

# **EMCON 200**

# **User Manual**



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The product information, specifications, and technical data embodied in this manual represent the technical status at the time of writing and are subject to change without prior notice.

We have done our best to ensure that the information given in this manual is useful, accurate and entirely reliable. However, OMICRON does not assume responsibility for any inaccuracies which may be present.

The user is responsible for every application that makes use of an OMICRON product.

OMICRON translates this manual from the source language English into a number of other languages. Any translation of this manual is done for local requirements, and in the event of a dispute between the English and a non-English version, the English version of this manual shall govern.

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# 1 Designated use

*EMCON 200* is an Ethernet media converter used for interconnecting optical fiber and twisted pair copper Ethernet networks. Copper-based connections are limited to a certain data transmission rate and distance, whereas optical fiber cables can transmit more data over much longer distances. A media converter like *EMCON 200* is used to connect your devices with a twisted pair Ethernet port to optical fiber networks.

Furthermore, you can use *EMCON 200* in networks with IEEE 1588 Precision Time Protocol (PTP) time synchronization, and it supports the most common link speeds. *EMCON 200* is also a valuable accessory for OMICRON's CMC and *DANEO 400* test sets that can provide the power supply for *EMCON 200* with Power over Ethernet (PoE).

EMCON 200 is intended for indoor use only.

# 2 Safety instructions

Before working with *EMCON 200*, carefully read the following safety instructions. If you do not fully understand any safety rule or instruction or any part thereof, contact OMICRON electronics before proceeding ( $\rightarrow$  page 17).

### 2.1 Symbols used

In this manual, the following symbols indicate safety instructions for avoiding hazards:

#### CAUTION



Minor or moderate injury may occur if the appropriate safety instructions are not observed.

### 2.2 Rules for use

- Only use *EMCON 200* after you have read and understood this user manual.
- ▶ EMCON 200 shall be used by adults only.
- Keep the EMCON 200 packaging out of reach from children. The EMCON 200 packaging contains small parts and plastic bags that may pose a choking hazard to children.
- ► EMCON 200 and its accessories shall only be used when in a technically sound condition. Before use, always check EMCON 200 and its accessories for damage.
- EMCON 200 is exclusively intended for the application areas specified in section Designated use on page 4. The manufacturer/distributors are not liable for damage resulting from unintended usage. The user alone assumes all responsibility and risk.

### 2.3 Safe operation procedures

- Do not operate EMCON 200 outside the specified conditions (see section Technical data on page 14).
- ▶ Do not operate EMCON 200 when explosive gas or vapors are present.
- Always make sure that no liquid of any kind enters the device.
- ▶ Do not open *EMCON 200* or remove any of its housing components.

### 2.4 Cleaning

To clean *EMCON 200*, use a cloth dampened with isopropanol alcohol.

## 3 Compliance statements

EMCON 200 is designated in the following statements as 'product', 'equipment', or 'apparatus'.

#### **Declaration of conformity (EU)**

The equipment adheres to the guidelines of the council of the European Community for meeting the requirements of the member states regarding the electromagnetic compatibility (EMC) directive and the RoHS directive.

#### FCC compliance (USA)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

#### ICES-003 compliance (Canada)

This Class B digital apparatus complies with Canadian CAN ICES-3 (B).

Cet appareil numérique de la classe B est conforme à la norme NMB-3 (B) du Canada.

# 4 Recycling

This device (including all accessories) is not intended for household use. At the end of its service life, do not dispose of the device with household waste!



#### For customers in EU countries (incl. European Economic Area)

OMICRON devices are subject to the EU Waste Electrical and Electronic Equipment Directive (WEEE directive). As part of our legal obligations under this legislation, OMICRON offers to take back the device and ensure that it is disposed of by authorized recycling agents.

#### For customers outside the European Economic Area

Please contact the authorities in charge for the relevant environmental regulations in your country and dispose the OMICRON device only in accordance with your local legal requirements.

## 5 Main features

EMCON 200 comes with the following main features:

- Cut-through forwarding between optical fiber and twisted pair copper networks
  - 100BASE-TX to 100BASE-X
  - 1000BASE-TX to 1000BASE-X
- PTP transparent clock according to IEEE 1588-2008 for preserving time synchronization
- Power supply with Power over Ethernet (PoE) or USB
- Link speeds of 100 Mbit/s or 1 Gbit/s (determined by the connected SFP transceiver)
- Various fiber types (depending on SFP module) for high flexibility
- Auto-negotiation with link partners
- Full wire speed performance
- No frame size limit (jumbo frames support)
- Link fault pass through
- Low power consumption

### 6 Device overview



- 1 **Link speed:** The LEDs show you which speed is active. If both LEDs are blinking, a link speed mismatch is detected ( $\rightarrow$  page 10).
- 2 **Conversion:** Toggle between PTP transparent and direct conversion ( $\rightarrow$  page 11). Use a ballpoint pen or a pointed tool to operate the switch.
- 3 **Power:** The LED shows you whether *EMCON 200* is active.
- 4 **USB port:** Connect a Micro-B USB 2.0 connector to power the device with a USB charger or a PC/laptop.
- 5 **SFP port:** Insert your SFP transceiver and connect the optical fiber cable.

#### CAUTION

#### Minor or moderate injury may occur.

- The optical fiber SFP transceiver modules are equipped with a Class 1 laser that emits invisible radiation. Do not look directly into a laser aperture, as prolonged exposure may cause eye damage.
- 6 **ETH port:** Connect your twisted pair Ethernet cable and establish a PoE connection. Once a physical link is established, the ETH status LEDs show the link and activity status:
  - Green LED is on: Link is active.
  - Yellow LED is blinking: Data is being transmitted.

# 7 Link speeds

*EMCON 200* supports the two most common optical fiber network link speeds: 100 Mbit/s and 1 Gbit/s. There is no link speed conversion between the optical fiber and twisted pair Ethernet networks. The SFP transceiver in use determines the link speed of the twisted pair Ethernet network connection.

For example, when you use a 100 Mbit/s SFP transceiver, the link speed in the twisted pair Ethernet cable is 100 Mbit/s as well:



#### Link speed mismatch

If the twisted pair Ethernet link partner of *EMCON 200* does not support the link speed of the connected SFP transceiver, *EMCON 200* shows one of the following error behaviors:

- The green LED at the ETH port is off, and it is not possible to establish a network link.
- Both link speed LEDs are blinking.

**Solution:** Make sure that the twisted pair Ethernet link partner is configured with auto-negotiation and that you are using the right SFP transceiver for your application. After a few seconds, *EMCON 200* tries to establish the link again with the link speed of the connected SFP transceiver.

# 8 Conversion modes

*EMCON 200* is a media converter with cut-through forwarding and offers the following two conversion modes: PTP mode and direct mode.

### 8.1 PTP mode

*EMCON 200* works as a PTP transparent clock that preserves PTP time synchronization. It modifies PTP messages as they pass through the media converter. *EMCON 200* knows how long a packet needs to pass through, i.e., it knows the packet's residence time. *EMCON 200* writes this residence time into the correction field of all PTP event packets.

### 8.2 Direct mode

When using direct mode, data is converted directly on the physical layer without adding or removing any information. In this mode, *EMCON 200* has minimum packet delays, but the delays are different for the two directions (i.e., "fiber to copper" and "copper to fiber"). The asymmetry of the packet delays affects the PTP path delay measurements, and this influences the PTP time synchronization accuracy in the network.

In special cases where two *EMCON 200* media converters are used "back to back", the asymmetry of the direct mode is compensated. Two common examples are shown in subsections Network TAP and Long distance fiber connections.

### 8.2.1 Network TAP

When you set up a network TAP to monitor or record network traffic, use two *EMCON 200* media converters to connect your tapping device (e.g., OMICRON's *DANEO 400* device) to the optical fiber network. The packet asymmetry created by the first media converter ("fiber to copper" connection) is compensated by the second media converter ("copper to fiber" connection).



Twisted pair Ethernet cables

### 8.2.2 Long distance fiber connections

For data transmissions over long distances, optical fiber cables are used. With *EMCON 200* you can connect your twisted pair Ethernet network on both ends of the line to the optical fiber cabling. Again, the packet asymmetry created by the first *EMCON 200* media converter is compensated by the second *EMCON 200* media converter.



### 9 **Powering options**

### 9.1 **PoE - Power over Ethernet**

To supply *EMCON 200* with PoE, connect it with an Ethernet cable to your power sourcing equipment (PSE), such as OMICRON's CMC or *DANEO 400* devices. If no PSE is available, you can use a PoE injector instead.

### 9.2 USB

You can establish the power supply for *EMCON 200* via its Micro-B USB 2.0 port. Use a common USB charger (e.g., from your mobile phone) or connect *EMCON 200* with a USB cable to your PC or laptop.

# 10 Technical data

Ports	
Twisted pair ETH port	100BASE-TX or 1000BASE-T
	<ul> <li>Auto-negotiation (100 / 1000 Mbit/s full duplex, depending on SFP transceiver)</li> </ul>
Optical fiber SFP port	• 100BASE-X or 1000BASE-X
	• 50/125 or 62.5/125 multi-mode fiber
	• 9/125 single-mode fiber
	Far end fault indication
	Auto-negotiation for 1000Base-X
USB port	Micro-B USB 2.0

Timing			
IEEE 1588-2008 protocol	Supports E2E and P2P delay mechanism		
	<ul> <li>Supports Layer 2 (with/without VLAN), IPv4, and IPv6 transport mechanisms</li> </ul>		
	No configuration required		
	<ul> <li>Suitable for PTP profiles such as IEC 61850-9-3 or IEEE C37.238-2011</li> </ul>		
PTP transparent clock	<ul> <li>Corrects internal latencies and inherent conversion asymmetries</li> </ul>		
	Updates PTP correction field for all event messages		
	Enabled in PTP conversion mode		
Minimal jitter	Time stamping resolution: 4ns		
	Typically <= 8ns in PTP conversion mode		
Low latency	PTP conversion mode:		
	• 25467 ns at 100 Mbit/s		
	• 2894 ns at 1 Gbit/s		
	Direct conversion mode:		
	• 915 ns at 100 Mbit/s		
	• 432 ns at 1 Gbit/s		

Power over Ethernet (PoE)	Class 1 powered device according to IEEE 802.3af
USB	< 2.5 W with active link depending on SFP transceiver

Mechanics	
Dimensions (L x W x H)	110 mm x 50 mm x 25 mm (4.3" x 2.0" x 0.98")
Weight	128 g (0.28 lb)

Environmental conditions			
Operating temperature	- 25 °C + 50 °C (- 13 °F + 122 °F)		
Humidity	5 % 95 % relative humidity; no condensation		

Safety standards			
Europe	EN 62368-1		
USA	UL 62368-1		
International	IEC 62368-1		

Electromagnetic compatibility			
Europe	EN 61326-1*; EN 55032 Class B; EN 55024		
USA	47 CFR 15 class B of FCC		
International	IEC 61326-1*; CISPR 32 Class B; CISPR 24		

\* Only applicable if EMCON 200 is used together with a measuring device such as OMICRON's DANEO 400.

# **11** Ordering information for SFP transceivers

OMICRON offers some SFP transceivers that are tested and recommended for use with *EMCON 200*. However, the SFP port is unlocked, and you can use any SFP transceiver of your choice (at your own responsibility).

SFP transceivers are not included in the delivery, but you can order the following recommended SFP transceivers separately:

Туре	Media*	Wavelength	Distance	Ordering number
100BASE-FX	MM	1310 nm	2 km (1.24 miles)	P0000600
1000BASE-SX	MM	850 nm	550 m (1,805 ft)	VEHZ1112
1000BASE-LX	SM	1310 nm	10 km (6.21 miles)	VEHZ1111

\* MM = multi-mode; SM = single-mode

# Support

When you are working with our products we want to provide you with the greatest possible benefits. If you need any support, we are here to assist you!

### 24/7 Technical support - get support



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