CMC 850

User Manual

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This manual is a publication of OMICRON electronics GmbH.

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

OMICRON electronics 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.

Table of Contents

1 Preface

The purpose of this manual is to familiarize users with the *CMC 850* test set and to show how to properly use it in various application areas. The manual contains important tips on how to use *CMC 850* safely, properly, and efficiently. Its purpose is to help you avoid danger, repair costs, and down time as well as to help maintain the reliability and life of *CMC 850*.

This manual is to be supplemented by existing national safety standards for accident prevention and environmental protection. Keep it available at the site where *CMC 850* is used. It should be read by all personnel operating the test set. In addition to the manual and the applicable safety regulations in the country and at the site of operation, heed the usual technical procedures for safe and competent work.

This manual describes the *CMC 850* hardware - that is, the physical test set. In order to get familiar with the software for controlling and configuring *CMC 850*, please refer to the *Test Universe*, *RelaySimTest* and/or the Web Interface Help and their accompanying software manuals.

2 Safety Instructions

Before operating the *CMC 850* test set, carefully read the following safety instructions. Only operate (or even turn on) *CMC 850* after you have read this manual and fully understood the instructions herein.

CMC 850 may only be operated by trained personnel. Any maloperation can result in damage to property or persons.

2.1 Rules for Use

- *CMC 850* should only be used when in a technically sound condition. Its use should be in accordance with the safety regulations for the specific job site and application. Always be aware of the dangers of the high voltages and currents associated with this equipment. Pay attention to the information provided in the manual and the software documentation.
- *CMC 850* is exclusively intended for the application areas specified in section 3 "Designated Use". The manufacturer/distributors are not liable for damage resulting from unintended usage. The user alone assumes all responsibility and risk.
- The instructions provided in this manual and the associated software manuals are considered part of the rules governing proper usage.
- Do not open *CMC 850* or remove any of its housing components.

2.2 Orderly Practices and Procedures

- Keep this manual available on site where *CMC 850* is used, either in electronic form as PDF or printed-out.
- Personnel assigned to using *CMC 850* must have read this manual and fully understood the instructions herein.
- Do not carry out any modifications, extensions or adaptations at *CMC 850*.

2.3 Operator Qualifications

- Testing with *CMC 850* should only be carried out by authorized and qualified personnel.
- Personnel receiving training, instruction, direction, or education on *CMC 850* should remain under the constant supervision of an experienced operator while working with the equipment.

2.4 Safe Operation Procedures

- Follow the instructions in section 6 "Setup and Operation" that describes how to set *CMC 850* into operation.
- Do not use any other power supply unit for *CMC 850* than the one provided by OMICRON.
- Do not block the access to safety-relevant test set components like the main power switch or the power cord. In cases of an emergency, these components need free and quick access.
- Before connecting and disconnecting test objects, verify that all outputs have been turned off. Never connect or disconnect a test object while the outputs are active.
- When disconnecting power supply cables or test leads, always start from the device feeding the power or signal.
- Do not operate *CMC 850* under wet or moist conditions (condensation).
- Do not operate *CMC 850* when explosive gas or vapors are present.
- If *CMC 850* is opened by unauthorized personnel, all guarantees are invalidated.
- Connect the *CMC 850* low level outputs LL out 1-6, LL out 7-12 and “external Interface” only to external devices that meet the requirements for low level equipment according to EN 60950 or IEC 60950.
- Connect ETH1 and ETH2 only to Ethernet ports. Do not connect them to telephone plugs.
- If *CMC 850* seems to be functioning improperly, please contact the OMICRON Technical Support (→ page 27).

2.5 Compliance Statements and Recycling

CMC 850 is designated in the following statements as “product”, “equipment”, or “apparatus”.

Declaration of Conformity (EU)

The product adheres to the specifications of the guidelines of the council of the European Community for meeting the requirements of the member states regarding the electromagnetic compatibility (EMC) Directive 2014/30/EU, the low voltage Directive 2014/35/EU, and the RoHS Directive 2011/65/EU.

FCC Compliance (USA)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

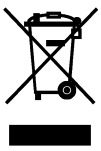
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Declaration of Compliance (Canada)

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de le classe A est comforme à la norme NMB-003 du Canada.

2.6 Information for Disposal and Recycling



This test set (including all accessories) is not intended for household use. After use, the test set cannot be disposed of as household waste!

For Customers in EU Countries (incl. EEA)

OMICRON test sets are subject to the EU Waste Electrical and Electronic Equipment Directive 2012/19/EU (WEEE directive). As part of our legal obligations under this legislation, OMICRON offers to take back the OMICRON test set and ensure that it is disposed of by authorized recycling agents.

For Customers Outside the EEA

Please contact the competent authorities for the relevant environmental regulations in your country and dispose of the OMICRON test set only in accordance with your local legal requirements.

3 Designated Use

CMC 850 is a test set designated to evaluate, test and commission IEDs (**I**ntelligent **E**lectronic **D**evices) in laboratories or substations that utilize GOOSE and Sampled Values according to IEC 61850.

Any other use of *CMC 850* is considered improper and may result in damage to property or persons.

4 Functionality

CMC 850 is part of OMICRON *Test Universe* system which, in addition to the physical test set, consists of a test software for a computer with a Windows operating system, and, if applicable, external voltage and/or current amplifiers[1], PTP, IRIG-B or GPS[1] time synchronization units or other accessories.

4.1 Interfaces to the Test Environment

To interface with the test environment, *CMC 850* provides two different functionalities.

The main focus is put onto IEC 61850 by employing Ethernet communication.

Additionally, *CMC 850* provides low level outputs to either directly send low level signals to the device under test, or to control external amplifiers.

For detailed information → “Connections and Interfaces” on page 10.

4.2 Operating CMC 850 with a controlling test software

Test Universe

As long as the interaction with devices under test utilizes GOOSE and Sampled Values, the *CMC 850* test set supports all test modules of the *Test Universe* software. Test plans utilizing GOOSE and Sampled Values, initially made for the test sets *CMC 256plus* or *CMC 356,* can also be used with *CMC 850*.

An example *Control Center* (OCC) document that illustrates how to configure the Sampled Values and GOOSE features for *CMC 850* is provided in the Test Library that is installed with the OMICRON *Test Universe*. The OCC document’s name is **CMC 850 Example.occ**, and it is stored at ***...OTU installation path*\Test Library\Samples\General Examples**.

RelaySimTest

The *CMC 850* test set can also be operated by the *RelaySimTest* software. For this, we strongls recommend a **NET-2** interface board to be installed in the test set (→ 5.2.1 "ETH1 and ETH2 Ports").

With a **NET-2** board, a *CMC 850* test set can work with up to 4 Sampled Values streams and GOOSEs simultaneously via both ETH ports.

1. External voltage/current amplifiers and the *CMGPS* Synchronization Unit are not part of the standard scope of delivery. The *CMGPS* Synchronization Unit is a meanwhile discontinued product. For questions about its successor *CMGPS 588* contact the OMICRON Technical Support or visit our website.

4.3 Time Synchronization

- NTP - **N**etwork **T**ime **P**rotocol.

  CMC 850 operates as a client to an NTP server. The time obtained this way is, for example, used for time stamping GOOSE messages.

- PTP - **P**recision **T**ime **P**rotocol.

  CMC 850 operates as a PTP slave node (IEEE 1588-2008, V2). The time obtained this way is, for example, used for time stamping GOOSE messages.

- IRIG-B

  The *CMIRIG-B* interface unit is another option for synchronized testing with CMC test sets and the *Test Universe* software. It serves as the “clearing house” for IRIG-B and PPS signals, regardless whether they come from an external clock or from the CMC itself. *CMIRIG-B* facilitates time synchronized triggering of test sequences or synchronizing Sampled Values to a PPS.

4.4 Web Interface

CMC 850’s embedded functions are accessible via a Web Interface. Any common Web browser can be used to access *CMC 850* and to make use of the embedded functions. The Web Interface menus link to pages dedicated to the different functions.

For a more detailed description, launch the *Web Interface* (→ page 17) and click **Help**.

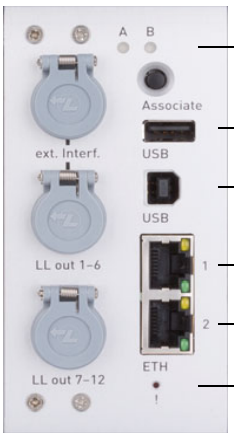
5 Connections and Interfaces

5.1 Power Socket

Power switch ON/OFF

48 VDC input from external power supply unit (isolated to housing).

5.2 Back Panel



Status LED “A” and “B” and "Associate" button (→ page 11)

USB ports (→ page 11)

ETH1 and ETH2 PoE (**P**ower **o**ver **E**thernet) ports (→ page 10)

! button (→ page 11)

5.2.1 ETH1 and ETH2 Ports

Depending on the interface board of your test set, the two PoE Ethernet (**P**ower **o**ver **E**thernet) ports ETH1 and ETH2 are either:

- 10/100Base-TX (twisted pair) Ethernet ports (at **NET-1**(x) boards)
- or 10/100/1000Base-TX (twisted pair) Ethernet ports (at **NET-2** board)

They support auto crossing (auto MDI/MDIX). This means you can use a standard cable or a cross-over Ethernet patch cable.

Since *CMC 850* can be controlled over a network, any distance between the controlling computer and the test set is possible. This enables direct remote control of *CMC 850*, e.g., for end-to-end testing.

The Ethernet ports also provide the basis for the processing of substation protocols according to the IEC 61850 standard. They allow flexible configurations, e.g., for separation of data traffic from different network segments or segregation of substation protocol data and test set control commands.

The yellow and green LEDs at each ETH port reflect the port’s operational status. Depending on your NET-x interface board, their behavior slightly varies → chapter 7.4, "Technical Data of the Communication Ports" on page 20.

5.2.2 USB Ports

The lower USB port (USB type B) at the CMC test set's standard interface **NET-2** board holds a **USB** port to connect *CMC 850* to your computer. To ensure the required EMC compatibility, we strongly recommend to use the OMICRON-supplied cable, only.

The upper USB port (USB type A) at the CMC test set's standard interface **NET-2** board is meant for future use of USB peripherals, such as memory sticks, etc.

For the technical data of the USB port → chapter 7.4, "Technical Data of the Communication Ports" on page 20.

5.2.3 ! Button

The ! button enables you to recover from unsuccessful software image downloads or other emergency situations. To start a new software image download, press the **!** button with a pointed tool or a paper clip while powering-up the CMC. In that case, the test set will not start as usual but wait for a new software image download.

5.2.4 Associate Button

The Associate button has the following functions:

- **Associate with controlling computer**

  An Ethernet communication port enables you to communicate with any CMC available on the network. This may lead to dangerous situations where a user accidentally connects to a device located on a desk of somebody else, emitting unsafe voltages and endangering the person working there.

  To prevent such a situation, a special mechanism is integrated into *CMC 850* that allows only "authorized" clients to control the test set. By using the **Associate** button, the test set is registered for use with a specific host PC. The test set issues voltages and current only when it is associated to the client requesting this. The association process can be initiated by *OMICRON Device Link* (→ "Setup and Operation" on page 16). For more details about this process, refer to the Help of the according tool.

  For the association the Ethernet hardware address (MAC) of the controlling computer is remembered. Consequently, if the network interface on the computer has changed, *CMC 850* has to be associated whenever the MAC address changes.

- **Reset IP Configuration**

  If the **Associate** button is pressed while powering up the CMC test set, the IP configuration of the network interfaces is reset to factory default, which is DHCP/AutoIP for both network interfaces. It may be necessary to reset the IP configuration in this way to recover from settings with conflicting static IP addresses.

5.2.5 Status LED A, B

The status LED A and B are of interest in case of troubleshooting.

A: yellow status LED

- A lit yellow LED indicates that the test set is ready to be controlled by a computer. The hardware checks in the test set are finished, and the test set is properly connected to a computer or a network.
- The LED is off when the test set is waiting for an "emergency software image download". This is the case when pressing the **!** button while powering-up the CMC test set.

B: green LED

If the yellow LED A is off, the green LED B signals the following conditions:

- LED B blinks slowly:

  CMC test set waits for the TFTP download (**T**rivial **F**ile **T**ransfer **P**rotocol) of a software image.
- LED B is lit:

  The TFTP download of the software image is in progress.
- LED B blinks quickly:

  The computer writes (e.g., the software image) to the flash memory of the CMC test set. Do not turn off the CMC test set as long as the writing is in progress.

5.3 Ethernet / Network Settings

General

The test software running on the PC communicates with *CMC 850* via a network connection. Therefore it is possible to either have *CMC 850* directly connected to the computer's network plug by a cable or to have *CMC 850* and the controlling computer connected to a computer network.

The yellow and green LEDs at each ETH port reflect the port's operational status. Depending on your NET-x interface board, their behavior slightly varies → chapter 7.4, "Technical Data of the Communication Ports" on page 20.

IP Configuration

For communication of *CMC 850* with the controlling PC and the OMICRON *Test Universe* software, TCP/IP is used. The IP parameters are set by *OMICRON Device Link*. *CMC 850* can either be set to static IP addresses or use DHCP (**D**ynamic **H**ost **C**onfiguration **P**rotocol) and AutoIP/APIPA (**A**utomatic **P**rivate **IP A**ddressing).

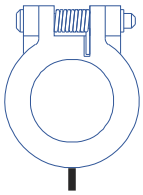
If the IP settings conflict with IP settings of other devices in the network, it is possible to reset the test set to factory defaults (DHCP and AutoIP) by pressing the "Associate" button at the rear of the test set while powering up the test set (→ page 11).

Security / Firewall Settings

To automatically detect and set the IP configuration of *CMC 850* test sets in the network, IP-multicasting is used by the *Test Universe* software. Therefore, a firewall program has to be configured to allow for this communication. For the Microsoft Windows Firewall in the configuration of the firewall is done automatically during installation of the OMICRON *Test Universe*.

The software component on the computer that automatically detects test sets on the network (OMFind.exe) requires an enabled inbound connection on port 4987 for UDP. For TCP communication, the software component on the computer that controls the test sets (CMEngAl.exe) requires an enabled outbound connection on port 2200.

5.4 External Interface (“ext. Interf.”)



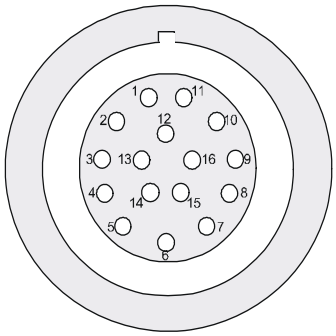
ext. Interf.

The interface connector “external Interface” holds four transistor binary outputs (Bin. out 11 - 14).

Bin. out 11 - 14 are bounce-free binary outputs (small signals) and have a minimal reaction time.

For technical data → “Low Level Binary Outputs “ext. Interf.”” on page 19.

Pin assignment

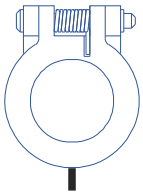


Pin	Function
Pin 1	Reserved
Pin 2	Reserved
Pin 3	Reserved
Pin 4	Neutral (N) connected to GND
Pin 5	Binary output 11
Pin 6	Binary output 12
Pin 7	Binary output 13
Pin 8	Binary output 14
Pin 9	Reserved
Housing	Screen connection

Time Synchronization

To use the OMICRON-supplied *CMIRIG-B* interface unit as reference for the a time synchronization of the IEC 61850 bus system, connect the *CMIRIG-B*‘s front side connector “CMC” to the *CMC 850*‘s “external Interface” connector. This provides both the IRIG-B or PPS reference signal to *CMC 850* and the power supply for the *CMIRIG-B*.

5.5 LL out 1 - 6 and LL out 7 - 12 (Low Level Outputs)



LL out 1 - 6

The interface connectors “LL out 1 - 6” and “LL out 7 - 12” hold a total of 12 independent high accuracy analog signal outputs. These *Test Universe*-controlled signal sources can serve to either drive external amplifiers or to directly provide small signal outputs.

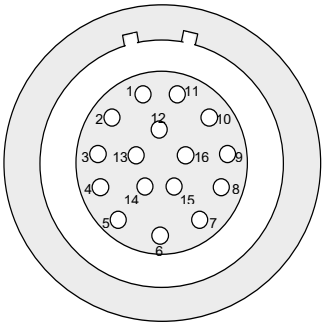
The low level outputs are short-circuit-proof and continually monitored for overload. They deliver calibrated signals in the range from 0 ... 7 V_{eff} nominal (0 ... ± 10 V).

For technical data, → “Low Level Outputs “LL out 1 - 6” and “LL out 7 - 12”” on page 18.

Overload Warning in the Test Software

When a low level output is overloaded, the test software issues an appropriate warning. Refer to the *Test Universe* or *RelaySimTest* Help for more details.

Pin assignment



Pin	Function LL out 1-6	Function LL out 7-12
Pin 1	LL out 1	LL out 7
Pin 2	LL out 2	LL out 8
Pin 3	LL out 3	LL out 9
Pin 4	Neutral (N) connected to GND	
Pin 5	LL out 4	LL out 10
Pin 6	LL out 5	LL out 11
Pin 7	LL out 6	LL out 12
Pin 8-16	For internal purposes	
Housing	Screen connection	

“LL out 1-3”, “LL out 4-6”, “LL out 7-9” and “LL out 10-12” each make up a selectable voltage or current triple.

6 Setup and Operation

Only operate (or even turn on) *CMC 850* after you have read this manual and fully understood the instructions herein.

Before operating *CMC 850* for the first time, use the printed **Quick Start** to verify that all components of the test system are available.

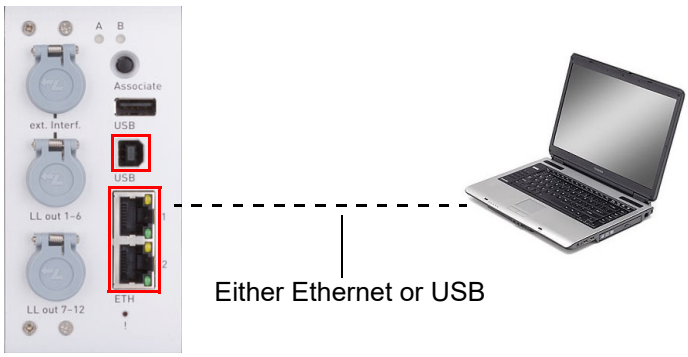
6.1 Installing the test software and connecting the computer to the CMC 850 test set

1. Install the test software on your computer.

   The test software can either be the *Test Universe* or the *RelaySimTest* software.

   Both software packages also install the *OMICRON Device Link*. Use *OMICRON Device Link* to associate CMC test sets that are connected to your computer via Ethernet (ETH).

2. Connect the power supply unit to *CMC 850* and turn on the test set at the ON/OFF switch.
3. Connect the computer to *CMC 850* via:
   - Ethernet cable: Valid for **NET-1B** and **NET-2**.
   - USB: Valid for **NET-2** only.



Use one of the PoE (**P**ower **o**ver **E**thernet) ports ETH1 or ETH2, or the USB port.

6.2 Configuring network settings and accessing Web Interface via Ethernet

1. Locate the *CMC 850* test set in *OMICRON Device Link*
2. Associate the *CMC 850* test set with your computer.
   a) In the device list, right-click the *CMC 850* entry to open a device-related menu.
   b) Click **Associate device** and follow the on-screen instructions.
3. Access the embedded functions via the Web Interface

   CMC 850's embedded functions are accessible via its Web Interface. Any common Web browser can be used to access *CMC 850* and to make use of the embedded functions.

   Alternative method to invoking the Web browser by the procedures described above:

   a) Start a Web browser of your choice on your computer.
   b) Enter *CMC 850*'s IP address (in a format like http://172.22.23.61) into the Web browser's address bar.
   c) Hit the <Return> key.

6.3 Using a *CMIRIG-B* interface unit

To use the OMICRON-supplied *CMIRIG-B* interface unit as reference for the time synchronization of the IEC 61850 bus system, connect the *CMIRIG-B*'s front side connector "CMC" to the *CMC 850*'s "external Interface" connector.

7 Technical Data

General: The values are valid for the period of one year after factory calibration, within 23 °C ± 5 °C at nominal value and after a warm-up time greater than 25 min.

7.1 External Power Supply Unit

Nominal input voltage	110 - 240 VAC; 1 phase
Permissible input voltage	90 ... 264 VAC
Nominal frequency	50/60 Hz
Output voltage	48 VDC (± 6.25 %)
Rated current	≥ 1.66 A
Rated power	≥ 80 W
Power connector	Standard DC barrel jack, Ø 2.1 mm x Ø 5.5 mm x 11 mm; center pin is positive.

7.2 Low Level Outputs “LL out 1 - 6” and “LL out 7 - 12”

Output voltage	-10 V ... +10 V
Max. output current	1 mA
Accuracy	Typical error : < 0.025 %; guaranteed: < 0.07 % at 1 V ... 10 V.
Resolution	250 µV
Harmonic distortion (THD+N)[1]	Typical: < 0.015 %.; guaranteed: < 0.05 %.
Phase error[2]	Typical: 0.02 °; guaranteed: < 0.1 °.
DC offset voltage	Typical: < 150 µV; guaranteed: < 1.5 mV.
Unconventional CT/VT simulation	Linear or Rogowski[3] mode (transient and sine wave).
Insulation	Reinforced insulation to all other potential groups of the test equipment.

1. THD+N: values at 50/60 Hz, 20 kHz measurement bandwidth, nominal value and nominal load.
2. Valid for sinusoidal signals at 50/60 Hz.
3. When simulating Rogowski sensors, the output voltage is proportional to the derivative of the current with respect to time (di(t)/dt).

Accuracy data for analog outputs are valid in the frequency range from 0 to 100 Hz, unless specified otherwise.

Ordering Information

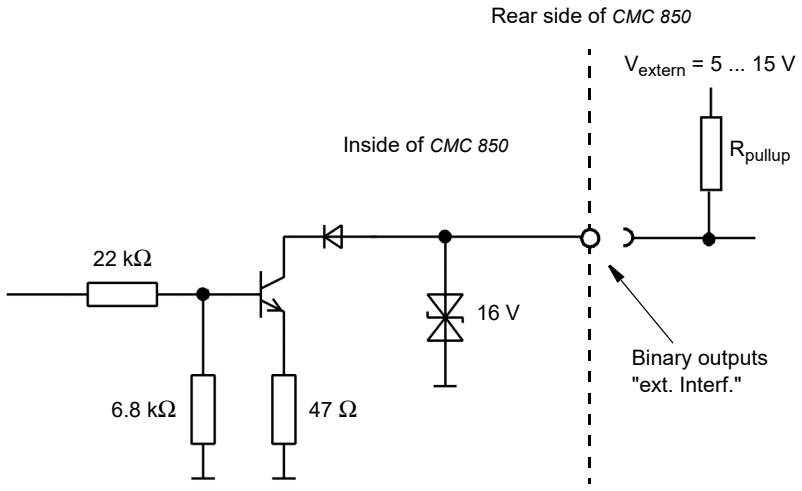
Connector for two guide notches and pull relief	FGB.2B.316.CLAD 72Z
Black anti-bend cable cover	GMA.2B.070 DN

For a manufacturer description about the connection sockets "LL out", visit the Web site http://www.lemo.com.

7.3 Low Level Binary Outputs “ext. Interf.”

Type	Open-collector transistor outputs; external pull-up resistor
Switching voltage	Max. 15 V
Max. input voltage	±16 V
Switch current	Max. 5 mA (current limited); min. 100 µA
Actualization time	100 µs
Rise time	< 3 µs (V_{extern} = 5 V, R_{pullup} = 4.7 kΩ)
Insulation	Reinforced insulation to all other potential groups of the test equipment.

Circuit diagram of binary transistor outputs of “external Interface”



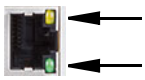
7.4 Technical Data of the Communication Ports

An overview:

A *CMC 850* test set's standard interface board is the **NET-2** board that, in addition to **ETH1**, **ETH2** and USB, provides one extra USB port for the use of USB peripherals, such as memory sticks, etc.

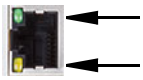
CMC 850 test sets with a **NET-1(x)** board can be upgraded with the new **NET-2** board.

7.4.1 The NET-2 Board

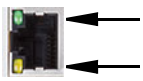
NET-2: 2 x USB port and Ethernet ports ETH1/ETH2		
	USB type	USB 2.0 high speed up to 480 Mbit/s
	USB connector	USB type A (for future use of USB peripherals)
	Output current	500 mA max.
	USB type	USB 2.0 high speed up to 480 Mbit/s; USB 1.1-compatible
	USB connector	USB type B (connect to computer)
	USB cable	USB 2.0 high speed type A-B, 2 m/6 ft.
	ETH type	10/100/1000Base-TX[1] (twisted pair, auto-MDI/MDIX or auto-crossover)
	ETH connector	RJ45
	ETH cable type	LAN cable of category 5 (CAT5) or better
	ETH port status LED 	Depending on the ETH type of your NET-2 interface board's counterpart, the status LED's behavior varies. Physical link established, port active: Mbit/s — Active LED ON 10 — yellow 100 — green 1000 — yellow + green If there is traffic via an ETH port, the active LEDs start blinking.
	ETH **P**ower **o**ver **E**thernet (PoE)	IEEE 802.3af compliant. Port capability limited to one Class 1 (3.84 W) and one Class 2 (6.49 W) power device.

1. 10Base = 10 Mbit/s transfer rate
   100Base = 100 Mbit/s transfer rate
   1000Base = 1000 Mbit/s transfer rate

7.4.2 The NET-1C Board

NET-1C: USB port and Ethernet ports ETH1/ETH2		
	USB type	USB 2.0 full speed up to 12 Mbit/s
	USB connector	USB type B (connect to computer)
	USB cable	2 m/6 ft USB 2.0 high speed type A-B
	ETH type	10/100Base-TX (10/100Mbit, twisted pair, auto-MDI/MDIX or auto-crossover)
	ETH connector	RJ45
	ETH cable type	LAN cable of category 5 (CAT5) or better
	ETH port status LED 	• Physical link established, port active: green LED ON. • Traffic via ETH port: yellow LED is blinking.
	ETH **P**ower **o**ver **E**thernet (PoE)	IEEE 802.3af compliant. Port capability limited to one Class 1 (3.84 W) and one Class 2 (6.49 W) power device.

7.4.3 The NET-1B Board

NET-1B: Ethernet ports ETH1 and ETH2		
	Type	10/100Base-TX (10/100Mbit, twisted pair, auto-MDI/MDIX or auto-crossover)
	Connector	RJ45
	Cable type	LAN cable of category 5 (CAT5) or better
	ETH port status LED 	• Physical link established, port active: green LED ON. • Traffic via ETH port: yellow LED is blinking.
	ETH **P**ower **o**ver **E**thernet (PoE)	IEEE 802.3af compliant. Port capability limited to one Class 1 (3.84 W) and one Class 2 (6.49 W) power device.

7.5 IEC 61850 GOOSE

Simulation	Mapping of binary outputs to data attributes in published GOOSE messages. Number of virtual binary outputs: 360 Number of GOOSEs to be published: 128
Subscription	Mapping of data attributes from subscribed GOOSE messages to binary inputs. Number of virtual binary inputs: 360 Number of GOOSEs to be subscribed: 128
Performance	Type 1A; Class P2/3 (IEC 61850-5). Processing time (application to network or vice versa): < 1 ms.
VLAN support	Selectable priority and VLAN-ID.

7.6 IEC 61850 Sampled Values (Publishing)

Specification	According to the “Implementation Guideline for Digital Interface to Instrument Transformers Using IEC 61850-9-2LE” of the UCA International Users Group and to the "IEC 61869-9:2016 Instrument transformers - Part 9: Digital interface for instrument transformers" (with fixed DataSets).
Sampling Rates	• 4000 Hz (80 SPC @ 50 Hz) - 1 sample per packet • 4800 Hz (80 SPC @ 60 Hz) - 1 sample per packet • 12800 Hz (256 SPC @ 50 Hz) - 8 samples per packet • 15360 Hz (256 SPC @ 60 Hz) - 8 samples per packet • 4800 Hz - 2 samples per packet • 14400 Hz - 6 samples per packet
Synchronization	Synchronization attribute (smpSynch) can be set when *CMC 850* is in synchronized operation mode utilizing *CMIRIG-B*, PTP. Sample count (smpCnt) zero is aligned with top of the second (IRIG-B and PPS). For the accuracy data ⟶ section 7.7 below.
VLAN support	Selectable priority and VLAN-ID.
Max. number of SV streams	3 when used with the *Test Universe* software 4 when used with the *RelaySimTest* software

7.7 Time Synchronization

IRIG-B synchronization with *CMIRIG-B*, timing accuracy (LL out)	Typical error: < 1 µs.; guaranteed: < 5 µs.
GPS synchronization with *CMGPS,*[1] timing accuracy (LL out)	Typical error: < 1 µs; guaranteed: < 5 µs.
Network Time Protocol (NTP)	NTP version 4
Precision Time Protocol (PTP)	Slave node according to IEEE 1588-2008 (V2).

1. The *CMGPS* Synchronization Unit is a meanwhile discontinued product. For questions about its successor *CMGPS 588* contact the OMICRON Technical Support or visit our website.

IEEE 1588-2008 (V2) supported profiles:

- IEEE 37.238-2011 (Power Profile)
- IEC/PAS 61850-9-3: Communication Networks and Systems for Power Utility Automation - Part 9-3: Precision Time Protocol Profile for Power Utility Automation (Utility Profile).

7.8 Environmental Conditions

Operation temperature	0 °C ... +50 °C (+ 32 °F ... + 122 °F)
Storage and transportation temperature	-25 °C ... +70 °C (-13 °F ... +158 °F)
Humidity	5 % … 95 % relative humidity; no condensation.
Climate	Tested according to IEC 68-2-78

7.9 Shock and Vibration

Vibration	Tested according to IEC 60068-2-6; frequency range 10 Hz ... 150 Hz; acceleration 2 g continuous (20 m/s²); 10 cycles per axis.
Shock	Tested according to IEC 60068-2-27; 15 g / 11 ms, half-sinusoid, each axis.

7.10 Mechanical Data

Weight	1.7 kg (3.7 lbs)
Dimensions W x H x D	85 mm x 145 mm x 325 mm (3.3 ” x 5.7 ” x 12.8 ”)
Housing	IP20 according to EN 60529.

7.11 Cleaning

To clean *CMC 850*, use a cloth dampened with isopropanol alcohol. Prior to cleaning, always switch off the power switch and unplug the external power supply unit.

7.12 Safety Standards, Electromagnetic Compatibility, Certificates

CE Conformity, Requirements	
The product adheres to the specifications of the guidelines of the council of the European Community for meeting the requirements of the member states regarding the electromagnetic compatibility (EMC) Directive 2014/30/EU and the low voltage Directive 2014/35/EU.	
Electromagnetic Compatibility (EMC)	
Emission	
Europe	EN 61326-1; EN 61000-6-4; EN 61000-3-2/3
International	IEC 61326-1; IEC 61000-6-4; IEC 61000-3-2/3
USA	FCC Subpart B of Part 15 Class A
Immunity	
Europe	EN 61326-1; EN 61000-6-2; EN 61000-4-2/3/4/5/6/11
International	IEC 61326-1; IEC 61000-6-2; IEC 61000-4-2/3/4/5/6/11
Certified Safety Standards	
Europe	EN 61010-1
International	IEC 61010-1
USA	UL 61010-1
Canada	CAN/CSA-C22.2 No 61010-1
Certificate	Manufactured under an ISO9001 registered system.

8 Software License Information

Parts of the CMC test set software are under OMICRON license, other parts are under open source software licenses. Both the open source license texts and the necessary source code are provided in the **OMICRON Open Source Download Area** at www.omicronenergy.com/opensource/.

Open this address in your Internet browser, click the **Download Software** button, and navigate to the **CMC Embedded Image/** directory.

Look for the file containing your corresponding version in the file name (for example, **Open Source CMC embedded Image 2.50.zip** for version 2.50).

In addition to some open source code packages, the archive contains an overview of all license information of the CMC test set.

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