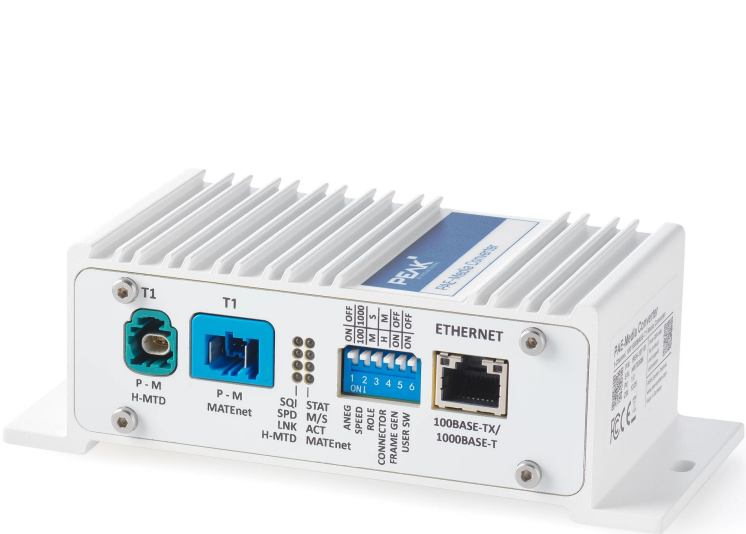


# PAE-Media Converter

## User Manual



# Relevant Products

Product designation	Model	Part no.
PAE-Media Converter		IPEH-101101

## Imprint

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Those responsible for the use of the product must acquire sufficient knowledge in order to ensure that the product is used correctly in their specific application. PEAK-System assumes no liability or responsibility for problems that may arise from improper use or the use of undocumented functions.

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# 1 Introduction

## 1.1 Description and Intended Use

The PAE-Media Converter allows conversion between Standard Ethernet and Single-Pair Ethernet (SPE), which is typically used in the automotive and industrial sectors. This, for example, enables a PC to easily communicate with a vehicle control unit.

The converter provides transparent bit-level communication with support for Fast Ethernet and Gigabit Ethernet. The speeds of 100/1000 Mbit/s can be set manually or determined via auto-negotiation. Thanks to the dual-interface design with H-MTD and MATenet connectors for Single-Pair Ethernet, as well as power supply via USB or Phoenix connector, the device can be flexibly integrated into various application environments.

The device is configured using DIP switches, also during operation. Furthermore, the PAE-Media Converter supports software-based configuration over the USB connection via a USB API. This allows, for example, SPE communication failures to be generated automatically in order to validate vehicle behavior on test benches.

## 1.2 Properties at a Glance

- Standard Ethernet connection:
  - 100BASE-TX / 1000BASE-T according to IEEE 802.3u / 802.3ab
  - RJ45 connector
- Single-Pair Ethernet connection:
  - 100BASE-T1 / 1000BASE-T1 according to IEEE 802.3bw / 802.3bp
  - Switchable between H-MTD and MATenet connector
- 100/1000 Mbit/s transfer rates, configurable manually or via auto-negotiation
- Configuration with DIP switches, also during operation

- Optional software-based configuration and status queries via USB API, effective until reset
- Voltage supply 6 to 36 V via supply connector or 5 V via USB-C connector
- Monitoring of the internal temperature, shut-off in case of overtemperature
- Aluminum profile housing with flange, front and rear panels made of composite materials
- LEDs for device status and power supply
- Extended operating temperature range -40 to +85 °C (-40 to +185 °F); to +70 °C (+158 °F) for product version 1.0

## 1.3 Scope of Supply

- PAE-Media Converter in aluminum profile housing
- Mating connector with screw terminals for voltage supply, type Phoenix Contact MC1,5/2-STF-3,81 1827703
- Printed quick start guide

Download:

- User manual in PDF format

## 1.4 Optional Accessories

Part no.	Designation	Properties
IPEK-100001	PAE-Cable H-MTD	H-MTD plugs on both ends, length 2 m



Part no.	Designition	Properties
IPEK-100002	PAE-Cable MATEnet	MATEnet plugs on both ends, length 2 m



## 1.5 Prerequisites for Operation

- Supply voltage 6 to 36 V DC to connect to mating connector for supply jack
- or
- Supply via USB cable with USB-C plug, minimum 500 mA

## 1.6 Glossary

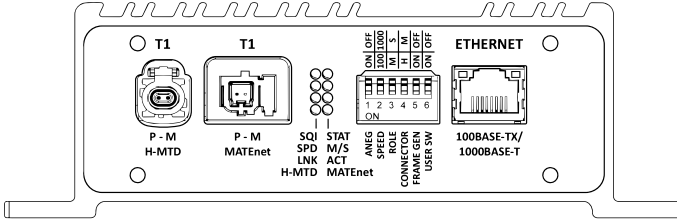
This document uses the following abbreviations for elements and functions of the PAE-Media Converter:

Abbreviation	Term	Explanation
ANEG	Auto-negotiation	Auto-negotiation of the Ethernet transfer rate and the SPE role (Master/Slave).
SPE	Single-Pair Ethernet	Dual-wire Ethernet for automotive and industrial applications, also known as T1 (from 100BASE-T1 and 1000BASE-T1)
MPE	Multi-Pair Ethernet	Also known as Standard Ethernet; is typically used for Ethernet connections with RJ45 connectors in local area networks.
USB CDC	USB Communications Device Class	Allows USB devices to appear as a virtual serial interface (COM port).

# 2 Operation of the Device

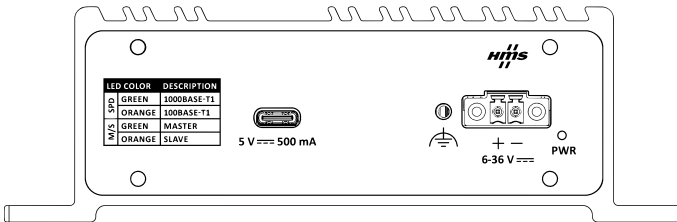
## 2.1 Overview of the Device Elements

### Device Front



- T1 connectors H-MTD and MATEnet for Single-pair Ethernet (P = Plus, M = Minus)
- Status LEDs (see section 2.4 on page 10)
- DIP switches for device configuration (see section 2.2 on the next page)
- ETHERNET connector for Standard Ethernet (MPE), RJ45 socket

### Device Back



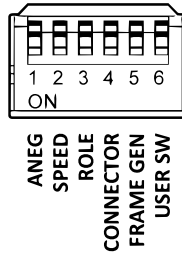
- USB-C connector for configuration and/or for alternative supply (see section 3 *USB API for Configuring During Runtime* on page 13)
- Connection for functional grounding, M3 screw
- Phoenix power connector 6 to 36 V DC
- PWR status LED for supply

## 2.2 Device Configuration via DIP Switches

When the PAE-Media Converter starts (after powering on) or restarts (after being reset via the USB API), it reads the device configuration from the DIP switches.

During operation ...

- changes to the DIP switches take effect immediately.
- a switch can be overridden via the USB API (see 3 *USB API for Configuring During Runtime* on page 13).



Switch	Function	Upper position	Lower position (ON)	Corresponding LED indicator	Remark
1/ANEG	Automatically negotiate Ethernet transfer rate and SPE role	off	on	STAT	Manual setting of the transfer rate should be preferred. Information about auto-negotiation in section 2.5 on page 11.
2/SPEED	Manually set Ethernet transfer rate (ANEG off)	1000 Mbit/s	100 Mbit/s	SPD green: 1000 Mbit/s SPD yellow: 100 Mbit/s	The SPE peer must have the same manual setting.

Switch	Function	Upper position	Lower position (ON)	Corresponding LED indicator	Remark
3/ROLE	SPE role (ANEG off)	Slave	Master	M/S green: Master M/S yellow: Slave	The master provides the clock signal for SPE communication. The peer device must have the opposite setting.
4/CONNECTOR	Used SPE connector T1	MATenet (right connector)	H-MTD (left connector)	H-MTD / MATenet each green	The other connector is deactivated.
5/FRAME GEN	Frame Generator SPE	off	on	none	For testing purposes; 64-byte frames with alternating bits are continuously generated on the SPE side.
6/USER SW	Reserved	no function	no function	none	Upper position recommended.

## 2.3 Putting into Operation

Follow these steps to put the PAE-Media Converter into operation:

1. Configure the device using the DIP switches.
2. Connect the device to a computer or an MPE switch via the RJ45 *ETHERNET* port using a standard Ethernet cable.
3. Connect the device to an SPE peer via one of the two T1 ports using an appropriate cable.

Depending on the configuration, the PAE-Media Converter can establish an SPE connection either via the H-MTD port (left) or via the MATenet port (right). Simultaneous data transmission via both SPE ports (T1) is not possible.

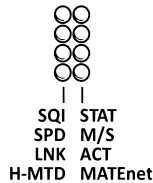
#### 4. Connect a power supply.

Power can be supplied either via the power connector (using the provided screw terminal plug) or via USB (500 mA). If both connectors are used, the power supply via the power connector is prioritized by the device.

The *PWR* LED on the device back lights up green, and the LED matrix on the device front indicates the status of the SPE communication.

## 2.4 Status LEDs

### LED Matrix on the Device Front



LED	Description	Indication	Meaning
SQI	Signal Quality Index Signal quality of the SPE connection (0 to 7)	green	Good signal quality (SQI = 6 or 7)
		yellow	Medium signal quality (SQI = 3 to 5)
		red	Low signal quality (SQI = 0 to 2)
STAT	Status Auto-Negotiation (ANEG) Matching of automatically negotiated transfer rates between SPE PHY and MPE PHY; details in section 2.5 <i>Auto-Negotiation of the Transfer Rate (ANEG)</i> on the next page	green	SPE PHY and MPE PHY both have a link and their transfer rates are matching
		yellow blinking	No match yet in transfer rates
		red blinking	No match in transfer rates
		off	Auto-Negotiation (DIP switch 1/ANEG) is set to off
SPD	Speed SPE transfer rate	green	1000 Mbit/s (1000BASE-T1)
		yellow	100 Mbit/s (100BASE-T1)

LED	Description	Indication	Meaning
M/S	Master/Slave SPE role (Master acts as clock source for the SPE connection)	green	Master
		yellow	Slave
LNK	SPE Link Connection to the SPE peer	off	No SPE connection
		green	SPE connection established
ACT	SPE Activity Data transfer via SPE	yellow blinking	Data transfer on the SPE connection
H-MTD MATEnet	Used SPE connector (T1)	green	The corresponding SPE connector is used

### LEDs on the MPE RJ45 Socket

LED	Description	Indication	Meaning
left	MPE Activity Data transfer via MPE	green blinking	Data transfer on the MPE connection
right	MPE Link Connection to the MPE peer	off	No MPE connection
		yellow	MPE connection established

### LED on the Device Back

LED	Description	Indication	Meaning
PWR	Power Power supply for the device	off	No power supply available
		green	Power supply provided, either via the two-pin power connector or via USB

## 2.5 Auto-Negotiation of the Transfer Rate (ANEG)

If DIP switch 1/ANEG is in the lower position (ON) when the device starts up, or is set to that position during operation, the transfer rates of the SPE PHY and MPE PHY, as well as the role of the SPE PHY, are automatically adjusted. In this mode, the settings of DIP switches 2/SPEED and 3/ROLE are ignored.



**Note:** The SPE peer must support auto-negotiation (ANEG), and the feature must also be enabled on that end.

The following LEDs are relevant for the status of the auto-negotiation:

- *STAT* (Status): process status when auto-negotiation is enabled
- *SPD* (Speed): negotiated transfer rate
- *M/S* (Master/Slave): negotiated SPE role

See section 2.4 *Status LEDs* on page 10.

# 3 USB API for Configuring During Runtime

When connected to a PC via USB, the PAE-Media Converter appears as a USB device of the Communication Device Class (CDC). No special device driver needs to be installed.

The operating system recognizes the device as a serial USB device: in Windows, it appears as a COM<sub>x</sub> serial port; in Linux, it appears as the device `/dev/ttyACMx`. Using text-based commands via the serial port, the device can be configured and status information can be read. The individual DIP switch configurations can be overridden with corresponding USB API commands. The reconfiguration remains in effect until the corresponding DIP switch is toggled again or the device is restarted.

One possible use case is automated testing of a system's response to a connection failure by switching between the two Single-pair Ethernet connectors.

You can either send commands (listed below) to the device manually via a terminal emulation program, or you can create a script or program that sends commands to the device via the virtual serial interface and evaluates the responses.

Communication takes place using ASCII strings terminated with CR and LF characters. The device responds to commands with a line of ASCII text, also terminated by CR and LF.

## 3.1 Usage Hints

### Serial Port under Windows

PowerShell command for determining (all three lines at once):

```
Get-PnpDevice -Class Ports `
| Where-Object { $_.InstanceId -match "VID_0C72&PID_0040" } `
| Select-Object -ExpandProperty FriendlyName
```

Sample result: USB Serial Device (COM10)

The sought serial port is shown in parentheses in the result. If no response is shown, no PAE-Media Converter is connected via USB.

### Serial Port under Linux

Bash command for determining:

```
realpath /dev/serial/by-id/*0C72*0040*
```

Sample result: /dev/ttyACM0

The result shows the sought serial port. If a message such as “File or directory not found” appears, no PAE-Media Converter is connected via USB.

### Tips for Manual Configuration Using a Terminal Emulation Program

- Enable local echo for keyboard input.
- Enable supplemental carriage return (CR) and line feed (LF).
- Set line width to at least 100 characters.

### Rules for Sending Commands

- The **baud rate setting** is irrelevant for the USB serial connection.
- Commands are **not case-sensitive**.
- **Spaces** must be observed.
- The **order of command parameters** must not be changed.

## 3.2 Commands

**Command:**

CONFIG SET [SPEED=X] ROLE=Y CONNECTOR=Z

**Parameters:**

X: 100 | 1000

Y: SLAVE | MASTER | KEEP

Z: HMTD | MATENET | KEEP

**Description:**

Sets the device's operating mode; the parameters specify the common transfer rate for MPE and SPE, the SPE role, and the SPE port used; parameter X can be omitted if the transfer rate is not to be changed; KEEP retains the current setting for the parameter (not for parameter X).

**Command:**

CONFIG GET

**Parameters:**

(none)

**Description:**

Retrieves the current configuration and returns the following values:

SPEED: Ethernet transfer rate, common for SPE and MPE

ROLE: SPE role (Master or Slave)

CONNECTOR: used SPE connector

FRAMEGEN: frame generator activation status

**Command:**

CONFIG AUTONEG X

**Parameters:**

X: ON | OFF

**Description:**

Automatically adjusts the Ethernet transfer rate for both SPE and MPE; information in section 2.5 *Auto-Negotiation of the Transfer Rate (ANEG)* on page 11.

**Command:**

STATUS GET

**Parameters:**

(none)

**Description:**

Shows the current device status: SPE link, SPE transfer rate, SPE role, SPE polarity, SPE SQI, MPE link, MPE transfer rate, MPE duplex mode.

**Command:**

DEVICE VERSION X

**Parameters:**

X: FW | HW

**Description:**

Reads the firmware or the hardware version number; if X is omitted, both are displayed.

**Command:**

DEVICE SERIAL

**Parameters:**

(none)

**Description:**

Reads the device's serial number.

**Command:**

DEVICE IDENTIFY

**Parameters:**

(none)

**Description:**

Reads manufacturer, product designation, microcontroller, and flash chip.

**Command:**

DEVICE UPDATE FW

**Parameters:**

(none)

**Description:**

Puts the device into firmware update mode (DFU).

**Command:**

DEVICE RESET

**Parameters:**

(none)

**Description:**

Restarts the device; the DIP switch settings are applied.

**Command:**

HELP

**Parameters:**

(none)

**Description:**

Shows a list of the USB API commands.

**Command:**

CONFIG MRVL SET FRAMEGEN=X

**Parameters:**

X: 0 (off) | 1 (on)

**Description:**

Enables the frame generator for testing purposes, which continuously generates 64-byte frames with alternating bits on the SPE side.

# 4 Technical Specifications

## Power Supply

Supply voltage	Power connector (prioritized supply): 6 to 36 V DC alternatively via USB: 5 V
Power consumption	< 2.5 W
Connector	<ul style="list-style-type: none"><li>2-pin Phoenix connector with screw terminal block, mating connector type Phoenix Contact MC1,5/2-STF-3,81 1827703</li><li>alternatively USB-C</li></ul>

## Single-Pair Ethernet (SPE)

Specifications	100BASE-T1 according to IEEE 802.3bw 1000BASE-T1 according to IEEE 802.3bp
Transfer rates	100 Mbit/s, 1000 Mbit/s, synchronous with Standard Ethernet
PHY	Marvell 88Q2220
Connectors	<ul style="list-style-type: none"><li>H-MTD, socket with Z coding, compatible with plug codings A to F, and Z</li><li>MATEnet, socket with C coding, compatible with plug codings C and Z</li><li>Selection of a connector via configuration</li></ul>
Number of mating cycles specified by manufacturer	H-MTD: $\geq 25$ MATEnet: $\geq 20$

## Standard/Multi-Pair Ethernet (MPE)

Specifications	100BASE-TX according to IEEE 802.3u 1000BASE-T according to IEEE 802.3ab
Transfer rates	100 Mbit/s, 1000 Mbit/s, synchronous with Single-Pair Ethernet
PHY	Analog Devices ADIN1300
Connector	RJ45

## USB

USB connector	USB-C socket
Communication standard	USB 2.0
USB device class	CDC (Communication Device Class), provides a virtual serial interface in the operating system of the connected PC
Purposes	<ul style="list-style-type: none"><li>■ runtime configuration via USB API</li><li>■ alternative power supply</li></ul>

## Measures

Size	145 x 68.5 x 46 mm (incl. flange and bolts)
Weight	364 g

## Environment

Operating temperature	-40 to +85 °C (up to +70 °C for product version 1.0) -40 to +185 °F (up to +158 °F for product version 1.0)
Temperature for storage and transport	-40 bis +85 °C (-40 to +185 °F)
Relative humidity	10 to 95 %, not condensing
Ingress protection (IEC 60529)	IP20

## Conformity

RoHS	EU Directive 2011/65/EU (RoHS 2) + EU Directive 2015/863/EU (amended list of restricted substances) DIN EN IEC 63000:2019-05
EMC	EU Directive 2014/30/EU DIN EN IEC 61000-6-2:2019-11 DIN EN IEC 61000-6-3:2022-06

# Appendix A CE Certificate

## EU Declaration of Conformity



This declaration applies to the following product:

Product name: **PAE-Media Converter**  
Item number(s): **IPEH-101101**  
Manufacturer: PEAK-System Technik GmbH  
Leydheckerstraße 10  
64293 Darmstadt  
Germany



We declare under our sole responsibility that the mentioned product is in conformity with the following directives and the affiliated harmonized standards:

### EU Directive 2011/65/EU (RoHS 2) + 2015/863/EU (amended list of restricted substances)

#### DIN EN IEC 63000:2019-05

Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances (IEC 63000:2016);  
German version of EN IEC 63000:2018

### EU Directive 2014/30/EU (Electromagnetic Compatibility)

#### DIN EN IEC 61000-6-2:2019-11

Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments (IEC 61000-6-2:2016);  
German version of EN IEC 61000-6-2:2019

#### DIN EN IEC 61000-6-3:2022-06

Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for equipment in residential environments (IEC 61000-6-3:2020);  
German version of EN IEC 61000-6-3:2021

Darmstadt, 8 June 2026

Kristofer Koch, Product Manager  
HMS Networks, Vehicle Communication, Technology Center Ravensburg

Page 1 of 1

# Appendix B FCC Certificate



FCC - Supplier's Declaration of Conformity

## Supplier's Declaration of Conformity 47 CFR § 2.1077 Compliance Information

Responsible Party:

HMS Industrial Networks Inc.  
35 E Wacker Dr, Suite 1900  
Chicago, IL 60601  
USA  
www.hms-networks.com  
Phone: +1 312 829 0601



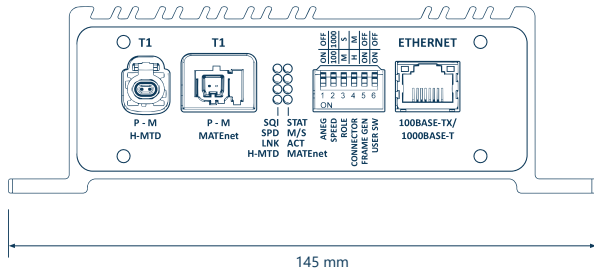
<b>TYPE OF PRODUCT</b>	Automotive Ethernet Media Converter
<b>MODEL(S)</b>	<b>ITEM CODE(S)</b>
PAE-Media Converter	IPEH-101101

We declare under our sole responsibility that the product(s) are in conformity with essential requirements of the FCC standards with 47 CFR Part 15 - Subpart B.

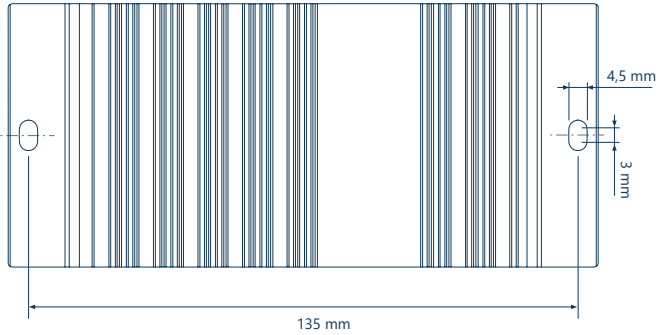
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:  
(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CHICAGO, Juni 01, 2026  
Jennifer Prisco, Vice President & General Counsel

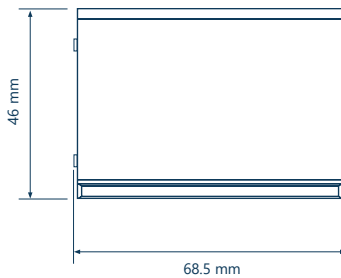
# Appendix C Dimension Drawings



Front view



Top view (with flange holes)



Side view

# Appendix D Disposal

You must dispose of the PAE-Media Converter properly according to local laws and regulations. Because this product contains electronic components, it must be disposed of separately from household waste. When this product reaches its end of life, contact local authorities to learn about disposal and recycling options, or simply drop it off at your local HMS office or return it to HMS.

For more information, see [www.hms-networks.com](http://www.hms-networks.com).

