100/1000BASE-T1 USB Interface MATEnet

User Manual

CHANGES

Date	Description	Created By	Review By
13.6.2025	Add MACHSYSTEMS USB Firmware Updater	KH	
10.1.2024	Initial release	PK	

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1 About

This document describes the usage of the **100/1000BASE-T1 USB Interface MATEnet**.

Product number: 1000BASET1-USB-MATENET
Product page: https://www.machsystems.cz/en/products/embedded-networking/gateways-and-bus-converters/100-1000base-t1-usb-interface-matenet

Figure 1 100/1000BASE-T1 USB Interface MATEnet

2 Introduction

The **100/1000BASE-T1 USB Interface MATEnet** realizes a connection between a 1000BASE-T1/100BASE-T1 network and a USB port. The device acts as a standard network interface card when plugged into a PC's USB port, and features TE MATEnet and USB 3.1 Type-C connectors.

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 USB interface 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.

Figure 2 Front and rear panels

3 Features

- Automotive Ethernet to USB 3.1/2.0 network interface card
- 1000BASE-T1 and 100BASE-T1 support
- 100/1000 Mbit full-duplex communication
- Configuration:
  - Speed: 100 / 1000 / Auto-negotiation
  - Mode: Master / Slave / Auto-negotiation
  - Frame generator: On / Off
  - Link mode: IEEE / Legacy
- Automatic polarity detection on T1 port
- Frame generator mode
- USB virtual COM port for configuration, status and port diagnostic
- Free-of-charge PC application
- Can be used as a USB to CAN(/FD) interface
- USB 3.1 Type-C connector
- USB-powered
- Aluminium enclosure
- DIN rail mounting possibility

4 Technical Specification

Features	
Conversion	100/1000BASE-T1 to USB 3.1/2.0 network interface card
Status information	Link status / activity / error
Configuration	Speed: 100 / 1000 / Auto-negotiation Mode: Master / Slave / Auto-negotiation Frame generator: On / Off Link mode: IEEE / Legacy
Integration	Open communication protocol over USB VCP or CAN(/FD) allows to configure port parameters, read port status, and run cable diagnostic
USB-CAN(/FD) Interface	Possibility to use the device as a USB-CAN(/FD) interface (open communication protocol over USB VCP) – simultaneously to the media conversion function
PC application	Free-of-charge PC application to read status information, configure the converter, run cable diagnostic, use USB-CAN(/FD) function
Firmware update	Over USB
Communication channels	
Automotive Ethernet	1000BASE-T1 (IEEE 802.3bp) or 100BASE-T1 (IEEE 802.3bw) Note: When plugged into a USB 2.0 port, the throughput for 1000BASE-T1 will be limited.
USB	USB 3.1 Gen 1 network interface card (backward compatible with USB 2.0) USB 2.0 Virtual COM port for diagnostic
CAN	CAN-HS channel with CAN FD support (ISO 11898-1:2015; CAN2.0A/B; ISO CAN FD)
Electrical	
Power	USB-powered USB 3.1: Sink current 900 mA USB 2.0: Sink current 500 mA
Consumption	1000 Mbit: 400 mA @ 5 V 100 Mbit: 220 mA @ 5 V
LEDs	4 Dual-colour LEDs 1 Power LED
Transceivers	1000BASE-T1: 88Q2110 A2 USB Ethernet Controller: LAN7801 CAN bus: TCAN337GD
Mechanical	
Connectors	1000BASE-T1: TE MATEnet CAN bus: 6-pin terminal block (Molex Micro-Fit) USB 3.1: 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 1 Technical specification

5 Device Description

5.1 Overview

The USB Interface features three connectors, five LEDs, four DIP switches and one push button.

Figure 3 Top view

5.2 Power

The 100/1000BASE-T1 USB Interface MATEnet is powered from USB only. Current drawn for USB 3.1 is 900 mA, and for USB 2.0 is 500 mA.

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.
Mating connector p/n: 2302454-9

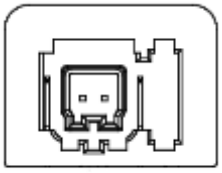
	Pin	Name	Description
 2 1 Front view	1	T1-N	Negative
	2	T1-P	Positive

Table 2 MATEnet connector - pin assignment

5.3.2 Molex Micro-Fit

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

	Pin	Name	Description
	1		Not connected

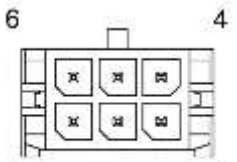
 Front view	2	GND	Ground
	3	PE	Shield (connected to the conductive enclosure)
	4	CAN_H	
	5	CAN_L	
	6		Not connected

Table 3 Molex Micro-Fit connector - 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. ~~The default function is legacy mode selection and the alternative function is a packet.~~

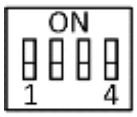
	No.	Name	Description
 Front view	1	Auto-negotiation	On: Auto-negotiation on Off: Auto-negotiation off
	2	Mode	On: Master mode Off: Slave mode *Note: Relevant when Auto-negotiation is off.*
	3	Speed	On: 1000 Mbit/s Off: 100 Mbit/s *Note: Relevant when Auto-negotiation is off.*
	4	User switch	The function 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 4 Switches

5.5 LEDs

The 100/1000BASE-T1 USB Interface MATEnet contains 5 status LEDs in total.

5.5.1 Front Panel

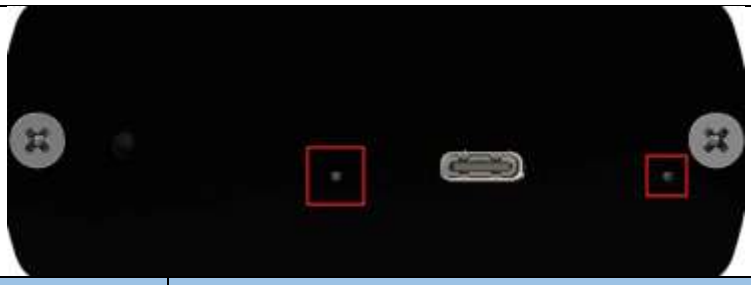
3 LEDs are on the front panel.

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 5 Status LEDs on front panel

5.5.2 Rear Panel

2 LEDs are on the rear panel.



LED Name	Note
USB LED	Green on: USB 2.0 connected Orange on: USB 3.1 connected
Power LED	Green on: The device is powered Off: The device is not powered

Table 6 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 4 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.

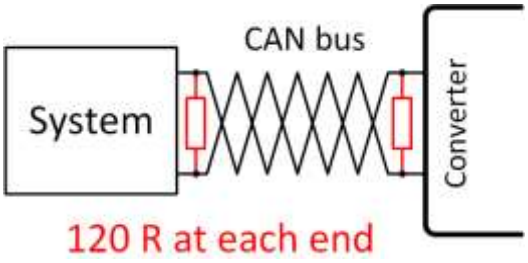


Figure 5 CAN bus termination

5.8 USB

USB Type-C connector uses the standard USB 3.1 pinout and can be used for Ethernet connection, firmware upload or as a virtual COM port (see 6.5). The ethernet connection speed is limited by type of USB connection. All combination of ethernet connections and USB connection is possible, but with speed bottleneck caused by USB. The supposed speed limit can be found in this table:

USB Connection Speed	Ethernet Connection Speed	Real throughput (considering overhead)
USB2.0 Full Speed (12 Mbit/s)	100 Mbit/s	~10 Mbit/s
	1000 Mbit/s	~10 Mbit/s
USB2.0 High Speed (480 Mbit/s)	100 Mbit/s	~95 Mbit/s
	1000 Mbit/s	~350 Mbit/s
USB3.0 Super Speed (5 Gbit/s)	100 Mbit/s	~95 Mbit/s
	1000 Mbit/s	~950 Mbit/s

Table 7 Ethernet connection bottlenecks

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 USB Interface MATEnet** can be easily used like this:

- **Connect cable** to the automotive Ethernet port (TE MATEnet 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:**
  - Connect USB cable

6.2 Physical-Layer Conversion

The USB Interface realizes a full-duplex physical-layer conversion between 1000BASE-T1 or 100BASE-T1 to Ethernet over USB network. 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 can be limited by the type of USB connection. If the T1 port speed is 1000 Mbit (either auto-negotiated or set manually), the device should be connected to PC with USB 3.1 otherwise the speed of the connection will be limited to maximum speed of USB 2.0. Mere about speed bottle neck in Table 7 Ethernet connection bottlenecks. If the T1 port speed is 100Mbit, the device can connect with USB 2.0 or USB 3.1 without any speed limitation.

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 USB Interface 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.

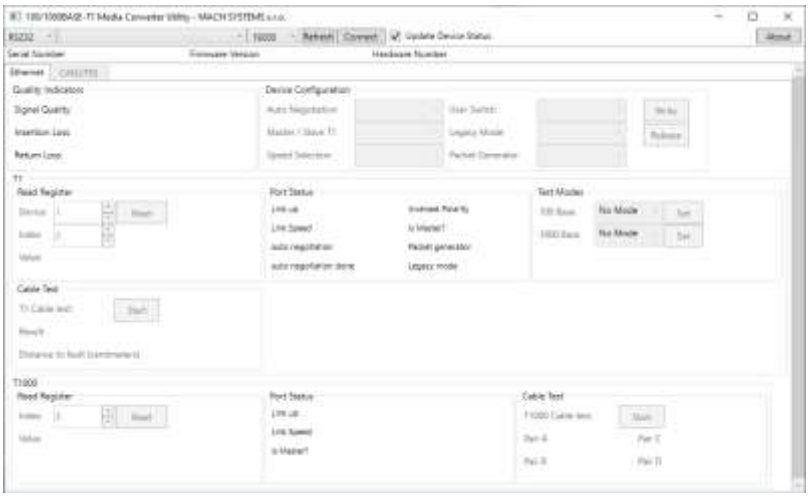


Figure 6 PC application

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 MATEnet female to female wire harness connected by a 2-meter long unshielded-twisted pair. MATEnet connectors are wired 1:1.

Figure 7 TE MATEnet cable harness

6.6.2 Molex Micro-Fit

This is a Molex Micro-Fit 6-pin to an open-end wire harness. The wires are 1 meter long, each 0.65 mm^2 (22 AWG).

Figure 8 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 8 Molex Micro-Fit cable harness colours

Figure 9 Molex Micro-Fit cable harness details

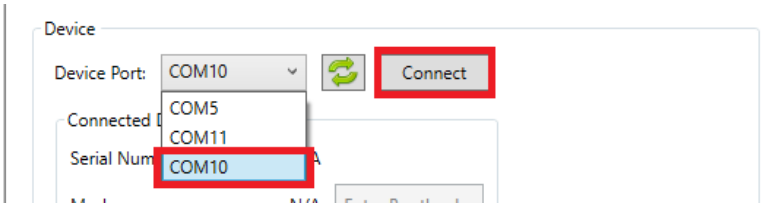
6.7 Firmware Update

Download the latest firmware from support page https://www.machsystems.cz/en/support. If your device is running firmware version v1.1 or older, first use **STM32CubeProgrammer** to install MACH SYSTEMS USB bootloader into the device (see section 6.7.2). After the bootloader is in place (or if your device already has a newer firmware), follow the update procedure in 6.7.1.

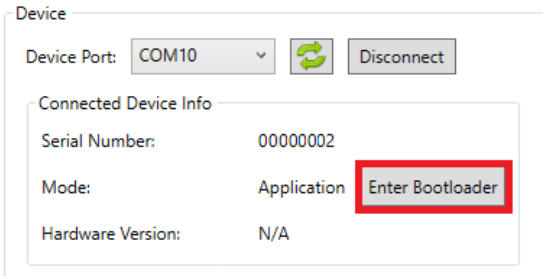
6.7.1 MACH SYSTEMS USB Firmware Updater

Firmware versions >v1.1 are shipped with MACH SYSTEMS bootloader that can be used together with MACH SYSTEMS USB Firmware Updater application for firmware update.

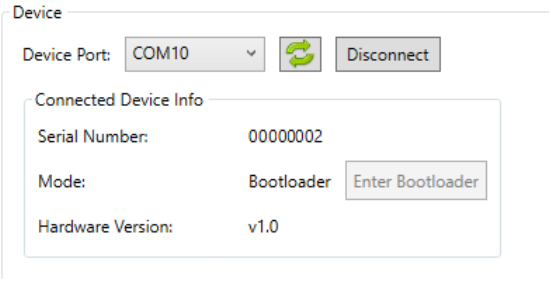
1. Connect the device to a computer using a USB cable.
2. Select the correct port and press “Connect”.



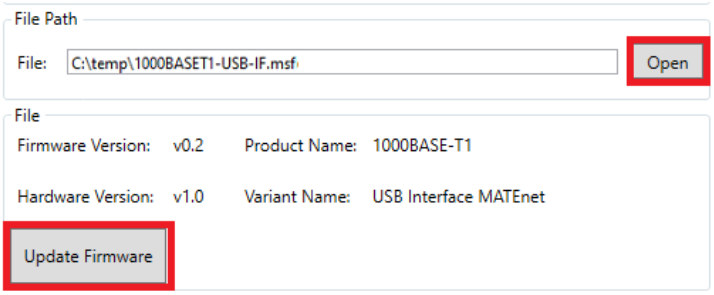
3. Press “Enter Bootloader”.



4. Wait a few moments and then connect to the device again; it should be in Bootloader mode now.



5. Open the correct firmware file and “Update Firmware”.



6. You should see in the output console that the device was flashed successfully. The device shall restart to the application automatically.

```
16:46:54 Sending firmware data packets...
16:46:55 Progress: 70,60%
16:46:56 Progress: 100,00%
16:46:56 Restarting device.
16:46:56 Device updated successfully. Disconnecting device.
```

6.7.2 STM32CubeProgrammer

This section covers flashing MACH SYSTEMS USB Bootloader on devices with firmware version v1.1 or older. Devices shipped with newer firmware already include the bootloader, so you can skip this step and proceed directly to the firmware update instructions in the next section.

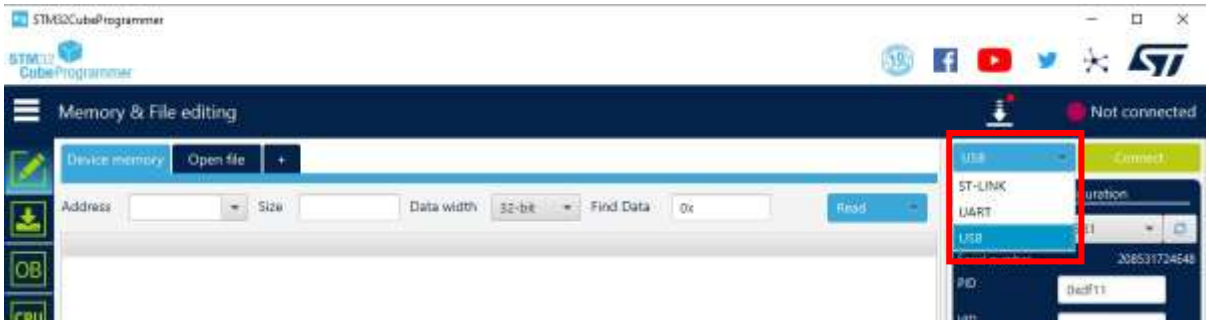
The STM32CubeProgrammer application is available from [1]. The application shall be installed before plugging the device into the computer. After flashing the USB bootloader, see 6.7.1 MACH SYSTEMS USB Firmware Updater for firmware update.

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:

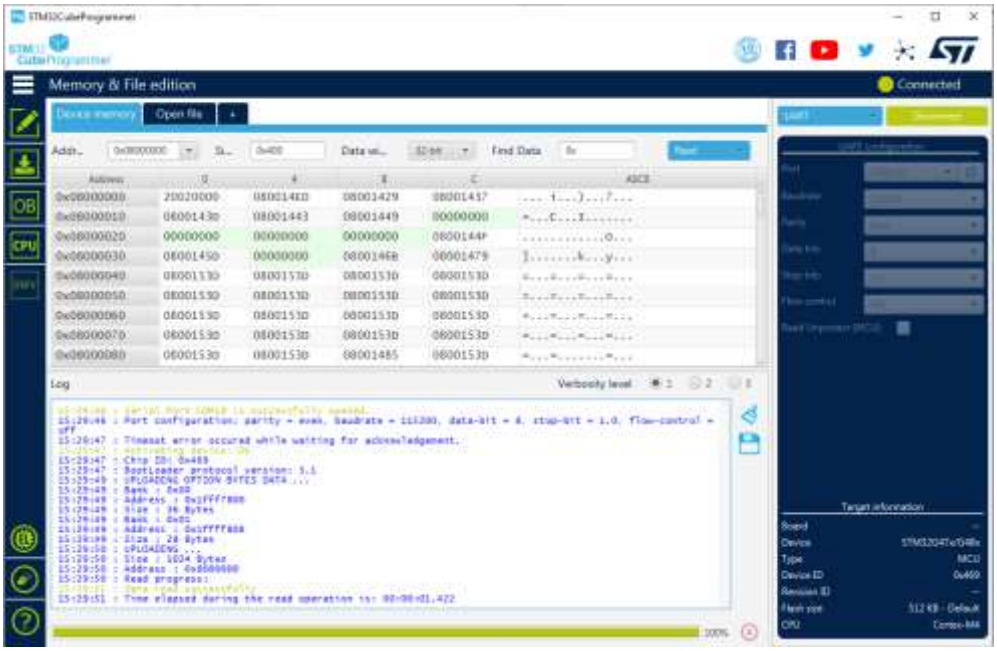
1. Open the *STM32CubeProgrammer* application (see download link above)
2. Turn the device off
3. Enter the system bootloader as described above
4. ~~Connect a USB cable (this also powers the device) to the PC~~
5. ~~4.~~ In the *STM32CubeProgrammer*:
    a. Select “USB” from drop-down



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.



~~6.~~5. Select "Erasing & Programming" from the left column, open a .hex file by "Browse" button and then press the "Start Programming" button to flash the device.

The device shall be powered off 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
100/1000BASE-T1 Media Converter v2 MATEnet
100/1000BASE-T1 Media Converter v2 H-MTD
100/1000BASE-T1 USB Interface MATEnet

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-HMTD
100/1000BASE-T1 Media Converter v2 MATEnet	1000BASET1-V2-MATENET
100/1000BASE-T1 Media Converter v2 H-MTD	1000BASET1-V2-HMTD
100/1000BASE-T1 USB Interface MATEnet	1000BASET1-USB-MATENET

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: February 24th 2025

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.

9 Ordering Information

Product Number	Description
1000BASET1-USB-MATENET	100/1000BASE-T1 USB Interface MATEnet
HARNESS-MATENET-MATENET-0M5	TE MATEnet female to MATEnet female cable harness (unshielded twisted pair); length 0.5 m
HARNESS-MATENET-MATENET-2M	TE MATEnet female to MATEnet female cable harness (unshielded twisted pair); length 2 m
HARNESS-MOLEX6-OPEN-1M	6-pin Molex Micro-Fit to open end; length 1 m
DIN-BRACKET-UNI	Universal holder for mounting any enclosure on a DIN rail

Table 9 Product Numbers

10 Contact

MACH SYSTEMS s.r.o.

www.machsystems.cz

info@machsystems.cz

Czech Republic

Company registration: 29413893

EU VAT number: CZ29413893