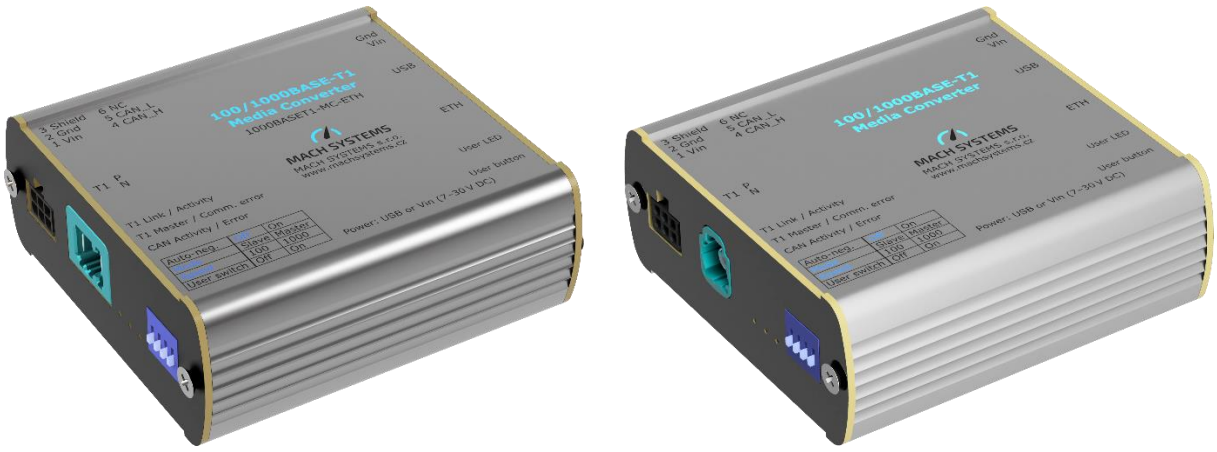
100/1000BASE-T1 Media Converter
User Manual

TE MATEnet version

Rosenberger H-MTD version



CHANGES

Date	Description	Created By	Review By
29.6.2023	A new product variant with Rosenberger H-MTD connector has been added: product numbers, connector description, ordering information	MM	PK
21.3.2023	Clarifications New wire harness order codes added	MM, PK	MM
20.12.2022	Initial release	PK	MM

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1 About

The **100/1000BASE-T1 Media Converter** is available in in two variants that differ in T1 port connector - TE MATEnet or Rosenberger H-MTD. The only difference between them is the connector of the T1 port. All other information such as powering, usage, and parameters are the same.

Product Number	Name	Connector for T1 Port
1000BASET1-MC-MATENET	100/1000BASE-T1 Media Converter MATEnet	TE MATEnet
1000BASET1-MC-HMTD	100/1000BASE-T1 Media Converter H-MTD	Rosenberger H-MTD

Table 1 Media converter connector variants

This document describes the usage of both variants. In the context of this document, the "100/1000BASE-T1 Media Converter" keyword refers to both product variants.

Product web site: https://www.machsystems.cz/en/products/embedded-networking/gateways-and-bus-converters/100-1000base-t1-media-converter

Figure 1 Front sides – TE MATEnet variant (left) and Rosenberger H-MTD variant (right)

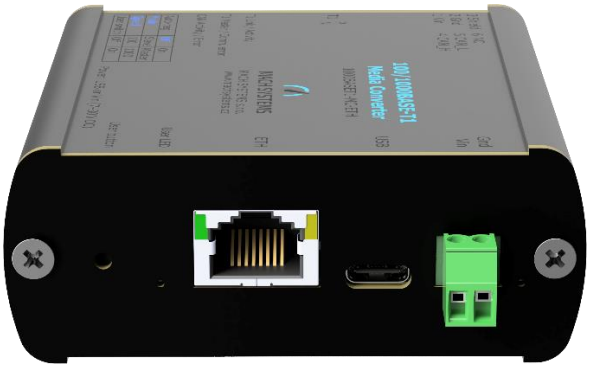


Figure 2 Rear side

2 Introduction

The **100/1000BASE-T1 Media Converter** realizes a full-duplex physical-layer conversion between 1000BASE-T1 and 1000BASE-T (Gigabit Ethernet), or 100BASE-T1 and 100BASE-TX (Fast Ethernet) networks, and features a RJ-45 connectors and either TE MATEnet or Rosenberger H-MTD connector depending on the product variant.

Communication speed and master/slave settings can be auto-negotiated with a link partner or set manually by the user. A USB port (VCP) can be used to read device status and port diagnostic. The device can also be used as a USB-CAN(/FD) interface simultaneously with the media conversion function.

The user can programmatically configure the device over USB or CAN(/FD) with the help of the open communication protocol that allows to read status information, configure port parameters, and enables to easily integrate the converter into any system. A free-of-charge PC application is available to visualise the device's status, configure its parameters and use the advanced functions.

3 Features

- Media conversion 1000BASE-T1 to 1000BASE-T or 100BASE-T1 to 100BASE-TX
- TE MATEnet or Rosenberger H-MTD connector variant
- Configuration:
  - Speed: 100 / 1000 / Auto-negotiation
  - Mode: Master / Slave / Auto-negotiation
  - Frame generator: On / Off
  - Link mode: IEEE / Legacy
- 1 CAN channel with CAN FD support
- USB 2.0
- Status information: Link status / activity / error
- IEEE and Legacy mode
- Frame generator mode
- USB for configuration, status and port diagnostic
- Can be used as a USB to CAN(/FD) interface
- Open communication protocol over USB VCP and CAN(/FD)
- USB or externally powered
- Aluminium enclosure
- DIN rail mounting possibility

4 Technical Specification

Communication channels	
Automotive Ethernet	1000BASE-T1 (IEEE 802.3bp) or 100BASE-T1 (IEEE 802.3bw)
Ethernet	1000BASE-T (IEEE 802.3ab – Gigabit Ethernet) or 100BASE-TX (IEEE 802.3u – Fast Ethernet)
CAN	CAN-HS channel with CAN FD support (ISO 11898-1:2015; CAN2.0A/B; ISO CAN FD)
USB	USB 2.0 CDC
Electrical	
Power	USB External 7 – 30 V DC (polarity and surge protection) over a 2-pin or 6-pin terminal block
Consumption	1000 Mbit: 150 mA @ 12 V 100 Mbit: 100 mA @ 12 V
LEDs	4 Dual-colour LEDs 2 ETH LEDs (RJ-45 connector) 1 Power LED
Transceivers	1000BASE-T1: 88Q2110 A2 1000BASE-T: KSZ9131
Mechanical	
Connectors	1000BASE-T1: TE MATEnet or Rosenberger H-MTD depending on product variant 1000BASE-T: RJ-45 CAN bus and power: 6-pin terminal block (Molex Micro-Fit) Power: 2-pin terminal block (TE) USB 2.0: USB Type-C
Buttons and switches	4 DIP switches 1 Push button
Dimensions (L x W x H)	84 x 82 x 33 mm
Weight	142 g
Operating temperature	-20 to 70 °C
Protection	IP20
Placement	Table (adhesive pads included) DIN-rail mount (sold separately)
Enclosure	Aluminium profile

Table 2 Technical specification

5 Device Description

5.1 Overview

The media converter features five connectors, seven LEDs, four DIP switches and one push button.

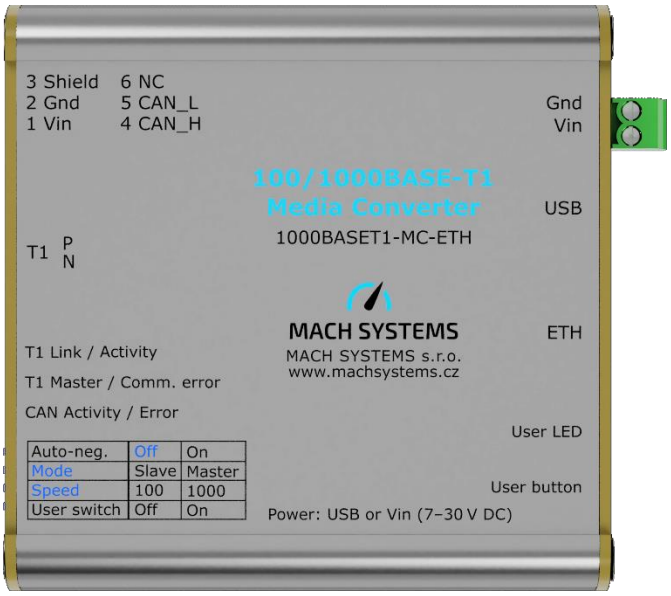


Figure 3 Top view

5.2 Power

The 100/1000BASE-T1 Media Converter can be powered over USB, or externally via a 2-pin terminal block or via the 6-pin Molex Micro-Fit connector. The external power range is 7 - 30 V DC. All grounds are connected together.

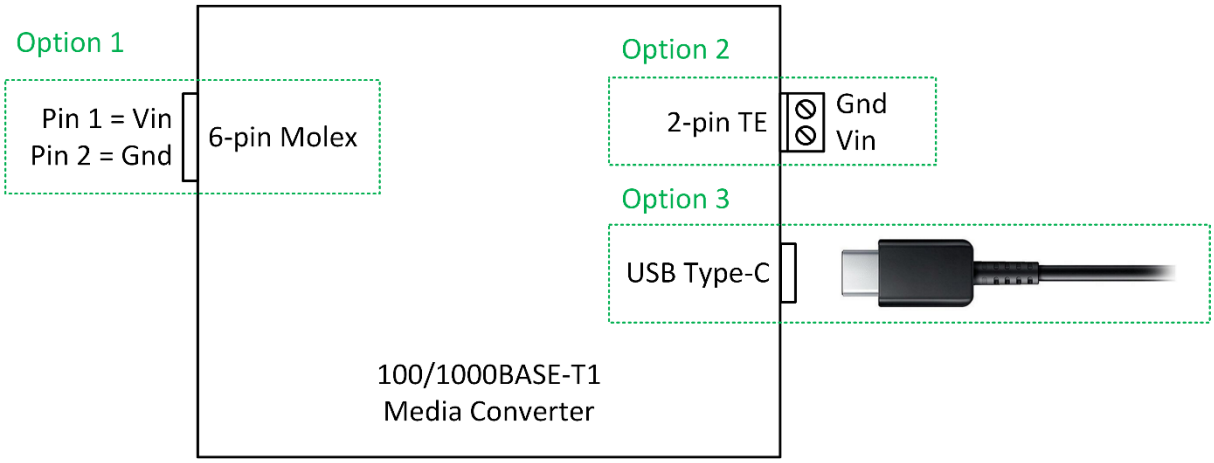


Figure 4 Power options

Figure 5 depicts the internal power block. When the external power is connected, there is no power drawn from USB.

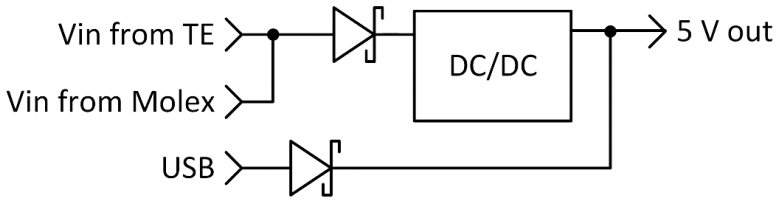


Figure 5 Power diagram

5.3 Connectors

5.3.1 TE MATEnet

The 2-pin TE MATEnet (p/n: 9-2304372-9) is used for 100/1000BASE-T1 channel on the 100/1000BASE-T1 Media Converter MATEnet.
Mating connector p/n: 2302454-9

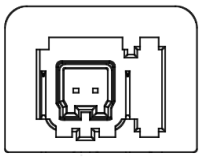
	Pin	Name	Description
 Front view	1	T1-N	Negative
	2	T1-P	Positive

Table 3 TE MATEnet connector - pin assignment

5.3.2 Rosenberger H-MTD

The 2-pin Rosenberger H-MTD (p/n: E6S20A-40MT5-Z) is used for 100/1000BASE-T1 channel on the 100/1000BASE-T1 Media Converter H-MTD.
Mating connector p/n: E9K10A-1AQX5-Z

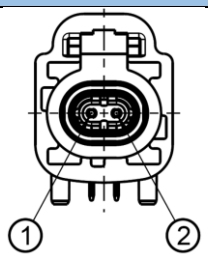
	Pin	Name	Description
 Front view	1	T1-P	Positive
	2	T1-N	Negative

Table 4 Rosenberger H-MTD connector - pin assignment

5.3.3 Molex Micro-Fit

The 6-pin Molex Micro-Fit connector (p/n: 43045-0600) contains a CAN bus, shield, and optionally power input pins.
Mating connector p/n: 43025-0600

	Pin	Name	Description
	1	Vin	Power input positive (7 – 30 V DC)

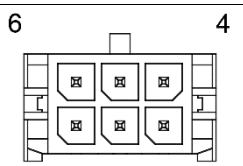
 Front view	2	Gnd	Power input negative
	3	PE	Shield (connected to the conductive enclosure)
	4	CAN_H	
	5	CAN_L	
	6		Not connected

Table 5 Molex Micro-Fit connector - pin assignment

5.3.4 TE 2-pin

The 2-pin TE connector (p/n: 284512-2) can be optionally used for power input. It is a disconnectable terminal block.

Mating connector p/n: 284506-2
Note: The mating connector is included in the scope of delivery.

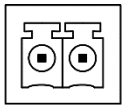
	Pin	Name	Description
 1 2 Front view	1	Vin	Power input positive (7 – 30 V DC)
	2	Gnd	Power input negative

Table 6 TE power - pin assignment

5.4 Switches

There are 4 DIP switches for converter configuration. Conversion behaviour is further explained in 6.2.

The function of DIP1-3 is predefined and cannot be changed. The function of DIP4 (user switch) is selectable from the PC application (see 6.5) or over communication protocol. The DIP4 default function is not assigned, but can be selected and save to EEPROM over communication protocol.

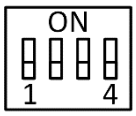
	No.	Name	Description
 Front view	1	Auto-negotiation	On: Auto-negotiation on Off: Auto-negotiation off
	2	Mode	On: Master mode Off: Slave mode *Note: Relevant when Auto-negotiation is off.*
	3	Speed	On: 1000 Mbit/s Off: 100 Mbit/s *Note: Relevant when Auto-negotiation is off.*
	4	User switch	The function of the user switch is mappable onto two possibilities: • Not assigned (default) • Legacy mode: On: Legacy mode enabled Off: Legacy mode disabled (IEEE Mode) • Packet generator: On: Packet generator enabled Off: Packet generator disabled

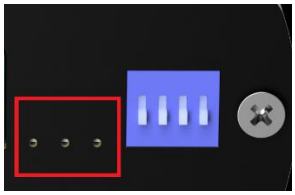
Table 7 Switches

5.5 LEDs

The 100/1000BASE-T1 Media Converter contains 7 status LEDs in total.

5.5.1 Front Panel

3 LEDs are on the front panel.

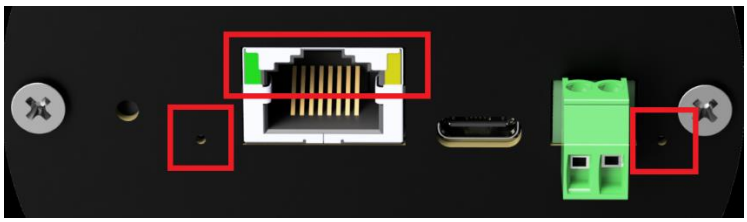


LED Name	Note
T1 Link / Activity	Green on: 100BASE-T1 link Green blinking: 100BASE-T1 activity Orange on: 1000BASE-T1 link Orange blinking: 1000BASE-T1 activity Off: no link
T1 Master / Comm. Error	On: T1 PHY is configured as Master Off: T1 PHY is configured as Slave Red: Ethernet Communication Error
CAN Activity / Error	Green on: CAN channel on Green blinking: CAN activity Red blinking: Error frame received Red on: CAN bus error

Table 8 Status LEDs on front panel

5.5.2 Rear Panel

4 LEDs are on the rear panel.



LED Name	Note
User LED	User specific function
RJ-45 Left LED	Green On: 100BASE-TX link Orange On: 1000BASE-T link Off: No link
RJ-45 Right LED	Orange blinking: Ethernet activity Off: No Ethernet activity
Power LED	Green on: The device is powered Off: The device is not powered

Table 9 Status LEDs on rear panel

5.6 User Button

The push button (a tactile switch) shall be used for firmware update. If the button is held during device's power-up, the device enters the boot mode. After that, the button can be released and the firmware can be updated – see 6.7. To enter the normal operation, the device should be powered off.

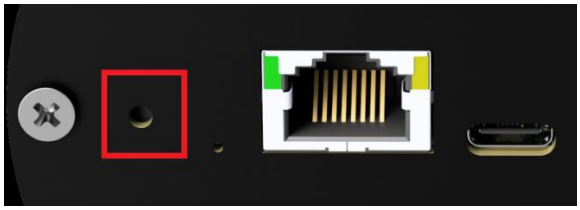


Figure 6 User button

5.7 CAN Bus Termination

There are no internal termination resistors inside the device. Therefore, the user has to make sure the CAN bus is properly terminated at both ends of the network.

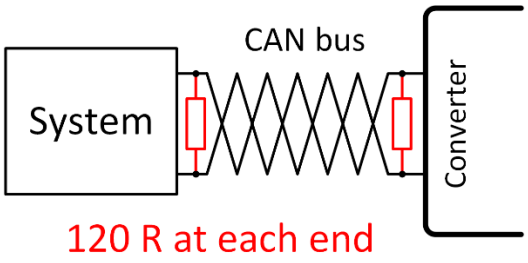


Figure 7 CAN bus termination

5.8 USB

USB Type-C connector uses the standard USB 2.0 pinout, and can be used for firmware upload or as a virtual COM port (see 6.5).

5.9 Galvanic Isolation

The device does **not** have any galvanic isolation. All ground signals are connected. The user has to make sure there are no ground loops in his setup.

6 Usage

6.1 Quick Start

The **100/1000BASE-T1 Media Converter** can be easily used like this:

- **Connect cables** to the automotive Ethernet port and the standard Ethernet port (RJ-45 connector)
- **Configure the device – by built-in DIP switches:**
  - Either enable the Auto-negotiation feature (T1 Speed and Master/slave configuration will be negotiated with the link partner); or
  - Set Speed and Master/slave configuration manually
- **Power the device – either over:**
  - USB
  - 2-pin terminal block
  - 6-pin Molex connector

6.2 Physical-Layer Conversion

The media converter realizes a full-duplex physical-layer conversion between 1000BASE-T1 and 1000BASE-T (Gigabit Ethernet), or 100BASE-T1 and 100BASE-TX (Fast Ethernet) networks. The T1 communication speed and Master/Slave settings can be auto-negotiated with a link partner, set manually by the user, or programmatically over USB or CAN(/FD).

The parameters of the T1 port must be compatible with the link partner on the other side. If the auto-negotiation is enabled, the speed and master/slave configuration by on-board switches is ignored, as their configuration will be auto-negotiated. The link partner shall also support the auto-negotiation. If the auto-negotiation is disabled, the correct speed (same on both devices) and the correct master/slave selection should be set by DIP switches.

The T1 polarity is automatically detected and corrected.

The speed selected on the T1 side should be also supported by the device connected to the RJ-45 connector. If the T1 port speed is 1000 Mbit (either auto-negotiated or set manually), the device connected to RJ-45 side shall support 1000BASE-T. Similarly, if the T1 port speed is 100Mbit, the device connected to RJ-45 shall support 100BASE-TX. If the auto-negotiation is enabled the fastest possible speed is automatically selected.

6.3 Frame Generator Mode

The frame generator function must be disabled for normal communication and should be enabled only for testing purposes. The generated frames contain no specific MAC source or destination. All bytes have the same pattern: 0xA5 and 0x5A in alternation.

6.4 IEEE and Legacy Modes

The IEEE mode is the default mode on the T1 port. The legacy mode should be only enabled if the link partner is Marvel PHY A0. For other PHYs, the legacy mode should be disabled.

6.5 PC Application

The user can use the free-of-charge application to access the media converter over USB VCP or CAN(/FD).

Note: In order to connect the device over CAN(/FD), a Kvaser CAN interface is needed, as the application uses the Kvaser driver.

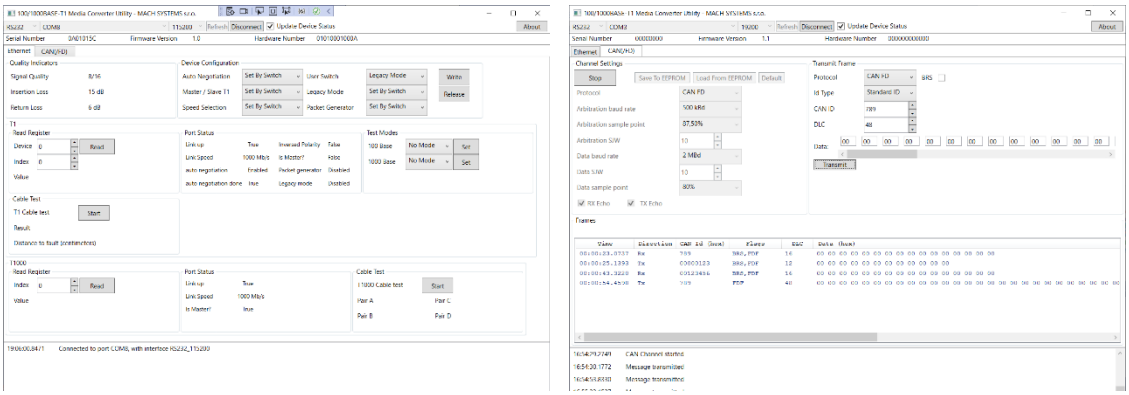


Figure 8 PC application

The application allows to read status information, configure port parameters, use the T1000 and T100 test modes, and run cable tests. The application also allows to use the device as a USB to CAN(/FD) interface and to transmit and receive CAN and CAN FD frames.

6.6 Cable Harnesses

Cable harnesses are available as optional accessories. See Chapter 9 for ordering information.

6.6.1 TE MATEnet

This is a TE Connectivity MATEnet female to female wire harness connected by an unshielded-twisted pair. MATEnet connectors are wired 1:1.

Figure 9 TE MATEnet cable harness

6.6.2 Rosenberger H-MTD

This is a Rosenberger H-MTD female to female wire harness connected by a shielded twisted-pair cable. H-MTD connectors are wired 1:1.

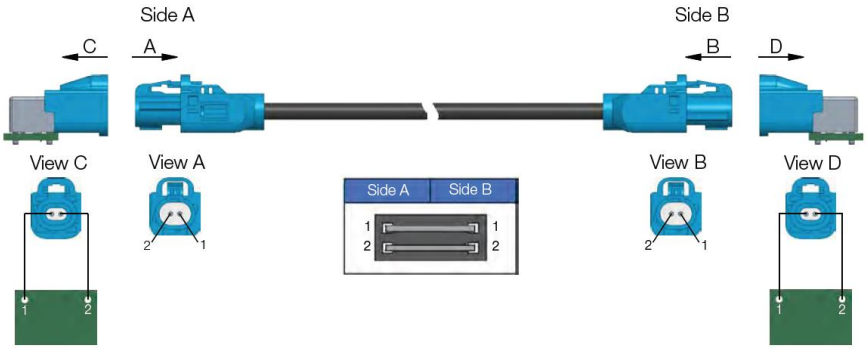


Figure 10 Rosenberger H-MTD cable harness

Source: Rosenberger Hochfrequenztechnik GmbH & Co. KG

6.6.3 TE MATEnet to DSUB9 Adapter

This is a TE Connectivity MATEnet female to DSUB9 female (DB9F) adapter. Length is 25 cm, UTP cable.

The following table shows the wiring:

100/1000BASE-T1 Signal	MATEnet	DSUB9F
Positive	2	4
Negative	1	5

Table 10 TE MATEnet to DSUB9F adapter wiring

See Figure 11 for TE MATEnet detail.

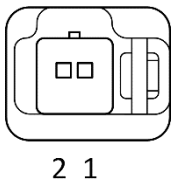


Figure 11 TE MATEnet cable connector front view

6.6.4 Molex Micro-Fit

This is a Molex Micro-Fit 6-pin to an open-end wire harness. The wires are 0.65 mm^2 (22 AWG).

Figure 12 Molex Micro-Fit cable harness

The following table shows the wire colours:

Pin Number	Colour	Note
1	Red	Twisted together
2	Black	
3	Green/Yellow	
4	White	Twisted together
5	Green	
6	Blue	

Table 11 Molex Micro-Fit cable harness colours

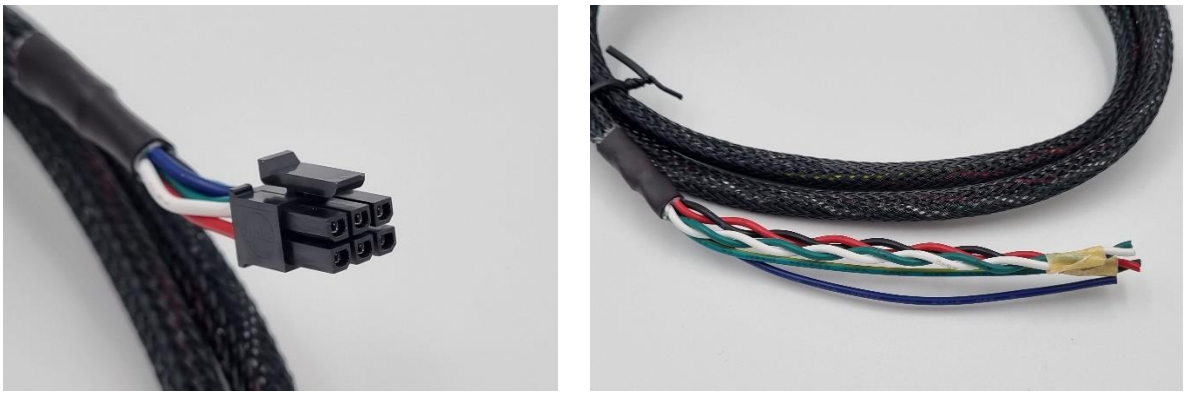


Figure 13 Molex Micro-Fit cable harness details

6.7 Firmware Update

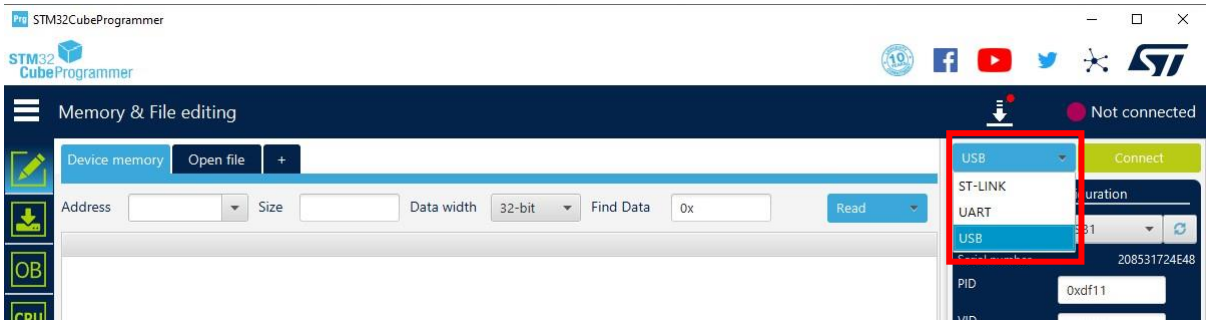
The STM32CubeProgrammer application is used to flash firmware into the device. The application is available from [1]. The application shall be installed before plugging the device into the computer.

The device contains a system bootloader which is pre-programmed in ROM during manufacture. The steps for **entering the bootloader**:

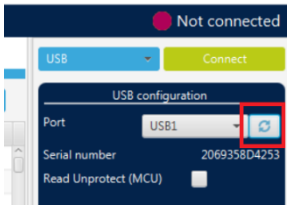
- Disconnect the USB and the external power supply so that the device is powered off
- Press and hold the User button on the side panel
- Connect the USB cable
- The device will enter the system bootloader over USB
- Release the button
- Firmware can be flashed

Steps for firmware update:

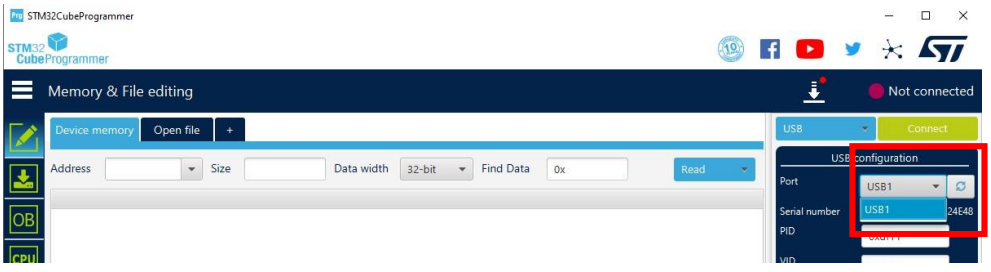
1. Open the *STM32CubeProgrammer* application (see download link above)
2. Turn the device off
3. Enter the system bootloader as described above
4. In the *STM32CubeProgrammer*:
    a. Select “USB” from drop-down



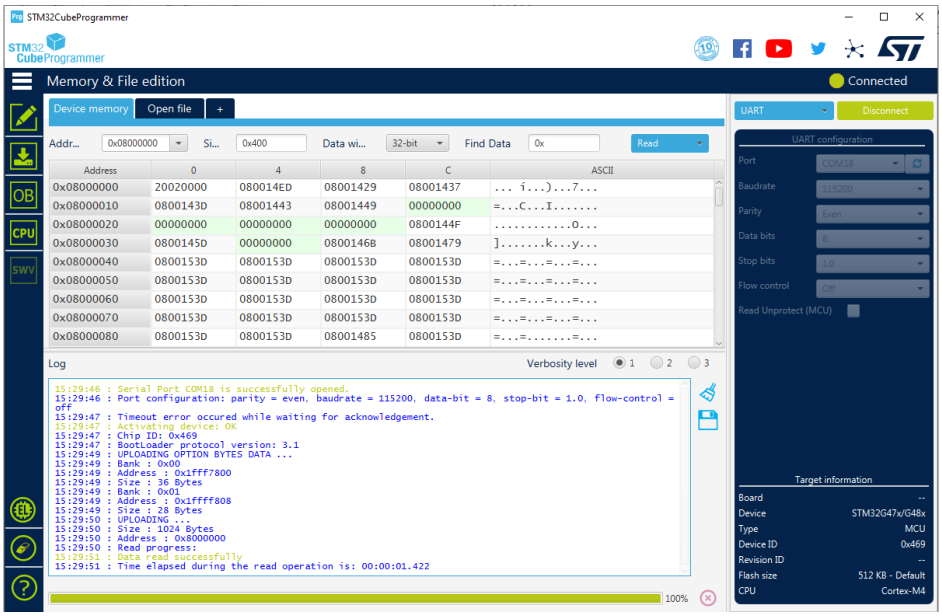
b. Click on the refresh arrows button to see available ports



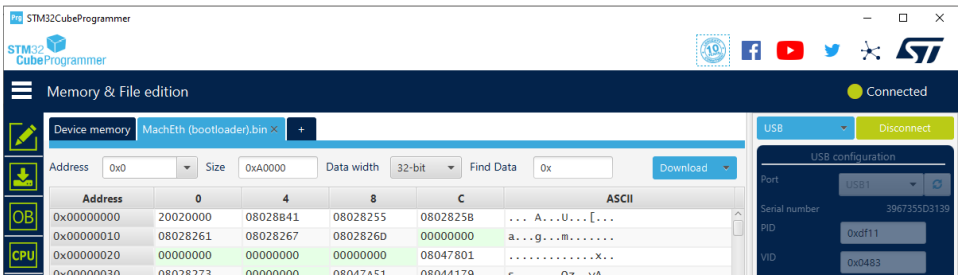
c. Select the correct port



d. Click connect. You will see a screen similar to this one. The device’s bootloader is connected to the PC.



5. In order to flash a new firmware, open a .hex file by „Open file“ button and press the „Download“ button.



The device shall be powered off in order to exit the bootloader mode.

7 Legal Information

7.1 Usage Warning

WARNING FOR ALL USERS

WARNING! - YOUR USE OF THIS DEVICE MUST BE DONE WITH CAUTION AND A FULL UNDERSTANDING OF THE RISKS!

THIS WARNING IS PRESENTED TO INFORM YOU THAT THE OPERATION OF THIS DEVICE MAY BE DANGEROUS. YOUR ACTIONS CAN INFLUENCE THE BEHAVIOR OF A DISTRIBUTED EMBEDDED SYSTEM, AND DEPENDING ON THE APPLICATION, THE CONSEQUENCES OF YOUR IMPROPER ACTIONS COULD CAUSE SERIOUS OPERATIONAL MALFUNCTION, LOSS OF INFORMATION, DAMAGE TO EQUIPMENT, AND PHYSICAL INJURY TO YOURSELF AND OTHERS. A POTENTIALLY HAZARDOUS OPERATING CONDITION IS PRESENT WHEN THE FOLLOWING TWO CONDITIONS ARE CONCURRENTLY TRUE: THE PRODUCT IS PHYSICALLY INTERCONNECTED TO A REAL DISTRIBUTED EMBEDDED SYSTEM; AND THE FUNCTIONS AND OPERATIONS OF THE REAL DISTRIBUTED EMBEDDED SYSTEM ARE CONTROLLABLE OR INFLUENCED BY THE USE OF THE CAN NETWORK. A POTENTIALLY HAZARDOUS OPERATING CONDITION MAY RESULT FROM THE ACTIVITY OR NON-ACTIVITY OF SOME DISTRIBUTED EMBEDDED SYSTEM FUNCTIONS AND OPERATIONS, WHICH MAY RESULT IN SERIOUS PHYSICAL HARM OR DEATH OR CAUSE DAMAGE TO EQUIPMENT, DEVICES, OR THE SURROUNDING ENVIRONMENT.

WITH THIS DEVICE, YOU MAY POTENTIALLY:

- CAUSE A CHANGE IN THE OPERATION OF THE SYSTEM, MODULE, DEVICE, CIRCUIT, OR OUTPUT.
- TURN ON OR ACTIVATE A MODULE, DEVICE, CIRCUIT, OUTPUT, OR FUNCTION.
- TURN OFF OR DEACTIVATE A MODULE, DEVICE, CIRCUIT, OUTPUT, OR FUNCTION.
- INHIBIT, TURN OFF, OR DEACTIVATE NORMAL OPERATION.
- MODIFY THE BEHAVIOR OF A DISTRIBUTED PRODUCT.

- ACTIVATE AN UNINTENDED OPERATION.
- PLACE THE SYSTEM, MODULE, DEVICE, CIRCUIT, OR OUTPUT INTO AN UNINTENDED MODE.

ONLY THOSE PERSONS WHO:

(A) ARE PROPERLY TRAINED AND QUALIFIED WITH RESPECT TO THE USE OF THE DEVICE,

(B) UNDERSTAND THE WARNINGS ABOVE, AND

(C) UNDERSTAND HOW THIS DEVICE INTERACTS WITH AND IMPACTS THE FUNCTION

AND SAFETY OF OTHER PRODUCTS IN A DISTRIBUTED SYSTEM AND THE APPLICATION FOR WHICH THIS DEVICE WILL BE APPLIED, MAY USE THE DEVICE.

PLEASE NOTE THAT YOU CAN INTEGRATE THIS PRODUCT AS A SUBSYSTEM INTO HIGHER-LEVEL SYSTEMS. IN CASE YOU DO SO, MACH SYSTEMS s.r.o. HEREBY DECLARES THAT MACH SYSTEMS s.r.o.'s WARRANTY SHALL BE LIMITED TO THE CORRECTION OF DEFECTS, AND MACH SYSTEMS s.r.o. HEREBY EXPRESSLY DISCLAIMS ANY LIABILITY OVER AND ABOVE THE REFUNDING OF THE PRICE PAID FOR THIS DEVICE, SINCE MACH SYSTEMS s.r.o. DOES NOT HAVE ANY INFLUENCE ON THE IMPLEMENTATIONS OF THE HIGHER-LEVEL SYSTEM, WHICH MAY BE DEFECTIVE.

7.2 Disposal and Recycling Information

When this product reaches its end of life, please dispose of it according to your local environmental laws and guidelines.

7.3 Declaration of Conformity

MACH SYSTEMS

EU Declaration of Conformity (DoC)

We

Company Name	MACH SYSTEMS s.r.o.		
Postal Address	Pocernicka 272/96	**City**	Prague
Postcode	108 00	**Country**	Czech Republic

declare that the DoC is issued under our sole responsibility and belongs to the following products:

100/1000BASE-T1 Media Converter MATEnet
100/1000BASE-T1 Media Converter H-MTD

Objects of the declaration:

Product	Product Number
100/1000BASE-T1 Media Converter MATEnet	1000BASET1-MC-MATENET formerly: 1000BASET1-MC-ETH
100/1000BASE-T1 Media Converter H-MTD	1000BASET1-MC-H-MTD

The objects of the declaration described above is in conformity with the relevant Union harmonisation legislation:

2014/30/EU - EMC Directive
2011/65/EU - RoHS (recast)

The following harmonised standards and technical specifications have been applied:

EN 55032	EN 61000-4-2
EN 63000	EN 61000-4-4

Signed for and on behalf of: MACH SYSTEMS s.r.o.

Place of issue: Prague, Czech Republic

Date of issue: June 26th 2023

Signature: _____

Name, function: Miroslav Machacek, Managing Director

MACH SYSTEMS s.r.o.
www.machsystems.cz

7.4 Patents, Copyrights and Trademarks

8 References

[1] "STM32CubeProgrammer Web Site," [Online]. Available: https://www.st.com/en/development-tools/stm32cubeprog.html.

[2] "100/1000BASE-T1 Media Converter - Product Web Page," [Online]. Available: https://www.machsystems.cz/en/products/embedded-networking/gateways-and-bus-converters/100base-t1-media-converter.

9 Ordering Information

Product Number	Description
1000BASET1-MC-MATENET	100/1000BASE-T1 Media Converter MATEnet
1000BASET1-MC-H-MTD	100/1000BASE-T1 Media Converter H-MTD
HARNESS-MATENET-MATENET-0M5	TE MATEnet female to MATEnet female cable harness; unshielded twister-pair (UTP); length 0.5 m
HARNESS-MATENET-MATENET-2M	TE MATEnet female to MATEnet female cable harness; unshielded twister-pair (UTP); length 2 m
HARNESS-MATENET-MATENET-5M	TE MATEnet female to MATEnet female cable harness; unshielded twister-pair (UTP); length 5 m
HARNESS-MATENET-MATENET-10M	TE MATEnet female to MATEnet female cable harness; unshielded twister-pair (UTP); length 10 m
HARNESS-HMTD-HMTD-0M5	Rosenberger H-MTD female to H-MTD female cable harness; shielded twisted-pair (STP); length 0.5 m
HARNESS-HMTD-HMTD-2M	Rosenberger H-MTD female to H-MTD female cable harness; shielded twisted-pair (STP); length 2 m
ADAPTER-MATENET-DSUB9-0M25	TE MATEnet female to DSUB9 female adapter / cable harness; unshielded twister-pair (UTP); length 25 cm
ADAPTER-MATENET-HMTD-F	TE MATEnet female to Rosenberger H-MTD female PCB adapter
ADAPTER-MATENET-TERMINAL-F	TE MATEnet female to terminal block PCB adapter

ADAPTER-HMTD-TERMINAL-F	Rosenberger H-MTD female adapter to terminal block PCB adapter
HARNESS-MOLEX6-OPEN-1M	6-pin Molex Micro-Fit to open end cable harness; length 1 m
HARNESS-MOLEX6-OPEN-5M	6-pin Molex Micro-Fit to open end cable harness; length 5 m
1000BASET1-NET-SDK	.NET SDK API (DLL) for 1000BASET1-MC-MATENET and 1000BASET1-MC-HMTD to access the device over USB (VCP) or CAN/FD. The API allows to read the status and configure the device, run cable test on both ports, as well as to use the device as a USB-CAN(FD) interface.
DIN-BRACKET-UNI	Universal holder for mounting any enclosure on a DIN rail

Table 12 Product Numbers

10 Contact

MACH SYSTEMS s.r.o.

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Czech Republic

MACH SYSTEMS

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