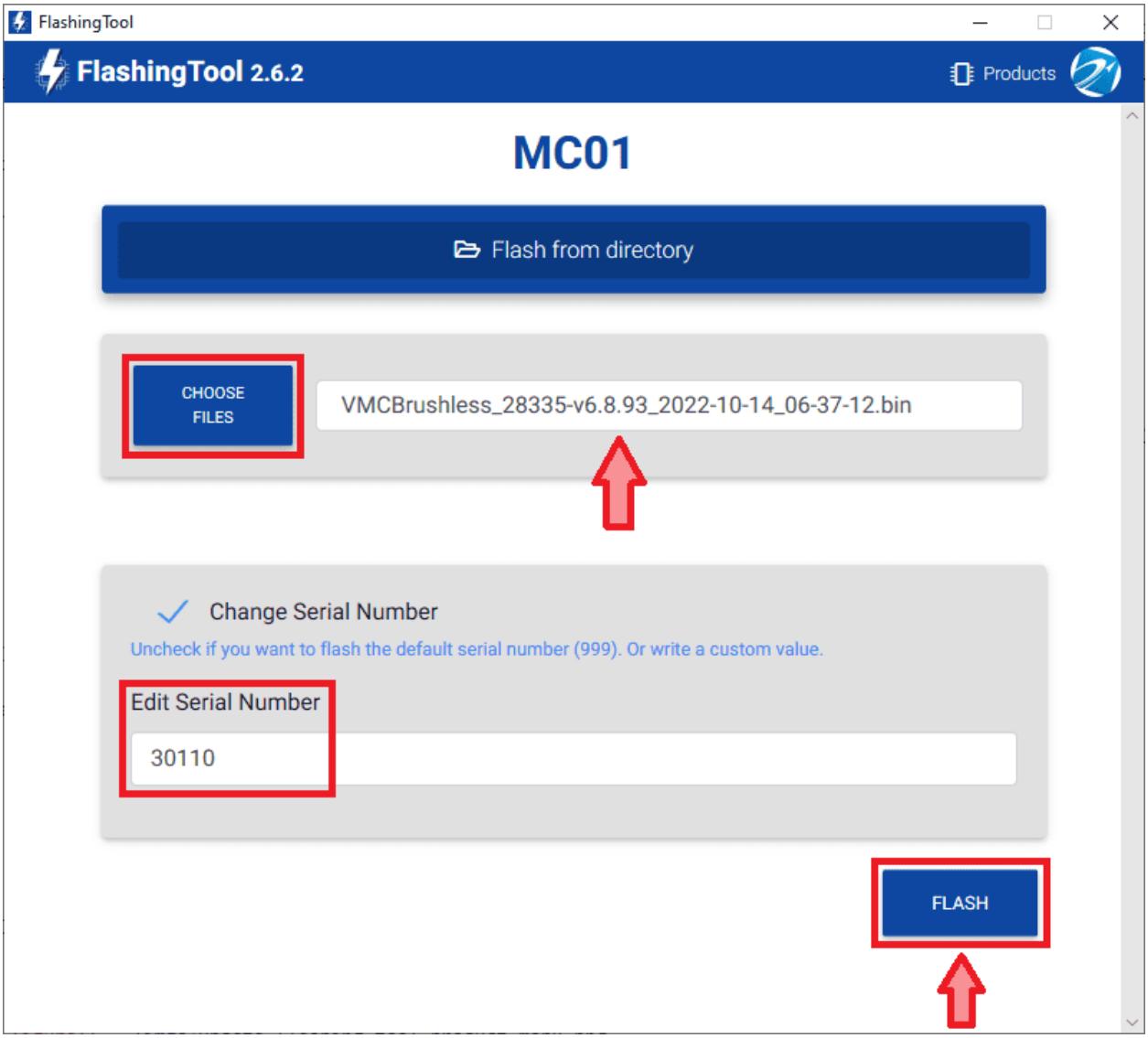


Fig. 7: **Flashing tool - File and address number**

7. Wait until flashing is complete:

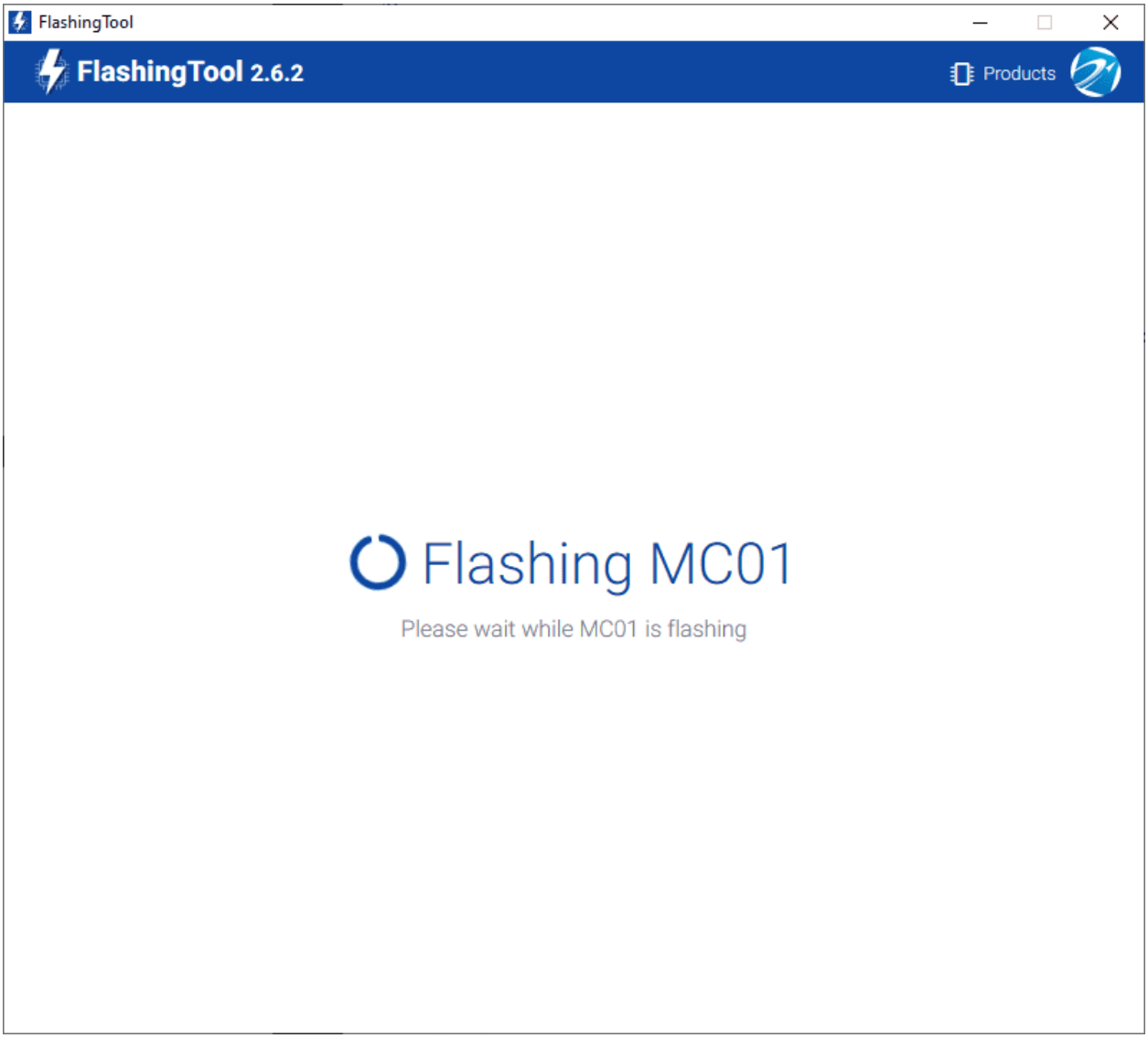


Fig. 8: **Flashing tool - Flashing process**

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

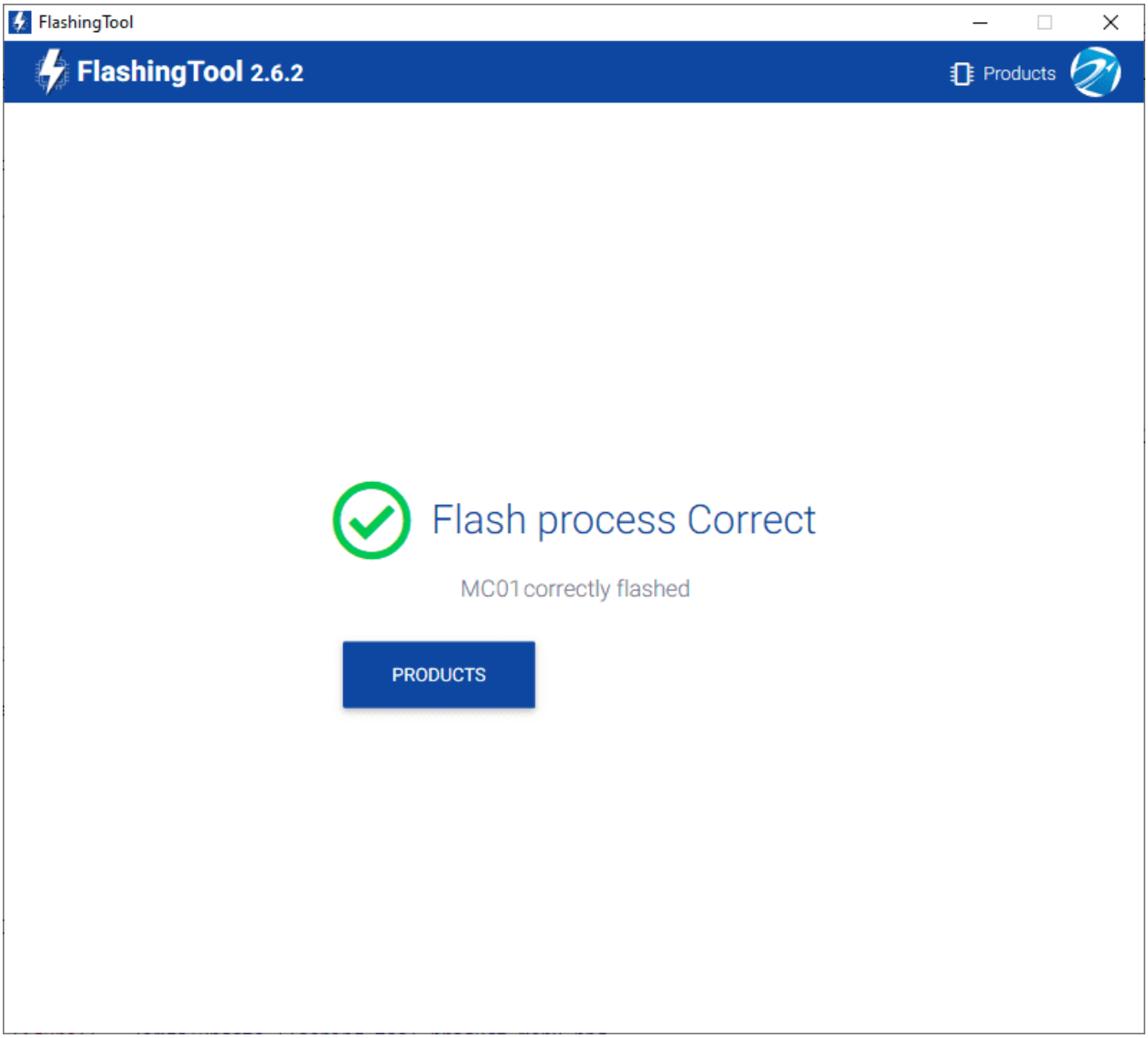


Fig. 9: **Flashing tool - Flashing process correct**

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

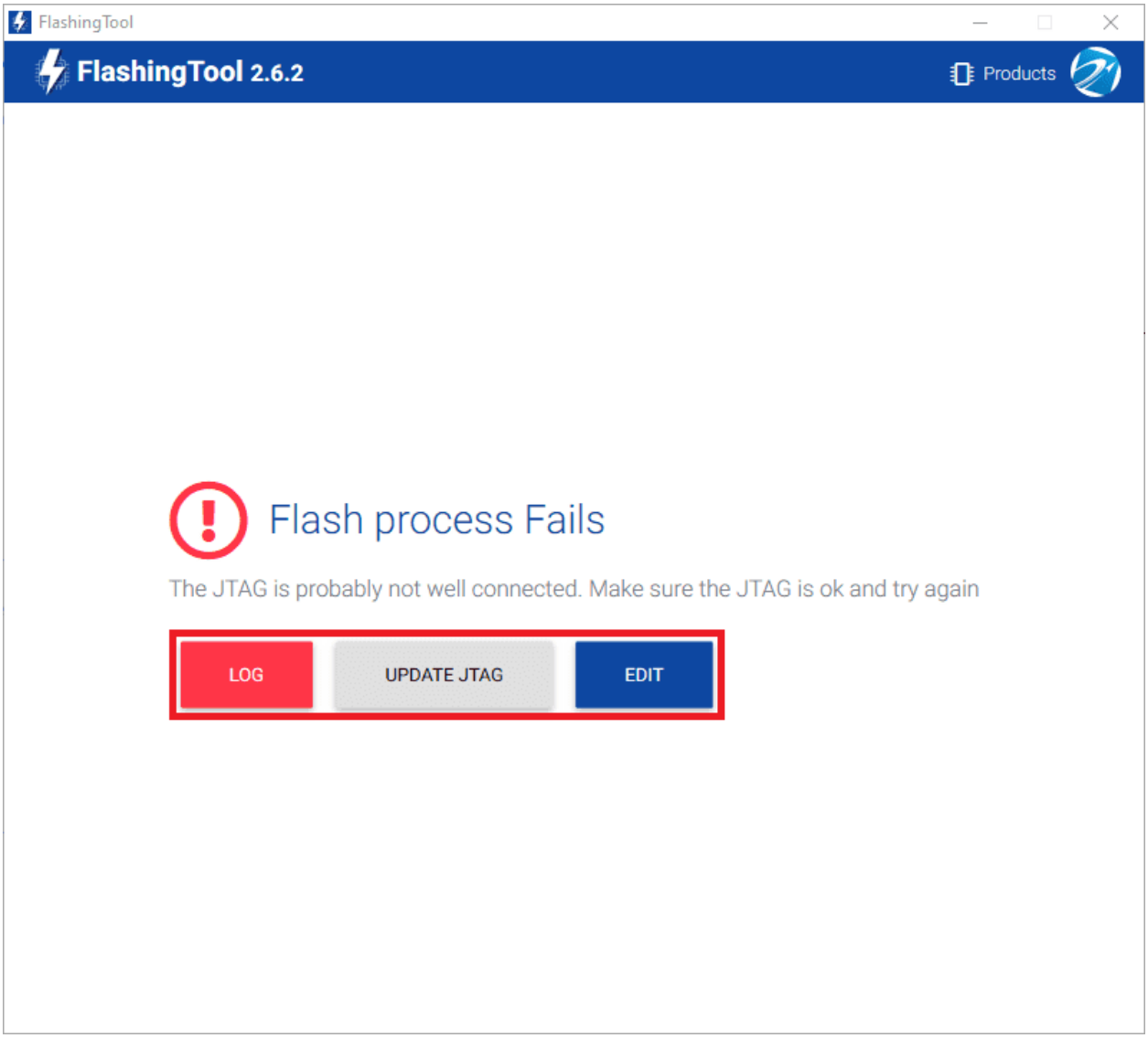


Fig. 10: **Flashing tool - Flashing process fails**

- Re-check the connections, reset MC01B/S 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**':

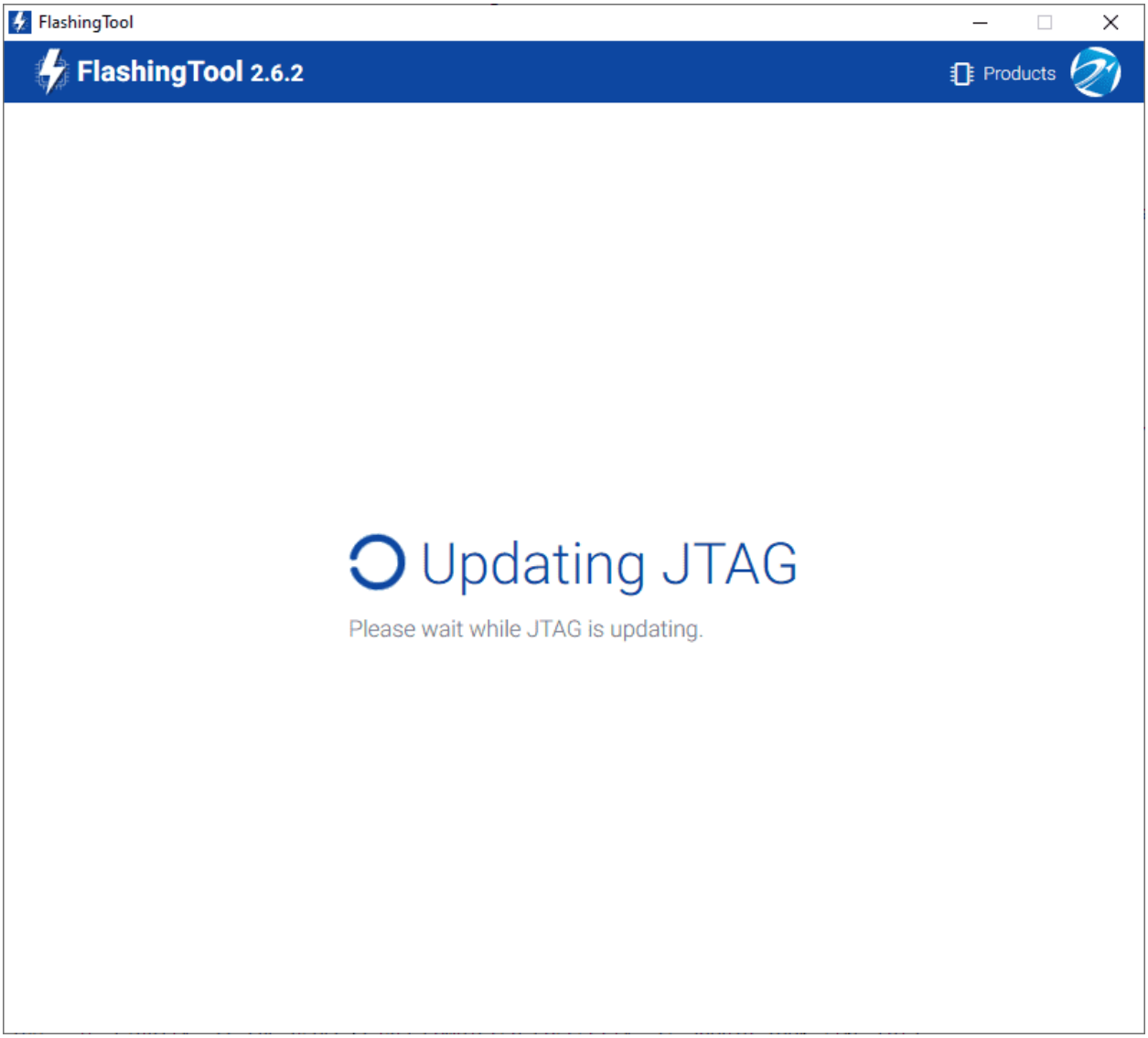


Fig. 11: **Flashing tool - Update JTAG process**

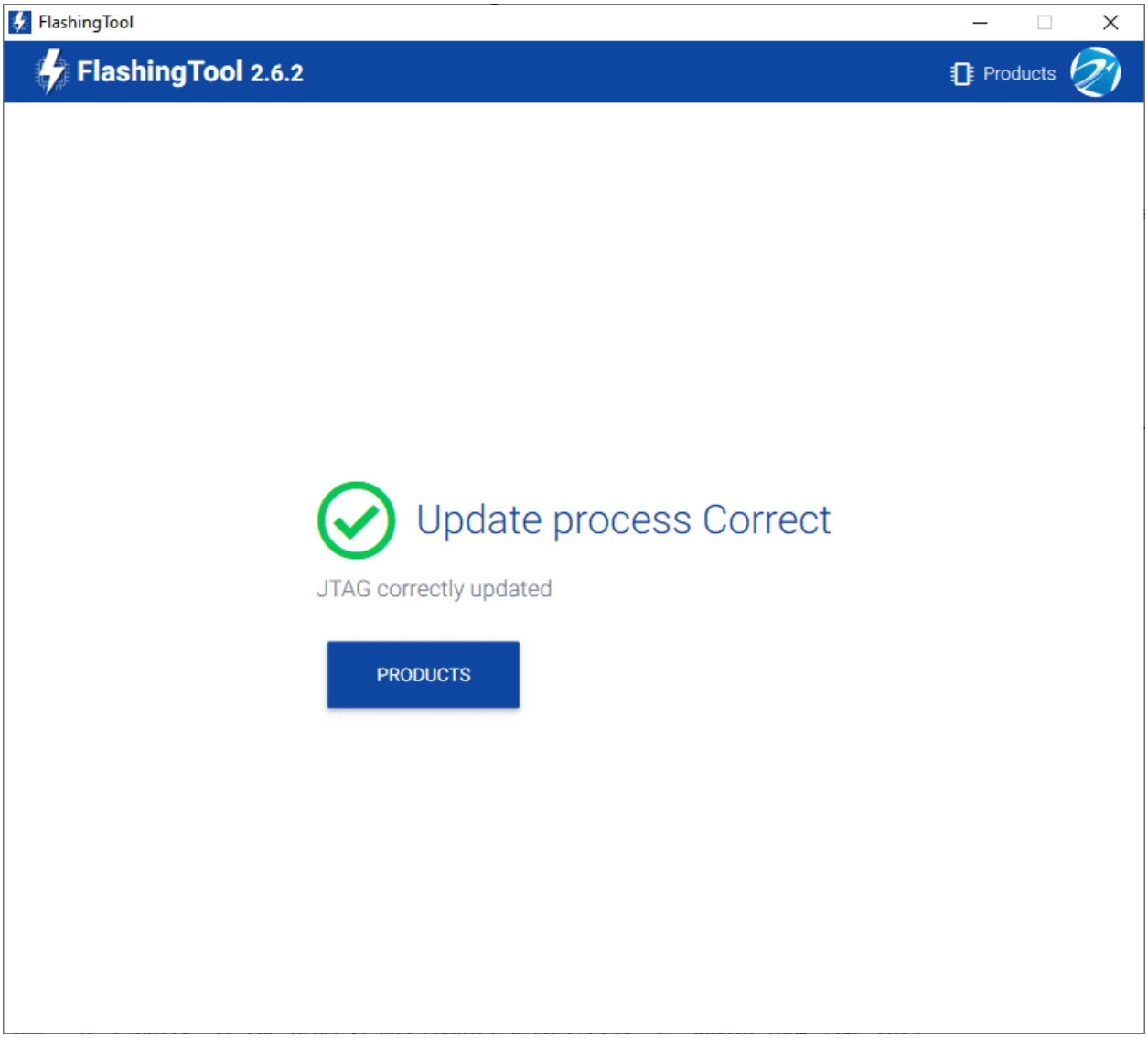


Fig. 12: **Flashing tool - Update JTAG process correct**

- After this, try again to flash the MC01B/S.

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

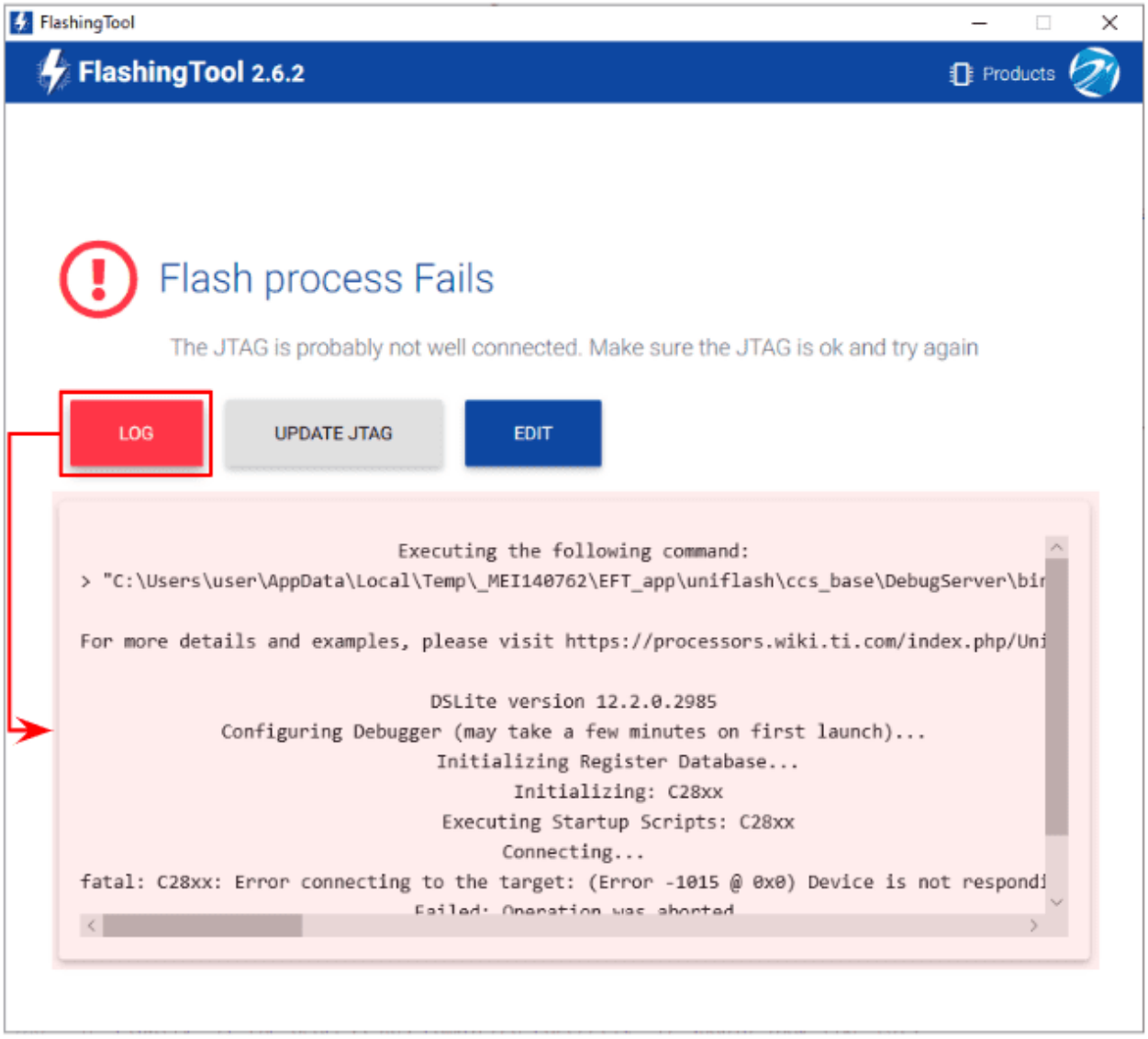


Fig. 13: **Flashing tool - Log**

CHAPTER

SEVEN

ACRONYMS AND DEFINITIONS

CAN	Controller Area Network
CLK	Clock
DC	Direct Current
ECAP	Enhaced CAPture
EQEP	Enhanced Quadrature Encoder Pulse sensor
ESC	Electronic Speed Control
GND	Electrical Ground
GPIO	General Purpose Input Output
JCF	Joint Collaboration Framework
JTAG	Joint Test Action Group
M	Metric (threads)
MC	Motor Controller
MC01B	Motor Controller: brushless variant
MC01S	Motor Controller: stepper variant
MISO	Master Input Slave output
PC	Personal Computer
PWM	Pulse Width Modulation signal
SDA	Serial DAta line
SPI	Serial Peripheral Interface
UAV	Unmanned Aerial Vehicle

CHAPTER

EIGHT

CONTACT DATA

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

Embention contact data is as follows:

Email: support@embention.com

Web page: https://www.embention.com/contact/

Telephone: (+34) 965 421 115

Address: Polígono Industrial Las Atalayas, C/ Chelín, Nº 16, CP 03114, Alicante (España).