MPD 800

User Manual

Manual Version: ENU 1223 05 01

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.

Contents

About this manual

This User Manual provides information on how to use the *MPD 800* test system safely, properly and efficiently. The *MPD 800* User Manual contains important safety rules for working with the *MPD 800* acquisition unit and gets you familiar with operating the *MPD 800* acquisition unit. Following the instructions in this User Manual will help you to prevent danger, repair costs, and avoid possible down time due to incorrect operation.

The *MPD 800* User Manual always has to be available on the site where the *MPD 800* acquisition unit is used. The users of the *MPD 800* acquisition unit must read this manual before operating the *MPD 800* acquisition unit and observe the safety, installation, and operation instructions therein.

Reading the *MPD 800* User Manual alone does not release you from the duty to comply with all national and international safety regulations relevant to working on high-voltage equipment.

Safety symbols used

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

DANGER

Death or severe injury will occur if the appropriate safety instructions are not observed.

WARNING

Death or severe injury can occur if the appropriate safety instructions are not observed.

CAUTION

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

NOTICE

Equipment damage or loss of data possible

1 Safety instructions

1.1 Operator qualifications

Working on high-voltage assets can be extremely dangerous. Only authorized personnel who are qualified, skilled and regularly trained in electrical engineering are allowed to operate the *MPD 800* acquisition unit and its accessories. Before starting to work, clearly establish the responsibilities.

Personnel receiving training, instructions, directions, or education on the *MPD 800* acquisition unit must be under constant supervision of an experienced operator while working with the equipment. The supervising operator must be familiar with the equipment and the regulations on site. The operator is responsible for the safety requirements during the whole test.

1.2 Safety standards and rules

1.2.1 Safety standards

Testing with the *MPD 800* acquisition unit must comply with the internal safety instructions and additional safety-relevant documents.

In addition, observe the following safety standards, if applicable:

- EN 50191 (VDE 0104) "Erection and Operation of Electrical Test Equipment"
- EN 50110-1 (VDE 0105 Part 100) "Operation of Electrical Installations"
- IEEE 510 "IEEE Recommended Practices for Safety in High-Voltage and High-Power Testing"

Moreover, observe all applicable regulations for accident prevention in the country and at the site of operation.

Before operating the *MPD 800* acquisition unit and its accessories, read the safety instructions in this User Manual and the appropriate accessory User Manual carefully.

Do not turn on the *MPD 800* acquisition unit and do not operate the *MPD 800* acquisition unit without understanding the safety information in this manual. If you do not understand some safety instructions, contact OMICRON before proceeding (see "Support" on page 65).

Maintenance and repair of the *MPD 800* acquisition unit and its accessories is only permitted by qualified experts at OMICRON Service Centers (see "Support" on page 65).

1.2.2 Safety rules

Always observe the five safety rules:

► Disconnect completely.

► Secure against re-connection.

► Verify that the installation is dead.

► Carry out grounding and short-circuiting.

► Provide protection against adjacent live parts.

1.3 Operating the measurement setup

- ► Switch off the high voltage.
- ► Always obey the five safety rules and obey the following safety instructions.
- ► Always obey the internal safety instructions for working in areas with high voltage to avoid injury.
- ► Before operating the *MPD 800* acquisition unit and its accessories, ground the setup as described in 1.2.2 "Safety rules" on page 6.
- ► Make sure to clear the high-voltage area.
- ► Observe the dangerous areas.
- ► Before switching on the high voltage, leave the high-voltage area.
- ► Make sure that the ground terminal of the test object is in good condition, clean, and free of oxidation.
- ► Do not connect any cable to the test object without a visible grounding of the test object.
- ► Always position the *MPD 800* acquisition unit, the external quadripole (*CPL1*/*CPL2*) and the rechargeable battery pack (*RBP1*) inside of the high-voltage area.
- ► Always operate and place the Multi-device Control Unit (*MCU2*) and the PC in the work area.
- ► Never use the external power supply when the *MPD 800* acquisition unit is operated at high-voltage potential.
- ► Never remove or attach any cables from the *MPD 800* acquisition unit and its accessories or the test object during a test.
- ► Do not use the OMICRON standard power supply during the operation of the *MPD 800* system. A flashover or breakthrough might invisibly damage the OMICRON 24 W DC supply.
- ► Do not use inadequately rated supply cords.
- ► Do not insert objects (for example, screwdrivers) into any input/output socket.
- ► Do not operate the *MPD 800* acquisition unit or its accessories under ambient conditions that exceed the temperature and humidity limits listed in 3 "Technical specifications" on page 52.
- ► Check your additional equipment (for example, PC) for environmental conditions before use.
- ► Always use dry and clean fiber-optic cables which are provided by OMICRON electronics. In dusty regions, use protective caps. Make sure that the cables have ground contact to avoid leakage current.
- ► Do not use metal coated/jacketed conductive fiber-optic cables. Store the fiber-optic cables in a dry area.
- ► Do not operate the *MPD 800* acquisition unit and its accessories in the presence of explosives, gas or vapors.
- ► Do not open the *MPD 800* acquisition unit or its accessories housing.
- ► Do not repair, modify, extend, or adapt the *MPD 800* acquisition unit or its accessories.
- ► Use only the *MPD 800* acquisition unit original accessories available from OMICRON.
- ► Keep the *MPD 800* acquisition unit and its accessories in a dry and clean condition.
- ► Do not expose the *MPD 800* acquisition unit or its accessories to direct sunlight or heating sources.
- ► Use *MPD 800* acquisition unit and its accessories only in a technically sound condition and when its use is in accordance with the regulations.

- If the *MPD 800* acquisition unit or its accessories do not seem to function properly (for example, in case of cable damages, abnormal warming of the batteries during charging, or overheating of components), stop using them and contact your regional OMICRON service center (see "Support" on page 65).
- Do not use CPL and the *MPD 800* acquisition unit outside of an EN50191 compliant environment.
- Always short circuit the *CPL2* **RTN/OUT** output to the **GND** if **RTN/OUT** is not used.
- The AC output of *CPL1 or CPL2* has to be short circuited if not connected to the *MPD 800* acquisition unit.
- Do not place the *MPD 800* acquisition unit, *CPL1/CPL2* and accessories outside of high-voltage area.
- Do not use the voltage display in the MPD software to determine the absence of voltage.
- Keep the appropriate distance to the test object in the high-voltage area.
- Do not use defective equipment.

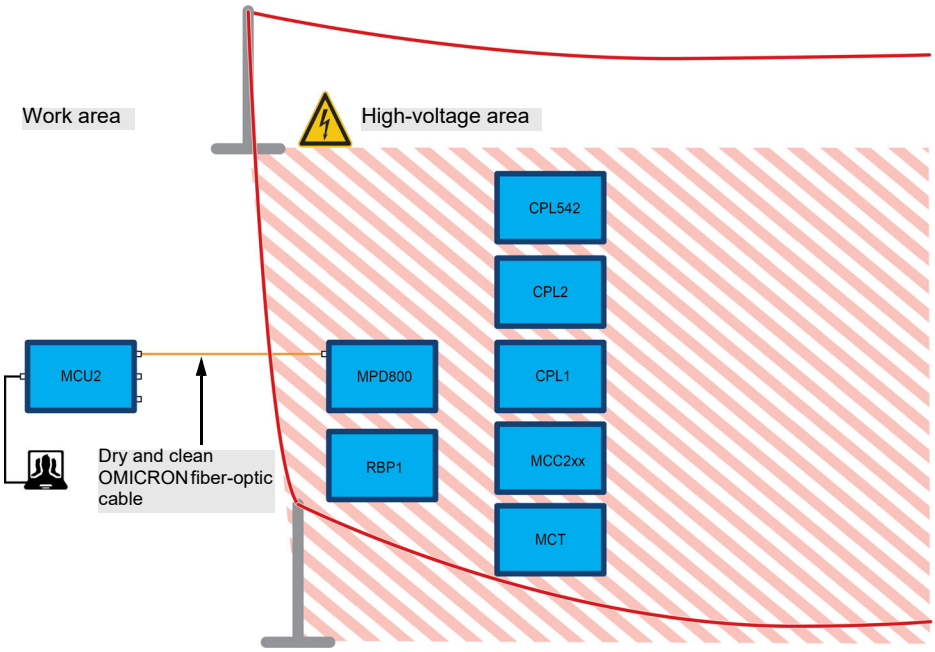


Figure 1-1: Illustration example of the work and high-voltage area established for working with *MPD 800* system

1.4 Orderly measures

The *MPD 800* User Manual or alternatively the e-book has always to be available on the site where the *MPD 800* acquisition unit is operated.

The users of the *MPD 800* acquisition unit and its accessories must read this manual before operating the *MPD 800* acquisition unit and its accessories and observe the safety, installation, and operation instructions therein.

The *MPD 800* acquisition unit and its accessories may only be used in accordance with the user documentation (including but not limited to User Manuals, Reference Manuals, Getting Started manuals and manufacturer manuals). The manufacturer and the distributor are not liable for damage resulting from improper usage.

Opening the *MPD 800* acquisition unit or its accessories without authorization invalidates all warranty claims. Any kind of maintenance, calibration or repair on the device itself may only be carried out by persons authorized by OMICRON.

1.5 Disclaimer

If the equipment is used in a manner not described in the user documentation, the protection provided by the equipment may be impaired.

1.6 Compliance statement

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, the low voltage directive (LVD) and the RoHS directive.

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 la classe A est conforme à la norme NMB-003 du Canada.

1.7 Recycling

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

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

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 test set 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 test set only in accordance with your local legal requirements.

2 *MPD 800* measurement system

2.1 Partial discharge measurement

Partial discharge phenomena, as defined by IEC60270, are localized dielectric breakdowns of a small portion of a solid or liquid electrical insulation system under high-voltage stress.

The detection of partial discharge is of vital importance because partial discharge phenomena often precede an insulation breakdown of high-voltage equipment leading to cost-intensive outages and repairs.

2.2 System overview

Designated use

The *MPD 800* system is an acquisition and analysis system for detecting, recording, and analyzing partial discharge events in many applications. It is suited for type and routine testing in high-voltage laboratory or test bays and especially for on-site high-voltage commissioning and acceptance testing on various high- and medium-voltage assets in various areas of primary applications.

The general use of the *MPD 800* system is described by referring to the general partial discharge measurement setup (see 2.3 "Application" on page 34).

2.2.1 *MPD 800* acquisition unit

Designated use

Figure 2-1: *MPD 800* acquisition unit

Being the core component of the *MPD 800* system, the *MPD 800* acquisition unit is designed to perform partial discharge measurement typically on power transformers, rotating machines or high-voltage cables. The *MPD 800* acquisition unit can be daisy chained by using a fiber-optic cable provided by OMICRON to perform multi-unit measurements.The *MPD 800* acquisition unit is designated to be connected to a number of accessories enabling partial discharge measurement on various high- and medium-voltage assets in high-voltage laboratories and on-site (see also 2.5 "Accessories" on page 49).

The *MPD 800* acquisition unit can be connected to the following accessories to achieve the desired measurement options or targets:

- The *MPD 800* acquisition unit can be connected to the test object or to a coupling capacitor using coupling units such as *CPL1* or *CPL2* external quadripole.
- The *MPD 800* acquisition unit can be connected directly to coupling capacitors.
- The *MPD 800* acquisition unit can be connected to high-frequency current transformers (HFCTs) (for example, *MCT 120*) for measurements on ground connections of various high-voltage assets.
- The *MPD 800* acquisition unit can be connected to voltage outputs or existing *CPL 542*s through an intermediate connection to a *V-to-AC-adapter*.
- The *MPD 800* acquisition unit can be connected to the existing terminal box (for example, the terminal box connected to rotating machine).
- The *MPD 800* acquisition unit can be connected to a partial discharge measuring bridge for balanced measurements.
- The *MPD 800* acquisition unit can be used to trigger external devices such as acoustic partial discharge localization systems (for example, *PDL 650*) by its optical or electrical trigger output.

DANGER

Death or severe injury caused by high voltage or current

► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before connecting or integrating the *MPD 800* acquisition unit into a system.

DANGER

Death or severe injury caused by high voltage or current

The *MPD 800* acquisition unit and its accessories are not suitable for reliably checking if a system is electrically live or energized.

► If readings from the *MPD 800* acquisition unit are used for safety relevant procedures, perform a double check by an independent measurement device.

WARNING

Death or severe injury caused by high voltage or current possible

When the test object is energized, flashovers or electrical breakthroughs may occur due to failure of test object. The *MPD 800* acquisition unit and *CPL1* or *CPL2* are not designed to withstand power frequency fault currents.

► Always observe the minimum safety distance and use personal safety equipment.

Front panel connections

Figure 2-2: *MPD 800* acquisition unit front panel

Two fiber-optic duplex LC-connectors **FO 1** and **FO 2** are located on the front panel. The connectors **FO 1** and **FO 2** are used to connect the *MPD 800* acquisition unit to *MCU2* or to connect an additional *MPD 800* acquisition unit in a daisy chain via fiber-optic cables provided by OMICRON. The protocol used for these fiber connections is proprietary and might therefore not be routed through existing fiber networks. Both fiber-optic connectors are equivalent in function. Therefore it doesn't matter which port is used for connecting *MCU2* or the subsequent *MPD 800* acquisition unit respectively.

Also an additional fiber-optic connector **TRIGGER** is located on the front panel. The **TRIGGER** output is used to connect the OMICRON *PDL 650* or other equipment which can be triggered by optical pulses. Consult the corresponding manuals for further information.

The **POWER** connection socket is used for the power supply which is connected to *RBP1*.

For description of the indicators (named **STATUS** on the front panel) see section "Indicators" on page 16.

This product contains one or more eye-safe lasers of class 1.

DANGER

Death or severe injury caused by high voltage or current

- ► Do not under any circumstances use metallic re-enforced conductive fiber-optic cables.
- ► Always use only fiber-optic cables supplied by OMICRON.
- ► Always use dry and clean fiber-optic cables to avoid or minimize leakage currents.
- ► Make sure that the cables have ground contact to avoid leakage current to *MCU2*.
- ► Eliminate the risk of leakage currents.
- ► Observe the appropriate distance to high-voltage area (see 1.2.1 "Safety standards" on page 6).
- ► Observe the minimum creeping distance on the fiber-optic cable (IEC 61010-1).

Rear panel connections

Figure 2-3: *MPD 800* acquisition unit rear panel

The rear panel of the *MPD 800* acquisition unit consists of two input channels, **CHANNEL 1** and **CHANNEL 2**. Each of the channels consists of two BNC connectors (**PD** and **AC**). The **PD** and **AC** connectors correspond to the BNC outputs which can be found on the *CPL1* and *CPL2* external quadripoles. The **AC** output on the external quadripole must be connected to the **AC** input on the *MPD 800* acquisition unit. Likewise, the **PD** output on the external quadripole must be connected to the **PD** input on the *MPD 800* acquisition unit. If no external quadripole is used, the coupling capacitor must be directly connected to the **PD** input and the **AC** input must be left open and the internal quadripole of the *MPD 800* acquisition unit must be activated.

The input impedance of both measurement input types (**PD** and **AC**) are complex and therefore frequency dependent. It is important to note that the **AC** input is a current measurement input with low impedance of 4.5 Ω. You must transform a voltage to a current by using the *V-to-AC-adapter* 100 kΩ, see 2.2.5 "V-to-AC-adapter" on page 32. The input impedance of the **PD** input at low frequencies strongly depends on whether the internal quadripole is activated or not. If the internal quadripole is not activated, the input impedance is 50 Ω over the rated frequency range. If the internal quadripole is activated, the input impedance is as low as < 10 Ω at frequencies below 1 kHz, in order to be able to measure the reactive current of coupling capacitors directly.

An additional BNC connector (**OUT**) is located on the rear panel. This output carries pulses that is tied to the unit's test generator or a trigger pulse that is tied to the trigger unit.

Also located on the rear panel of the *MPD 800* acquisition unit is the auxiliary control connector (**AUX**). This connector is used to connect auxiliary devices (for example, *MBB1*).

CAUTION

Minor or moderate injury caused by voltage or current possible

If the ratings are violated, damage or loss of precision of the equipment might be the consequence.

- ► Observe the maximum current and power ratings of the measurement inputs.
- ► Never connect a voltage source directly to the **AC** inputs.
- ► Never connect a current source directly to the **PD** inputs having the internal quadripole deactivated.
- ► If the internal quadripole is activated, make sure to observe the current rating of the **PD** input.

WARNING

Death or severe injury caused by high voltage or current possible

The *MPD 800* acquisition unit is not intended to be used for measurements which are connected directly to mains circuits (IEC61010-2-030). Measurements of mains voltages require accessories with proper CAT rating (< 1000 V_{AC}) or proper lightning/switching impulse over-voltage rating (>1000 V_{AC}). Insulation transformer are not recommended.

- ► Make sure to connect the *MPD 800* acquisition unit to the test setup using appropriate rated accessories because the *MPD 800* acquisition unit is not able to handle power frequency fault currents.

Indicators

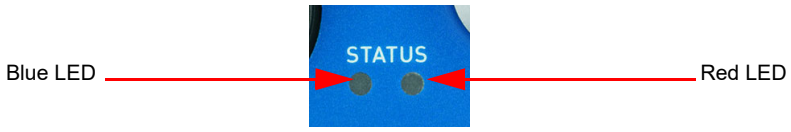


Figure 2-4: *MPD 800* acquisition unit indicators (LEDs)

Each *MPD 800* acquisition unit is equipped with 2 LEDs (blue and red) for displaying the unit's status or malfunctions. The following tables depict the condition and description of the two LEDs.

Table 2-1: Blue and red LED inidications

Condition		Description
Blue LED	**Red LED**	
Blinking	Off	Device is powered and in standby mode.
Off	Blinking	Error Device is not working properly. Check the *RBP1* connection or replace the *RBP1* connection cable. If the red LED is still blinking, contact the OMICRON technical support (see "Support" on page 65).
Off	On	Device is okay. Computer does not recognize the device. Check the fiber-optic connection or replace the fiber-optic cable.
On	Off	Device is in operation mode (powered and the software is running).

Integration into systems

The *MPD 800* acquisition unit, *CPL1*, *CPL2* and the *V-to-AC-adapter* are designed as a system. It is recommended to use them as described in the respective "Designated use" (see 2.2) and "Application" (see 2.3) chapters. If one or more of the *MPD 800* system components need to be integrated into a existing system, the following additional precautions must be fulfilled:

► If connected to an existing coupling capacitor, locate the *MPD 800* acquisition unit in close proximity of the bottom end connection of the coupling capacitor with a distance of less than one meter.

► If a ground-referenced measurement device which is not part of the *MPD 800* system is used together with the *MPD 800* system, use *CPL2* due to special grounding restrictions. The maximum ground-referenced voltage at the input of the low arm capacitor must not exceed 140 V_{RMS} under any measurement condition. Therefore, perform additional precautions to achieve the desired safety requirements.

Note: If the *MPD 800* acquisition unit, *CPL1* or *CPL2* is accessible during measurement, additional touch protection is required.

► Do not use the *MPD 800* acquisition unit in an electrical path where a failure of the *MPD 800* acquisition unit (for example, short or open circuits of measurement inputs) causes:

- a voltage regulation feedback loop to become dysfunctional.
- an over-current protection to become dysfunctional.
- an indicator for hazardous live electrical quantities (IEC 61010-1, VDE 0105-100) to become dysfunctional.

- If the *MPD 800* acquisition unit needs to be grounded, use the shortest path with the lowest achievable inductance. For this purpose, use the common grounding circuit of the test voltage source, test object and coupling capacitor.
- *RBP1* is grounded through the *MPD 800* acquisition unit. Therefore, make sure that the *RBP1* housing is electrically insulated from ground potential.
- Place *MCU2* in close proximity to the PC and outside of the high-voltage or test area (EN 50191). If leakage current to *MCU2* can not be prevented completely, provide additional safety measures, for example, grounded USB hub. Observe the safety advises from "Front panel connections" on page 13, regarding fiber-optic connections.
- It is not recommended to place the *MPD 800* acquisition unit outside of the high-voltage or test area (EN 50191). If the *MPD 800* acquisition unit is placed outside these areas, perform additional precautions in order to achieve an equivalent safety level according to safety standards (see 1.2.1 "Safety standards" on page 6).

DANGER

Death or severe injury caused by high voltage or current

- Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before connecting or integrating the *MPD 800* acquisition unit into a system.
- Provide protection against live parts in order to avoid accidental contacts.

2.2.2 *CPL1* and *CPL2* external quadripole

Designated use

Figure 2-5: *CPL1* and *CPL2* external quadripole

The *CPL1* and *CPL2* external quadripoles are designed to connect the *MPD 800* acquisition unit to a capacitance (coupling capacitor or test object), which drives a reactive current larger than the current the *MPD 800* acquisition unit can handle directly.

CPL2 allows furthermore to operate third party measuring equipment using the same coupling capacitor or test object as the *MPD 800* system. Additional precautions must to be fulfilled to achieve the desired safety requirements.

DANGER

Death or severe injury caused by high voltage or current

► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before connecting or integrating *CPL1* or *CPL2* into a system.

DANGER

Death or severe injury caused by high voltage or current

CPL1 or *CPL2* and its accessories are not suitable for reliably checking if a system is electrically live or energized.

► Do not use *CPL1* or *CPL2* for safety relevant procedures.

WARNING

Death or severe injury caused by high voltage or current possible

When the test object is energized flashovers or electrical breakthroughs may occur due to failure of test object. The *MPD 800* acquisition unit and *CPL1* or *CPL2* are not designed to withstand power frequency fault currents.

► Always observe the minimum safety distance and use personal safety equipment.

Front panel connections

Figure 2-6: *CPL1* and *CPL2* front panel

The BNC outputs **PD** and **AC** are connected by short, screened cables (< 20 cm) to the BNC inputs at the *MPD 800* acquisition unit accordingly (see "Rear panel connections" on page 14).

WARNING

Death or severe injury caused by high voltage or current possible

An open **AC** output may carry hazardous voltage.

► Terminate the **AC** output using a short-circuit cap.

Rear panel connections *CPL1*

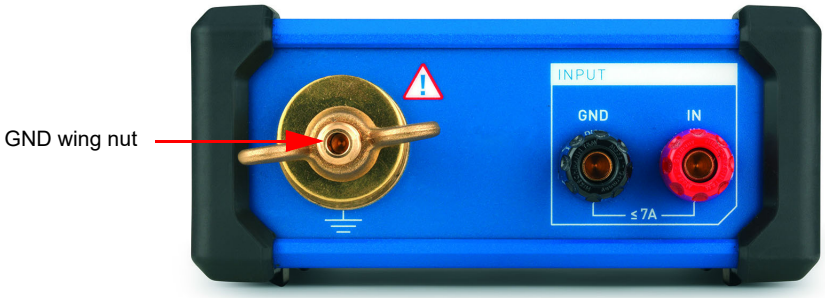


Figure 2-7: *CPL1* rear panel

The GND or GND wing nut is connected to the ground with a short connection.

► Do not ground the *MPD 800* acquisition unit or its accessories in this case.

The **IN** input is connected to the bottom end connection of the coupling capacitor or test object.

► Do not exceed 7 A_{RMS} reactive current at the **IN** input.

For low frequencies below 1 kHz, the input impedance is in the < 100 mΩ range. For high frequencies above 10 kHz, the termination impedance is equivalent to the termination impedance of 50 Ω connected to the **PD** output of *CPL1*. Special versions of *CPL1* for NEMA and CISPR measurements feature an input impedance of 150 Ω or 300 Ω respectively.

DANGER

Death or severe injury caused by high voltage or current

A failure inside *CPL1* may result in residual charges at the coupling capacitor or test object, even with high-voltage side grounded.

► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before connecting or integrating *CPL1* into a system.

CAUTION

Minor or moderate injury caused by voltage or current possible

If the ratings are violated, damage or loss of precision of the equipment might be the consequence.

► Observe the maximum current and power ratings of the measurement input.

► Never connect a voltage source directly to the **IN** input.

WARNING

Death or severe injury caused by high voltage or current possible

CPL1 is not intended to be used for measurements which are connected directly to mains circuits (IEC61010-2-030).

► Make sure to connect *CPL1* to the test setup using appropriate rated accessories because *CPL1* is not able to handle power frequency fault currents.

Rear panel connections *CPL2*

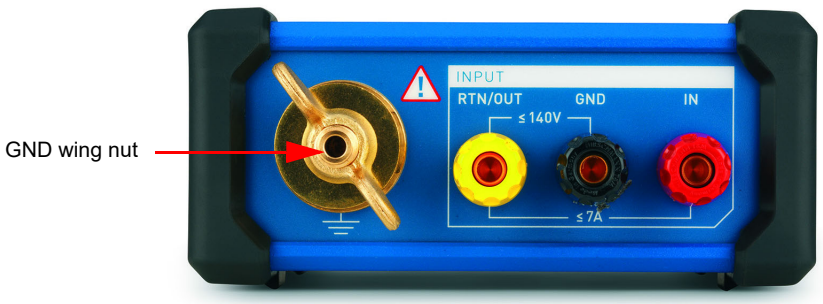


Figure 2-8: *CPL2* rear panel

The GND wing nut is connected to the ground with a short connection.

► Do not ground the *MPD 800* acquisition unit or its accessories in this case.

The **IN** input is connected to the bottom end connection of the coupling capacitor or test object.

► Do not exceed 7 A_{RMS} reactive current at the **IN** input.

► Do not connect the **IN** input to a voltage source.

For low frequencies below 1 kHz, the input impedance is in the < 100 mΩ range. For high frequencies above 1 kHz, the termination impedance is equivalent to the termination impedance of 50 Ω connected to the **PD** output of *CPL2*. Special versions of *CPL2* for NEMA and CISPR measurements transform a 50 Ω impedance connected to the **PD** output to 150 Ω or 300 Ω respectively.

The **RTN/OUT** connector of *CPL2* may be connected to the current input of an additional third party measuring device. The voltage at this point must not exceed 140V_{RMS} respective to the **GND** connector. The external measuring device must be able to handle the current fed into the *CPL2* **IN** input.

DANGER

Death or severe injury caused by high voltage or current

A failure or an open **RTN/OUT** connector of *CPL2* may result in residual charges at the asset, even with high-voltage side grounded.

► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before connecting or integrating *CPL2* into a system.

► Short circuit the **RTN/OUT** connector to the **GND** connector if not used.

CAUTION

Minor or moderate injury caused by voltage or current possible

If the ratings are violated, damage or loss of precision of the equipment might be the consequence.

► Observe the maximum current and power ratings of the measurement input.

► Never connect a voltage source directly to the **IN** input.

WARNING

Death or severe injury caused by high voltage or current possible

CPL2 is not intended to be used for measurements which are connected directly to mains circuits (IEC61010-2-030).

► Make sure to connect *CPL2* to the test setup using appropriate rated accessories because *CPL2* is not able to handle power frequency fault currents.

Integration into systems

The *MPD 800* acquisition unit, *CPL1*, *CPL2* and the *V-to-AC-adapter* are designed as a system. It is recommended to use them as described in the respective “Designated use” (see 2.2) and “Application” (see 2.3) chapters. If one or more of the *MPD 800* system components need to be integrated into a system, the following additional precautions must be fulfilled:

- ► If connected to an existing coupling capacitor, locate external quadripoles *CPL1* and *CPL2* in close proximity of the bottom end connection of the coupling capacitor with a distance of less than one meter.
- ► If a ground-referenced measurement device which is not part of the *MPD 800* system is used together with the *MPD 800* system, use *CPL2* due to special grounding restrictions. The maximum ground-referenced voltage at the input of the low arm capacitor must not exceed 140 V_{RMS} under any measurement condition. Therefore, perform additional precautions to achieve the desired safety requirements.
- ► Do not use neither *CPL1* nor *CPL2* in an electrical path where a failure of *CPL1* or *CPL2* (for example, short or open circuits of measurement inputs) causes:
  - a voltage regulation feedback loop to become dysfunctional.
  - an over-current protection to become dysfunctional.
  - an indicator for hazardous live electrical quantities (IEC 61010-1, VDE 0105-100) to become dysfunctional.
- ► Ground *CPL1* or *CPL2* using the shortest path with the lowest achievable inductance. For this purpose, use the common grounding circuit of the test voltage source, test object and coupling capacitor.
- ► The *MPD 800* acquisition unit and *RBP1* are inherently grounded through the connection cables to *CPL1* or *CPL2*. Therefore, make sure that the device housings is electrically insulated from ground potential.
- ► Place *MCU2* in close proximity to the PC and outside of the high voltage or test area (EN 50191). Make sure that the computer is grounded through protective earth, for example, grounded USB hub.
- ► It is not recommended to place *CPL1* or *CPL2* outside of the high-voltage or test area (EN 50191). If *CPL1* or *CPL2* is placed outside these areas, perform additional precautions in order to achieve an equivalent safety level according to safety standards (see 1.2.1 "Safety standards" on page 6).

DANGER

Death or severe injury caused by high voltage or current

- ► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before connecting or integrating *CPL1* or *CPL2* into a system.
- ► Provide protection against live parts in order to avoid accidental contacts.
- ► Connect the **AC** output of *CPL1* or *CPL2* to the *MPD 800* acquisition unit or short-circuit the **AC** output because the **AC** output can have voltages higher than 30 V. The **AC** output is limited by a protection circuit.

2.2.3 *MCU2* multi-device control unit

Designated use

Figure 2-9: *MCU2* multi-device control unit

The multi-device control unit (*MCU2*) is designated to connect one or more OMICRON acquisition units (for example, *MPD 800* or *MPD 600*) to the PC. It converts optical signals generated by an OMICRON acquisition unit and transmitted by a fiber-optic cable provided by OMICRON into a standard electrical communication signal, USB 3.0.

Front panel connections

Figure 2-10: *MCU2* front panel

The front panel of *MCU2* consists of the **STATUS** (status LEDs), the **TRIGGER** (trigger sensor) and the **USB** socket.

The **USB** socket is used to connect *MCU2* to the PC. A USB 3.0 or higher port is required to gain the full functionality of *MCU2*. USB 3.0 ports are usually marked with the SS symbol and typically have a blue insert. The built-in light-sensitive sensor of *MCU2* can be used as the **TRIGGER** source. This sensor is a photodiode which allows to synchronize to line frequency from artificial light sources.

For description of the **STATUS** indicators see section "Indicators" on page 25.

Rear panel connections

Figure 2-11: *MCU2* rear panel with three fiber-optic channel

Three fiber-optic connectors **FO 1**, **FO 2** and **FO 3** are located on the rear panel. The connectors can be used as follows:

- **FO 1** is used for the connection to an *MPD 800* acquisition unit.
- **FO 2** can be optionally used for the connection to an additional *MPD 800* acquisition unit.
- **FO 3** is used for the connection to an *MPD 600* acquisition unit.

Each connection is realized via a fiber-optic cable provided by OMICRON. The protocols used for these fiber connections are proprietary and might therefore not be routed through existing fiber networks.

This product contains three eye-safe laser products of class 1.

DANGER

Death or severe injury caused by high voltage or current

- ► Make sure that *MCU2* and the PC are located in the work area.
- ► Always use only fiber-optic cables supplied by OMICRON.
- ► Always use dry and clean fiber-optic cables to avoid or minimize leakage currents.
- ► Make sure that the cables have ground contact to avoid leakage current.
- ► Eliminate the risk of leakage currents.
- ► Do not under any circumstances use metallic re-enforced conductive fiber-optic cables.
- ► Observe the appropriate distance to high-voltage area (see 1.2.1 "Safety standards" on page 6).
- ► Observe the minimum creeping distance on the fiber-optic cable (IEC 61010-1).

Indicators

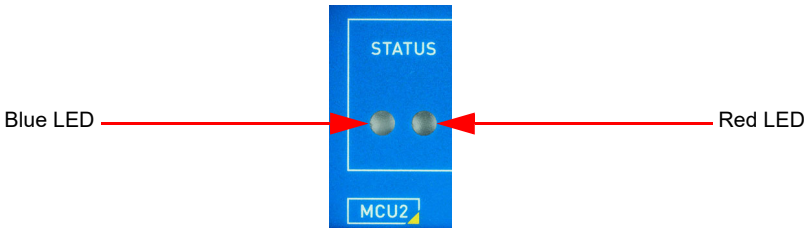


Figure 2-12: *MCU2* indicators (LEDs)

MCU2 is equipped with two **STATUS** indicators (blue and red LEDs) that display the status or malfunction of the multi-device control unit.

The following tables depict the condition and description of the two LEDs.

Table 2-2: Blue LED indications (on the left-hand side)

Condition	Description
Flashing (A short switch-on phase and long switch-off phase)	Device is powered and in standby mode.
Blinking (The switch-on and switch-off phases are of the same length)	Device is powered and in active mode. A secondary malfunction or error was detected and performance might be affected negatively. Check the fiber-optic connection. **Note:** In case of malfunction, contact the OMICRON technical support (see "Support" on page 65).
Continuous on	Device is powered and in active mode.
Continuous off	Device is not powered.

Table 2-3: Red LED indications (on the right-hand side)

Condition	Description
Flashing (A short switch-on phase and long switch-off phase)	Enumeration of the device was unsuccessful.
Blinking (The switch-on and switch-off phases are of the same length)	A malfunction or error has been detected. Device is not working properly and might be performing a cool-down. **Note:** In case of malfunction, contact the OMICRON technical support (see "Support" on page 65).
Continuous on	Device performs a self-check during power-up.
Continuous off	No malfunction or error has been detected.

2.2.4 *RBP1* rechargeable battery pack

Designated use

Figure 2-13: Rechargeable battery pack (*RBP1*)

RBP1 is a rechargeable lithium-ion battery pack provided by OMICRON for operating measuring devices without the local power supply. *RBP1* can be stacked to increase the available capacity. You can connect up to five *RBP1* rechargeable battery packs to power long-time measurement setups.

RBP1 must be used and charged properly. Before using *RBP1*, you must read and understand the following warning messages. If you have any question, contact the OMICRON technical support.

WARNING

Death or severe injury caused by fire and burns possible

- ► Do not drop or crush, do not short circuit, do not open, and do not expose the battery to high temperatures.
- ► Do not immerse the battery in any liquids.
- ► Do not charge the battery in flammable environment.
- ► Do not charge it below 0 °C/32 °F and above 40 °C/104 °F and do not operate it below –20 °C/–4 °F and above 55 °C/131 °F
- ► Never charge the battery near flammable objects.
- ► Do not deep discharge the battery and recharge it regularly during storage.
- ► Dispose of the battery properly, it may explode if damaged or disposed of in fire.
- ► Read this User Manual before charging the battery and use the specified charger only. Follow the local ordinances and/or regulations for usage of lithium batteries.

NOTICE

Equipment damage possible

- ► Do not use *RBP1* for powering *MPD 500/600*, *MI 540/600*, *PDL 650*, and *UHF 608/620* devices.
- ► Do not use any adapter cable to connect the *RBP1* power connector to the legacy connector. Otherwise, the legacy device will be damaged irreversibly.
- ► Use *RBP1* only for powering the OMICRON devices as specified in and in accordance with the relevant documentation.

Battery charging and capacity information

RBP1 is designated only for use with the power supply shipped with *RBP1*. For the battery status, see "Indicators" on page 30 or optionally the status information of the control software.

The required charging time depends on the charging level of the battery and may vary up to a few hours for full charge for a single *RBP1*. The required charging time increases at lower temperatures and with an increasing number of *RBP1* devices in serial connection. Do not leave *RBP1* on prolonged charge when not in use.

After extended periods of storage, you may need to charge and discharge the cells or batteries several times to obtain maximum performance.

To extend the battery life, observe the following recommendations:

- ► Store the battery at about 40 % charging level and at a low temperature (4 ºC/40 ºF). A refrigerator provides good storage as long as the temperature does not drop below 0 ºC/32 ºF.
- ► Never fully discharge the battery (below 9 V). Avoid a deep discharge at any time.
- ► Charge the battery early and often.
- ► Always charge the battery at least every four months to prevent deep discharge.

Figure 2-14 "Typical charge setup" on page 28 shows a typical charge setup. To connect *RBP1* devices to each other or to the *MPD 800* acquisition unit, use the battery connection cable shipped with the *RBP1*.

Note: The battery connection cable is shielded. The housings of the connected measuring devices and *RBP1* are connected electrically, too.

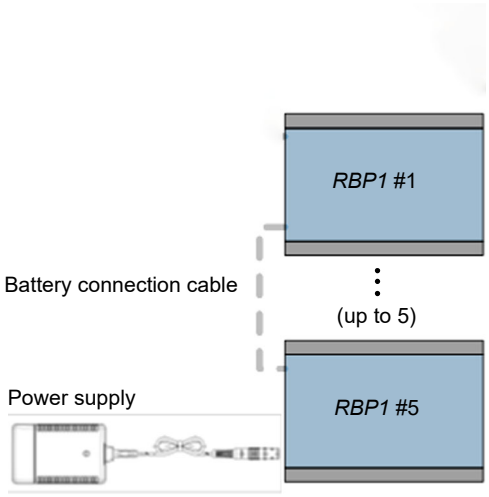


Figure 2-14 Typical charge setup

Use only the OMICRON 24 W DC supply shipped with *RBP1* to charge *RBP1* (see 2.5 "Accessories" on page 49). Up to five *RBP1* units can be charged in series connection. Do not charge *RBP1* in setups requiring robust and high-sensitive measurements.

Figure 2-15 Charge setup with one and three *RBP1* device

DANGER

Death or severe injury caused by high voltage or current

- ► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before connecting or integrating *RBP1* into a system.
- ► Provide protection against live parts in order to avoid accidental contacts.

DANGER

Death or severe injury caused by high voltage or current

A flashover or breakthrough might invisibly damage the OMICRON 24 W DC supply or might divert hazardous voltage to the work area which leads to a high risk of electrical hazard.

- ► Do not use the OMICRON 24 W DC supply if an electrical flashover or an electrical breakthrough of the test object cannot be eliminated.

Front panel connections

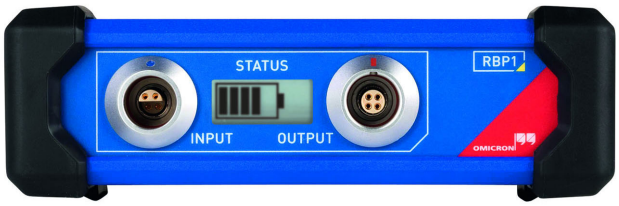


Figure 2-16: *RBP1* front panel

RBP1 provides the following connectors and display:

INPUT	Lemo	Power supply input Connect the OMICRON power supply or a preceding *RBP1*.
OUTPUT	Lemo	Battery output Connect a measuring device or an adjacent *RBP1*.
STATUS	Display	*RBP1* battery display See "Indicators" on page 30.

Indicators

The display of *RBP1* provides information about the battery status. If the display is blank the battery is completely discharged, defect or in sleep mode. In this case, try to recharge *RBP1* (see "Battery charging and capacity information" on page 27). If this does not solve the problem, contact the OMICRON technical support for service.

The following tables describe in detail the displayed symbols.

Table 2-4: System status

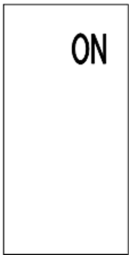
Symbol	Status	Description
	Visible	Battery is charging or in operation.
	Blinking	An error occurred. Connect the battery charger. If the symbol remains blinking, the battery is defective and has to be replaced.
	Hidden	Battery is in sleep mode.

Table 2-5: Battery and bar graph symbols (Charger is not connected.)

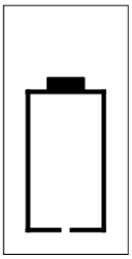
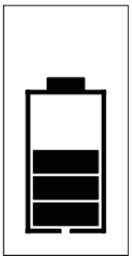
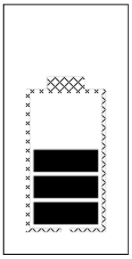
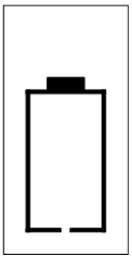
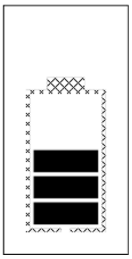
Symbol	Status	Description
	Visible	Battery state of charge ≤ 10 %
	Blinking	Battery state of charge ≤ 5 % or temperature out of range
	Visible	Each bar symbol shows 20 % of the charge capacity.
	Blinking (all)	An error occurred. Connect the battery charger. If the symbol remains blinking, the battery is defective and has to be replaced.
	Visible (bars)	Each bar symbol shows 20 % of the charge capacity.
	Blinking (battery)	Temperature out of range, battery not in operation

Table 2-6: Battery and bar graph symbols (Charger is connected.)

Symbol	Status	Description
	Visible	Battery state of charge ≤ 10 % and charging not in progress Verify the connections between *RBP1* and the battery charger and the connection of the battery charger to the power outlet.
	Blinking	Battery state of charge ≤ 5 % and charging not in progress Verify the connections between *RBP1* and the battery charger and the connection of the battery charger to the power outlet.
	Visible	Each bar symbol shows 20 % of the charge capacity.
	Blinking (all)	An error occurred. Connect the battery charger. If the symbol remains blinking, the battery is defective and has to be replaced.
	Blinking (one bar)	Charging in progress
	Visible (bars)	Each bar symbol shows 20 % of the charge capacity.
	Blinking (battery)	Temperature out of range, battery not in operation

2.2.5 *V-to-AC-adapter*

Designated use

Figure 2-17: *V-to-AC-adapter*

The *V-to-AC-adapter* is designed to connect the three existing types of OMICRON external quadripoles to the *MPD 800* acquisition unit:

- *CPL 542* type 0.5 A
- *CPL 542* type 2 A
- *CPL 542* type 5 A

The *V-to-AC-adapter* converts a limited voltage of a voltage source with low impedance to a respective current which can be handled by the *MPD 800* acquisition unit. It can be connected directly into the **AC** input channels of an *MPD 800* acquisition unit.

Connections

The *V-to-AC-adapter* has two BNC connectors, a plug and a socket connector respectively. It is connected to the BNC cable and can be treated as an extension of a BNC cable. It has no flow direction.

► In order to prevent extensive currents in case of an accidental short circuit at the connection cable, ideally locate the *V-to-AC-adapter* near the voltage source.

► Make sure that connection cables are as short as possible.

The *V-to-AC-adapter* consists of a single series resistor (100 kΩ, CAT I) between the two centre contacts. It offers a voltage range of 140 V which corresponds to a full range output current of 1.4 mA. Therefore, the ratio is 0.01 mA/V.

DANGER

Death or severe injury caused by high voltage or current

► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before connecting or integrating the *V-to-AC-adapter* unit into a system.

DANGER

Death or severe injury caused by high voltage or current

The *V-to-AC-adapter* is not suitable for reliably checking if a system is electrically live or energized.

► If readings from the *V-to-AC-adapter* are used for safety relevant procedures, perform a double check by an independent measurement device.

CAUTION

Minor or moderate injury caused by voltage or current possible

If the ratings are violated, damage or loss of precision of the equipment might be the consequence.

► Observe the maximum current and power ratings.

WARNING

Death or severe injury caused by high voltage or current possible

The *V-to-AC-adapter* is not intended to be used for measurements which are connected directly to mains circuits (IEC61010-2-030).

► Make sure to connect *V-to-AC-adapter* to the test setup using appropriate rated accessories because the *V-to-AC-adapter* is not able to handle over-voltage category CAT I.

Integration into systems

The *MPD 800* acquisition unit, *CPL1*, *CPL2* and the *V-to-AC-adapter* are designed as a system. It is recommended to use them as described in the respective “Designated use” (see 2.2) and “Application” (see 2.3) chapters. If one or more of the *MPD 800* system components need to be integrated into a system, the following additional precautions must be fulfilled:

► Do not use the *V-to-AC-adapter* in an electrical path where a failure of the *V-to-AC-adapter* (for example, short or open circuits of measurement inputs) causes:

- a voltage regulation feedback loop to become dysfunctional.
- an over-current protection to become dysfunctional.
- an indicator for hazardous live electrical quantities (IEC 61010-1, VDE 0105-100) to become dysfunctional.

► If the *V-to-AC-adapter* needs to be grounded, use the shortest path with the lowest achievable inductance. For this purpose, use the common grounding circuit of the test voltage source, test object and coupling capacitor.

► Place *MCU2* in close proximity to the PC and outside of the high voltage or test area (EN 50191). Make sure that the computer is grounded through protective earth.

► It is not recommended to place the *V-to-AC-adapter* outside of the high-voltage or test area (EN 50191). If the *V-to-AC-adapter* unit is placed outside these areas, perform additional precautions in order to achieve an equivalent safety level.

DANGER

Death or severe injury caused by high voltage or current

► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before connecting or integrating the *MPD 800* acquisition unit into a system.

► Provide protection against live parts in order to avoid accidental contacts.

2.3 Application

This section contains the quick application guide and provides you with an introduction into the usage of the *MPD 800* software and hardware.

Standard connection application of the *MPD 800* system

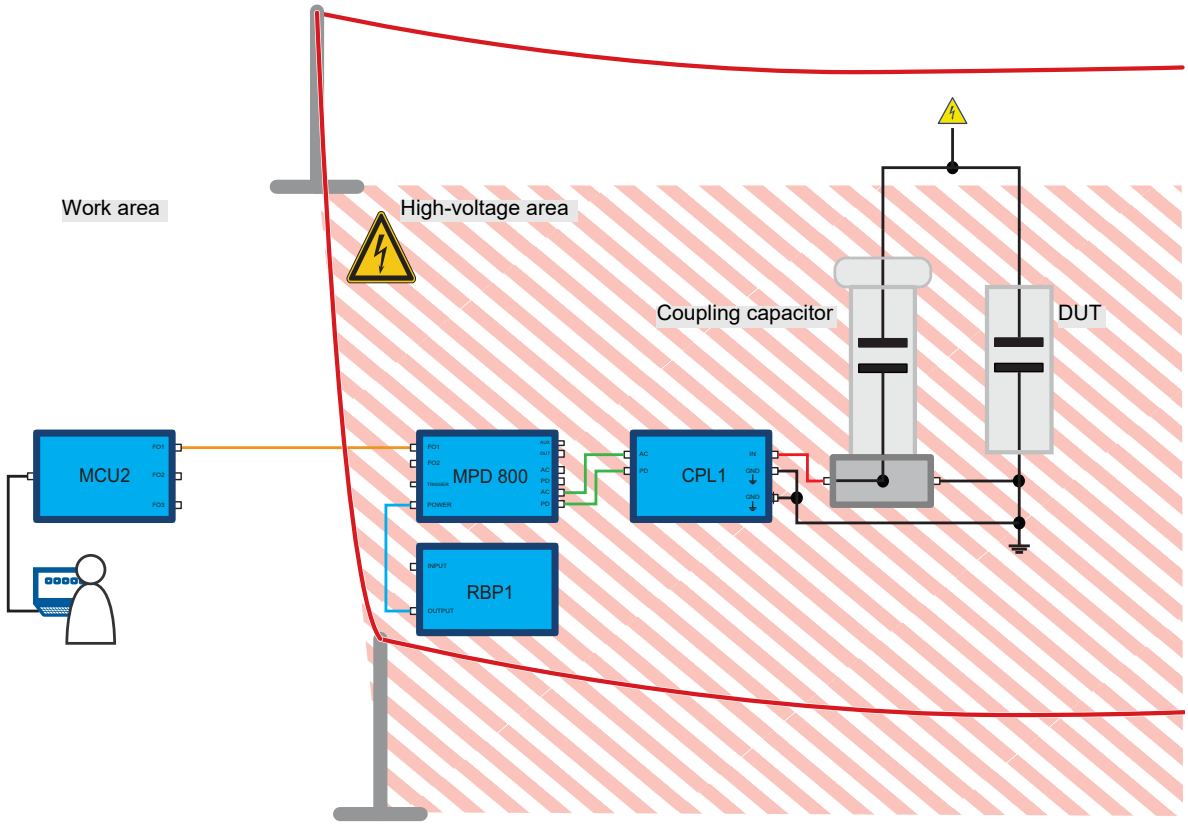


Figure 2-18: Standard connection application of the *MPD 800* system

Further connection application of the *MPD 800* system

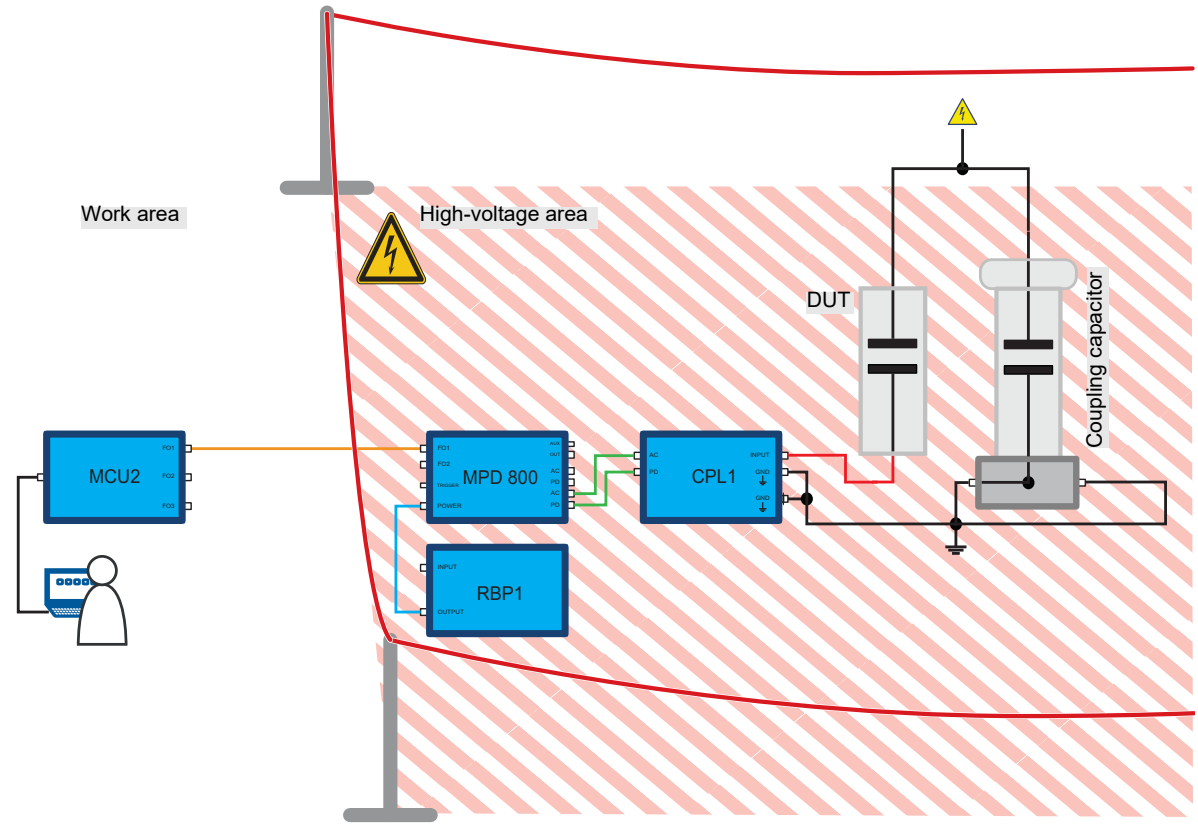


Figure 2-19: Further connection application of the *MPD 800* system

2.3.1 Specific safety instructions

Prior to setting up and operating the *MPD 800* system to carry out a PD test, it is essential that you have read and understood the chapter 1 "Safety instructions" on page 6.

Before entering the high-voltage area, observe the following instructions:

WARNING

Death or severe injury caused by high voltage or current possible

Working in the area of high-voltage systems is very dangerous!

- ► Switch off the high voltage.
- ► Always obey the five safety rules (see 1.2.2 "Safety rules" on page 6) and follow the detailed safety instructions.
- ► Make sure to observe dangerous areas.
- ► Always obey the internal safety instructions for working in areas with high voltage to avoid injury.
- ► Before switching on the high voltage, leave the high-voltage area.

► Turn off and disconnect the high voltage from the test object.

► Protect yourself and your working environment against an accidental reconnection of high voltage by other persons and circumstances.

WARNING

Death or severe injury caused by high voltage or current possible

► Carry out grounding and short-circuiting of the test object's terminals using a grounding set.

► Protect yourself and your working environment with a suitable protection against other (possible) live circuits.

► Protect others from accessing the dangerous area and accidentally touching live parts by setting up a suitable barrier.

2.3.2 Connection to the device under test

Check your additional equipment (PC) for environmental conditions before use.

1. Install the MPD software (if not already done) without connection between PC and *MCU2* (for more information, read the software manual).

WARNING

Death or severe injury caused by high voltage or current possible

► Switch off the high voltage.

► Always obey the five safety rules (see 1.2.2 "Safety rules" on page 6) and follow the detailed safety instructions.

► Follow the internal safety instructions.

► Use only original cables provided by OMICRON.

2. Use the fiber-optic cables to provide a connection between *MCU2* and *MPD 800* units.

Note: Always use dry and clean fiber-optic cables. Make sure that the cables have ground contact to avoid leakage current.

3. Connect the *MPD 800* acquisition unit to *MCU2* using fiber-optic cables.

   Note: Use either **FO1** or **FO2** connector for the connection to *MCU2*. FO3 connector plugs are color-coded. It is used for the connection to an additional *MPD 600* acquisition unit.

   Note: The delivered fiber-optic cable has a push-pull locking mechanism. To connect the fiber-optic cable, hold the *MPD 800* acquisition unit in one hand and insert the fiber-optic plug with the guide rail on the top into the socket and push it until the mechanism is locked in place with a click. To disconnect the fiber-optic cable, pull the front ring of the plug back and remove the whole plug.

Figure 2-20: Disconnection of the fiber-optic cable

4. Connect *RBP1* to the *MPD 800* acquisition unit using the battery cable. The red LED at the *MPD 800* acquisition unit starts flashing, indicating that the acquisition unit is ready for operation.

   Note: Position the *MPD 800*/*RBP1* units on insulating ground to ensure maximum sturdiness. Make sure that *RBP1* is always placed on the top of the *MPD 800* acquisition unit.

WARNING

Death or severe injury caused by fire and burns possible

RBP1 is a rechargeable lithium-ion battery pack.

- ► Do not drop or crush, do not short circuit, do not open, and do not expose the battery to high temperatures.
- ► Do not immerse the battery in any liquids.
- ► Do not charge the battery in flammable environment.
- ► Do not charge it below 0 °C/32 °F and above 40 °C/104 °F and do not operate it below –20 °C/–4 °F and above 55 °C/131 °F
- ► Never charge the battery near flammable objects.
- ► Do not deep discharge the battery and recharge it regularly during storage.
- ► Dispose of the battery properly, it may explode if damaged or disposed of in fire.
- ► Read this User Manual before charging the battery and use the specified charger only. Follow the local ordinances and/or regulations for usage of lithium batteries.

5. Connect *CPL1* or *CPL2* to the *MPD 800* acquisition unit. Use two short BNC cables and connect the **PD** and **AC** outputs of *CPL1* to the **PD** and **AC** inputs of the *MPD 800* acquisition unit.

Before entering the high-voltage area, observe the following instructions:

WARNING

Death or severe injury caused by high voltage or current possible

Working in the area of high-voltage systems is very dangerous!

- ► Switch off the high voltage.
- ► Always obey the five safety rules (see 1.2.2 "Safety rules" on page 6) and follow the detailed safety instructions.
- ► Make sure to observe dangerous areas.
- ► Always obey the internal safety instructions for working in areas with high voltage to avoid injury.
- ► Before switching on the high voltage, leave the high-voltage area.

6. Connect *CPL1* to a high-voltage coupling capacitor (for example, MCC unit) and ground *CPL1* using the grounding screw. Keep the cable(s) as short as possible.
7. Optional: If you use an MCC 2xx coupling capacitor, connect the capacitor directly to the PD input of *MPD 800* acquisition unit, select the internal quadripole in the software and ground the MCC unit using the grounding screw. If a *CPL 542* is pre-installed, connect a *V-to-AC-adapter* between the *CPL 542* voltage output and the *MPD 800* acquisition unit's AC input.
8. Optional: If you use an *MCC 1xx* coupling capacitor, provide a connection to the *MPD 800* 's **PD** input using a coax cable and a TNC/BNC adapter, and ground the MCC unit using the grounding screw. The **AC** input of the *MPD 800* acquisition unit is not used.
9. Leave the high-voltage area, go to the work area and connect *MCU2* to the PC using the USB cable.
10. Now, the *MPD 800* system is installed. In the next steps:
    - the software will be configured.
    - the measurement circuit will be calibrated.
    - the *MPD 800* system will be prepared to be ready for PD testing.

2.3.3 PD measurement preparation

This chapter gives a quick introduction into the MPD software and provides step-by-step the basic information to prepare a PD measurement.

Following procedures cover the charge calibration and test voltage calibration. At the end of this chapter, the *MPD 800* system is setup and ready to perform a PD measurement.

1. Start the MPD software.

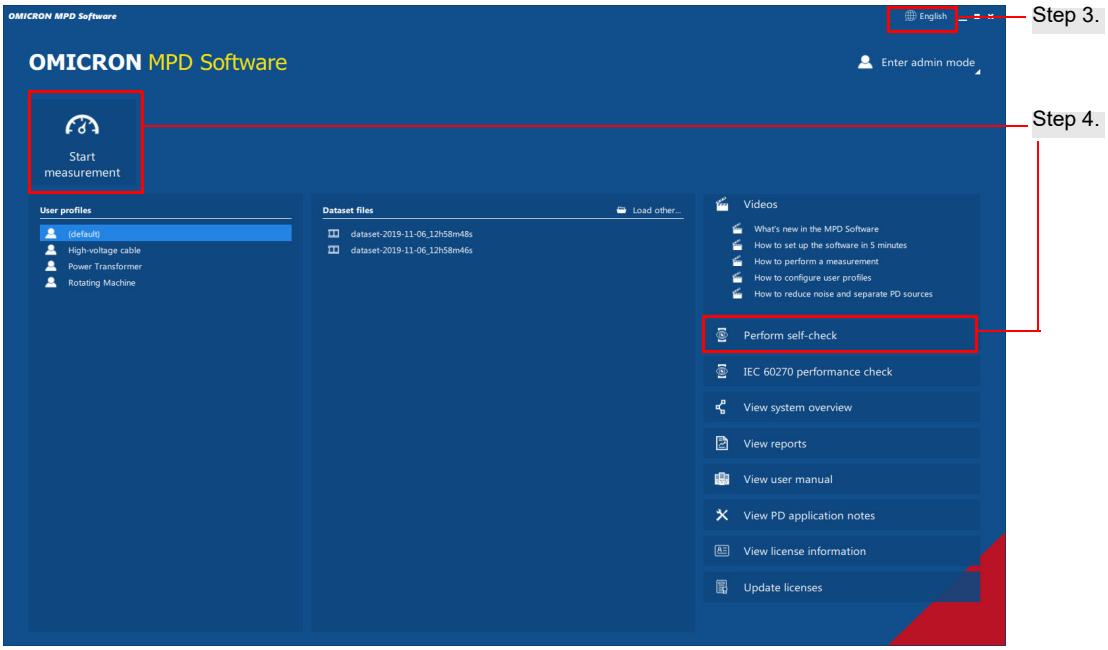


Figure 2-21: MPD software start page

2. When you open the software for the first time, the start page will appear. It is your main gateway into the functionality of the software.
3. Select your preferred language in the upper right corner.
4. Click the **Start measurement** button to switch to the main measurement window (see Figure 2-22).

   Note: To check your *MPD 800* system, click on the **Perform self-check** button.

Measurement setup and calibration

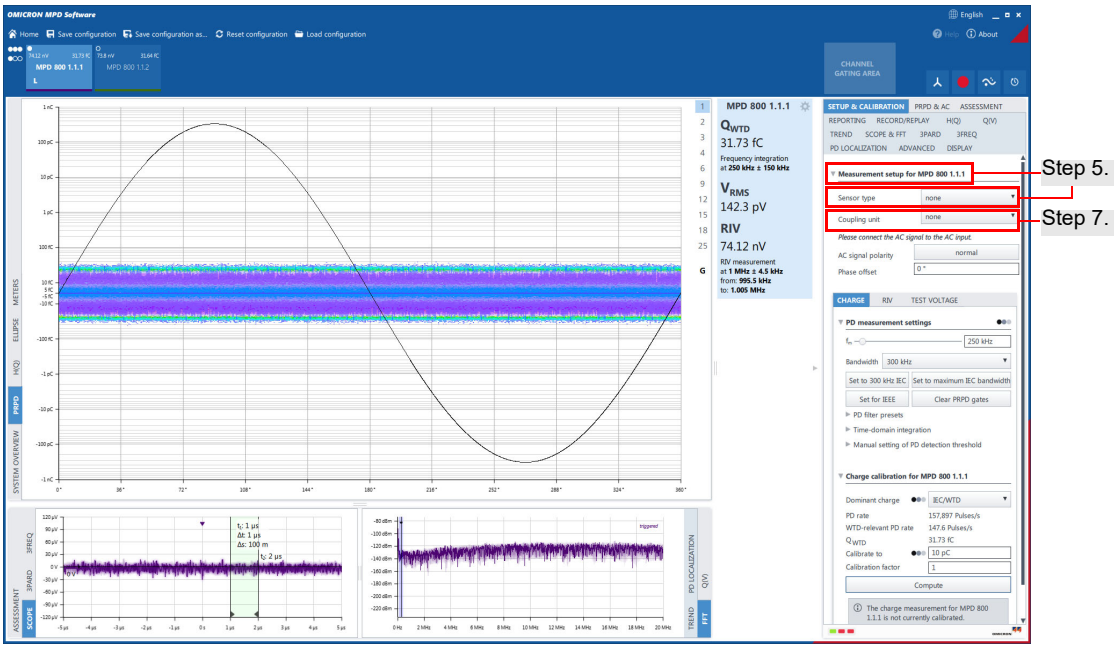


Figure 2-22: Main measurement window

Note: By default, the first channel (MPD 800 1.1.1) is selected (highlighted).

5. In the **Measurement setup for MPD 800 1.1.1** area of the **SETUP & CALIBRATION** tab, select the **Sensor Type** from the drop-down list box.

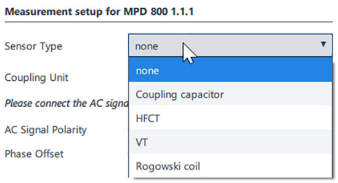


Figure 2-23: Selection of **Sensor Type**

6. Continue with the **Device** selection, after having selected the **Sensor Type**.

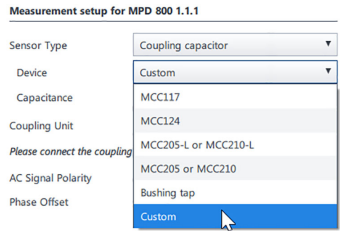


Figure 2-24: Selection of the **Device**

7. Select the **Coupling Unit** from the drop-down list box (see also Figure 2-22).

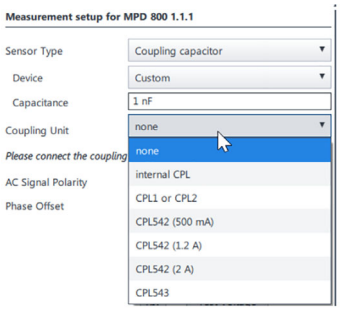


Figure 2-25: Selection of the **Coupling Unit**

Note: If an external sensor or coupling device:

- inverts the AC signal, click on **Normal** to invert the current flow.
- adds a phase shift/offset to the signal, enter the **Phase Offset** in the input box.

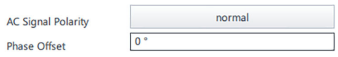


Figure 2-26: Correction of the **AC Signal Polarity** and **Phase Offset**

8. The **CHARGE** subtab in the main measurement window is selected by default.

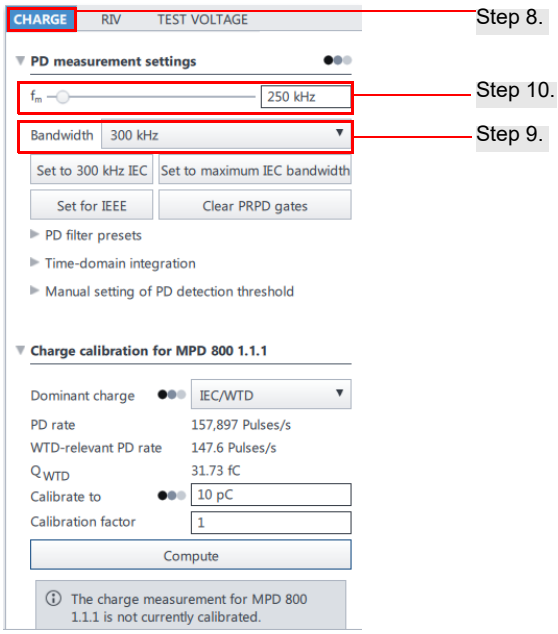


Figure 2-27: **CHARGE** subtab

9. Select the bandwidth of the PD measurement filter in the **Bandwidth** drop-down list box.
10. Select or enter the center frequency (f_m) of the PD measurement filter.

    Note: Clicking the **Set to 300 kHz IEC**, **Set to maximum IEC bandwidth** or **Set for IEEE** button, the bandwidth and center frequency (f_m) are set to standard compliant values.

Charge calibration

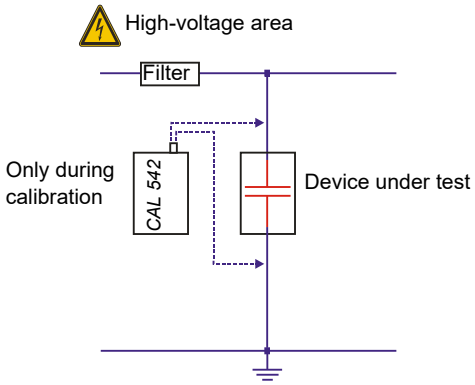


Figure 2-28: Connecting the calibrator

WARNING

Death or severe injury caused by high voltage or current possible

- ► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before entering the high-voltage area.
- ► Switch off the high voltage and ground the test setup before connection or disconnection of *CAL 542*.
- ► Keep the high voltage switched off during the whole charge calibration process.
- ► During the actual calibration of the PD measurement, the high voltage has to be temporarily ungrounded. Ensure that all safety rules are met at any time.

11. Connect the calibrator *CAL 542* in parallel to the device under test (DUT).

12. Keep the cable connections between *CAL 542* and the DUT as short as possible.

13. After connecting and adjusting *CAL 542*, place *CAL 542* inside of the high-voltage area, if available. For the actual calibration, the high-voltage terminals have to be temporarily ungrounded.

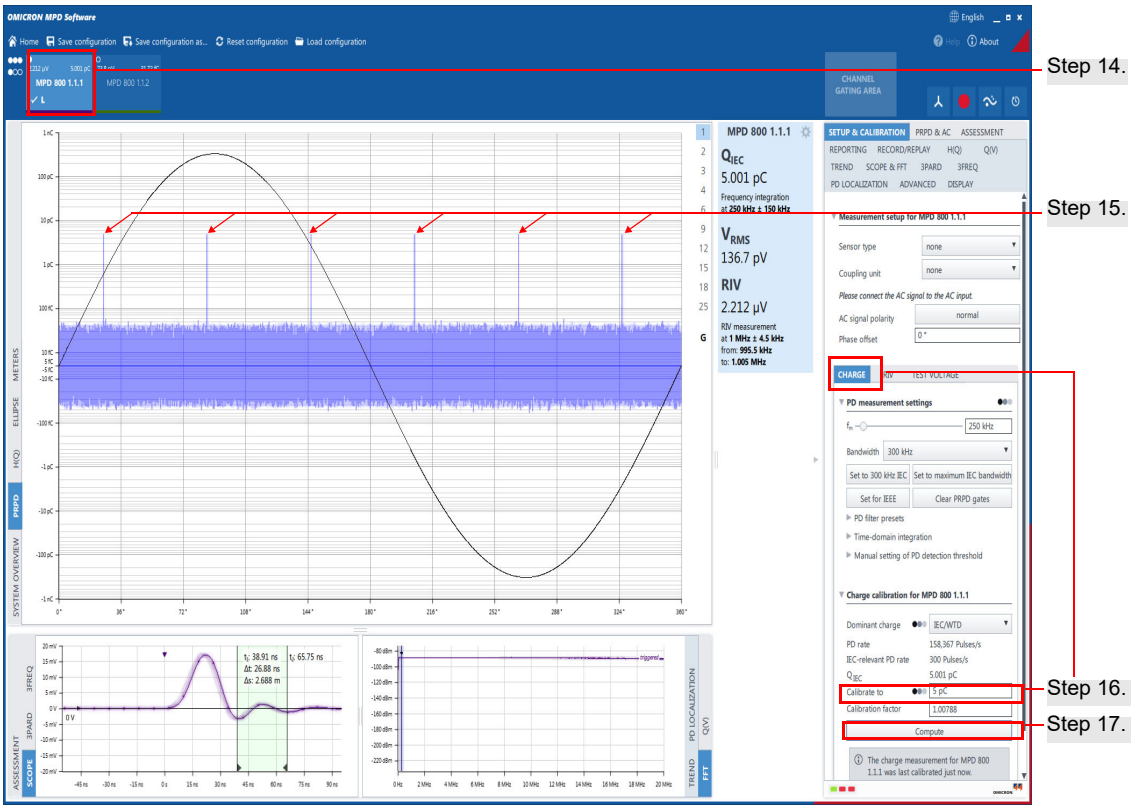


Figure 2-29: Main measurement window for charge calibration

14. Select the first channel for charge calibration.
15. Verify in the PRPD diagram that the calibrator pulses are clearly above noise and disturbances during the calibration process.

Note: In disturbed environments and to improve the signal-to-noise ratio (SNR), re-adjust the center frequency (f_m).

16. In the **Charge** subtab, enter in the **Calibrate to** input box the displayed charge value of the calibrator.
17. Click the **Compute** button.
18. To calibrate the next channel or unit, select the desired channel (for example, the second channel MPD 800 1.1.2) and follow the instructions from step 5. on page 40.

WARNING

Death or severe injury caused by high voltage or current possible

- ► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before entering the high-voltage area.
- ► Switch off the high voltage and ground the test setup before reconnection or disconnection of *CAL 542*.

NOTICE

Equipment damage caused by accidentally connected *CAL 542* possible

- ► After the calibration process is finished and **BEFORE** the voltage is applied, ensure that *CAL 542* and its connection cables are completely disconnected from the DUT.
- ► Do not apply voltage at the calibrator's BNC connector.
- ► Remove the calibrator before energizing the test setup.

Test voltage calibration

The test voltage calibration is generally performed at 10 % … 20 % of the maximum test voltage.

WARNING

Death or severe injury caused by high voltage or current possible

Working in the area of high-voltage systems is very dangerous.

- ► Make sure to observe dangerous areas.
- ► Always obey the internal safety instructions for working in areas with high voltage to avoid injury.

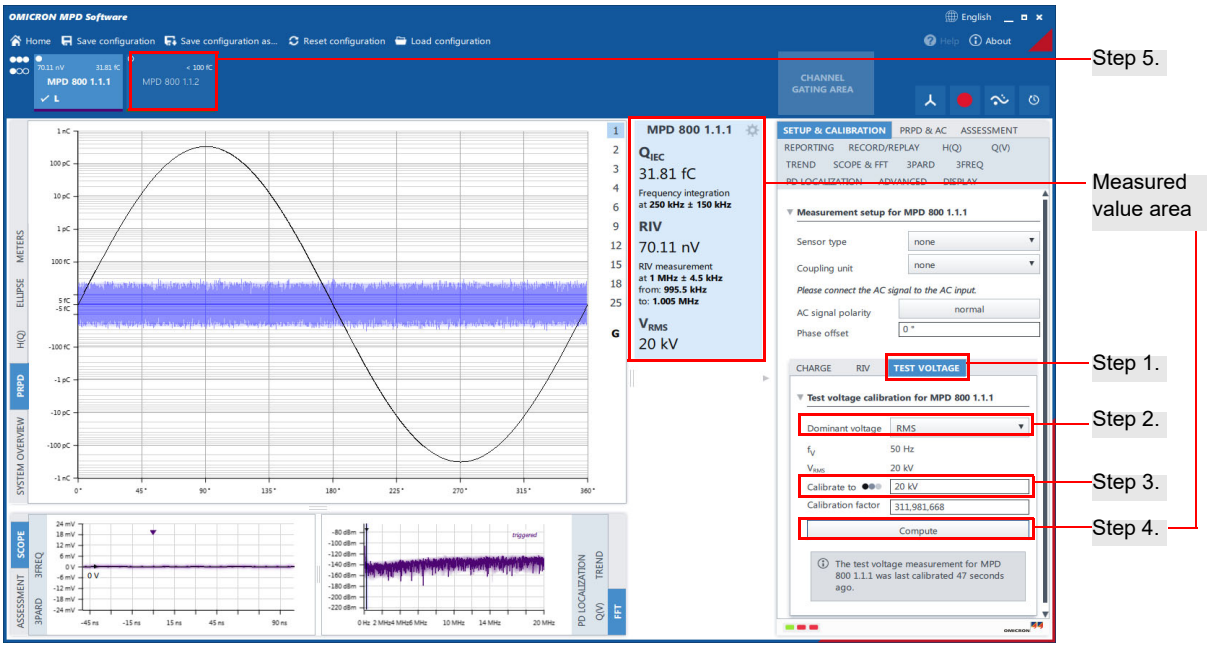


Figure 2-30: Main measurement window for **Test Voltage** calibration

1. Click the **Test Voltage** subtab.
2. Select the **Dominant Voltage** for the voltage calibration.
3. Use the **Calibrate to** input box to match the voltage display with the voltage that is being applied. This value can be read, for example, from another measurement instrument.

4. Click the **Compute** button. Now the high voltage is shown in the measured value area.
5. Select the next channel or unit (for example, MPD 800 1.1.2) for further **Test Voltage** calibration and follow the instructions from step 1. on page 44.

Now, the *MPD 800* system is configured and the high-voltage setup is calibrated. The *MPD 800* acquisition unit is ready for PD testing and you can conduct the measurement.

PRPD & AC tab

In the **PRPD & AC** tab, the synchronization source for the PRPD pattern is selected and the PRPD diagrams are scaled to the expected PD level.

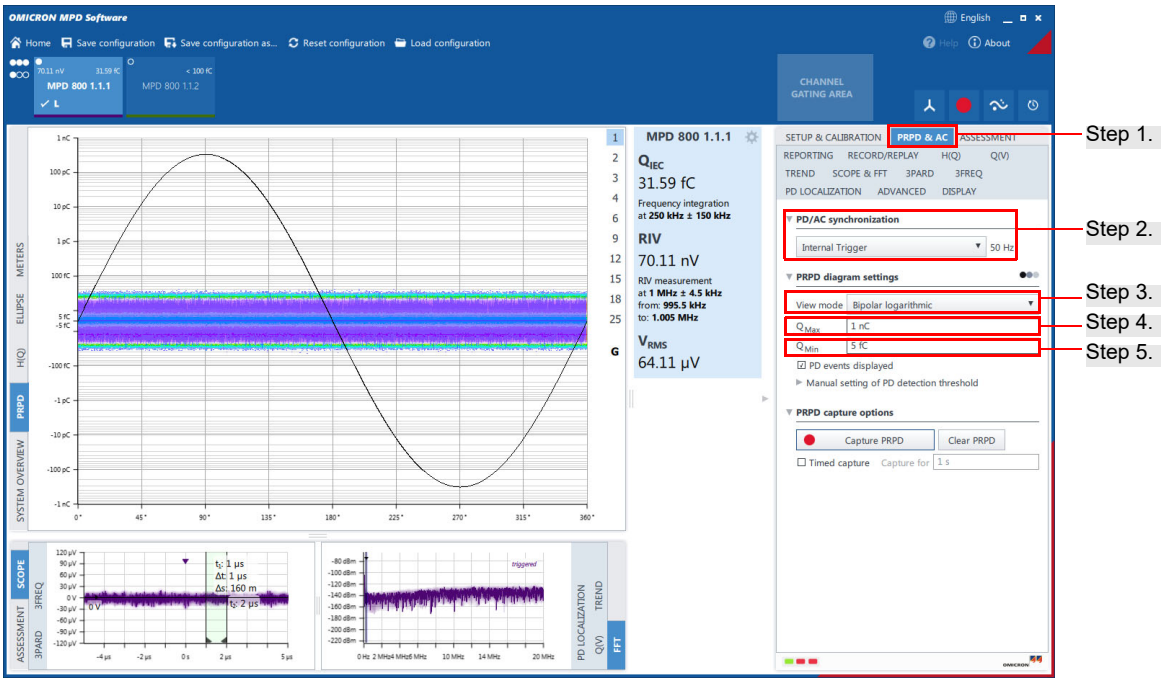


Figure 2-31: PRPD & AC view

1. Select the **PRPD & AC** tab.
2. Select the test voltage synchronization source for generating phase-resolved partial discharges (PRPDs) in the **PD/AC synchronization** drop-down list box.
3. Select the view mode for the PRPD pattern (unipolar, bipolar, linear or logarithmic) in the **View mode** drop-down list box.
4. In the next step, scale the PRPD view: Enter the maximum expected charge value in the $\mathbf{Q_{Max}}$ input box.
5. Enter the minimum expected charge value which is at the edge of the background noise level in the $\mathbf{Q_{Min}}$ input box, so that only a few pulses are detected.

2.3.4 Disconnection

Before entering the high-voltage area, observe the following instructions:

WARNING

Death or severe injury caused by high voltage or current possible

- ► Switch off the high voltage.
- ► Always obey the five safety rules (see 1.2.2 "Safety rules" on page 6) and follow the detailed safety instructions.
- ► Make sure to observe dangerous areas.
- ► Always obey the internal safety instructions for working in areas with high voltage to avoid injury.

1. Clean the fiber-optic cables. In dusty regions, use protective caps.
2. Disconnect the cables.
3. Remove the *MPD 800* acquisition unit, *RBP1*, *CPL1*/*CPL2* or accessories from the high-voltage area.
4. Recharge the battery pack for later use.

WARNING

Death or severe injury caused by fire and burns possible

RBP1 is a rechargeable lithium-ion battery pack.

- ► Do not drop or crush, do not short circuit, do not open, and do not expose the battery to high temperatures.
- ► Do not immerse the battery in any liquids.
- ► Do not charge the battery in flammable environment.
- ► Do not charge it below 0 °C/32 °F and above 40 °C/104 °F and do not operate it below –20 °C/–4 °F and above 55 °C/131 °F
- ► Never charge the battery near flammable objects.
- ► Do not deep discharge the battery and recharge it regularly during storage.
- ► Dispose of the battery properly, it may explode if damaged or disposed of in fire.
- ► Read this User Manual before charging the battery and use the specified charger only. Follow the local ordinances and/or regulations for usage of lithium batteries.

2.4 Package Contents and Delivery

The following items are delivered with the "*MPD 800* single unit high-end partial discharge measuring system":

Table 2-7: Package content and delivery

Item	
One *MPD 800* acquisition unit	
One *CPL1* external quadripole including two BNC cables	 
One *RBP1* rechargeable battery pack including battery connection cable	 
One *MCU2* standard multi-device control unit including USB cable	 
One fiber-optic cable (20 m / 65 ft)	
One *V-to-AC-adapter*	
One charger for *RBP1* (OMICRON 24 W DC supply)	
One *MPD 800* Getting Started Manual	
One *MPD 800* OMICRON factory test certificate	

The following items are delivered with the “*MPD 800* three unit high-end partial discharge measuring system”:

Table 2-8: Package content and delivery

Item	
Three *MPD 800* acquisition unit	
Three *CPL1* external quadripole including two BNC cables	 
Three *RBP1* rechargeable battery pack including battery connection cable	 
One *MCU2* standard multi-device control unit including USB cable	 
Three fiber-optic cable (20 m / 65 ft)	
Three *V-to-AC-adapter*	
Three charger for *RBP1* (OMICRON 24 W DC supply)	
One *MPD 800* Getting Started Manual	
One *MPD 800* OMICRON factory test certificate	

2.5 Accessories

The following items might not be included in the scope of delivery and could be ordered separately.

Table 2-9: Package content and delivery

Item	
MPD 800 acquisition unit	
CPL1 option IEC external quadripole including two BNC cables	 
CPL1 option NEMA ANSI IEC CISPR external quadripole including two BNC cables	 
CPL1 option CISPR IEC external quadripole including two BNC cables	 
CPL2 option IEC external quadripole including two BNC cables	 
CPL2 option NEMA ANSI IEC CISPR external quadripole including two BNC cables	 
CPL2 option CISPR IEC external quadripole including two BNC cables	 
RBP1 rechargeable battery pack including battery connection cable	 

Table 2-9: Package content and delivery (continued)

Item	
MCU2 multi-device control unit including USB cable	 
Standard fiber-optic cable (3 m / 9,8 ft)	
Standard fiber-optic cable (20 m / 65 ft)	
Rugged fiber-optic cable (5 m / 16,4 ft)	
Rugged fiber-optic cable on drum (50 m / 164 ft)	
Fiber-optic coupler	
V-to-AC-adapter	

Table 2-9: Package content and delivery (continued)

Item	
OMICRON 24 W DC supply	
MPC1 measurement protection case (empty) **Note:** *MPC1* can be equipped with the following options: A: 2 x *MPD 800* with 2 x *RBP1* B: 1 x *MPD 800* with 1 x *RBP1* and *UHF 800* with *RBP1* C: 1 x *MPD 800* with 1 x *RBP1* and *CPL1* D: 1 x *UHF 800* with *RBP1* E: 1 x *MPD 800* with 1 x *RBP1*	
Flight case (*MTC2*) for *MPD 800* system *MTC2* is the MPD flight case. It can contain: 3 x *MPD 800* acquisition units or 3 x *UHF 800* 3 x *CPL1* 1 x *CAL 542* or 1 x *RIV1* 1 x *MCU2* 3 x *RBP1*	
Transport case (*MTC1*) for *MPD 800* system *MTC1* is the universal MPD transport case and can contain: Option A: 5 x *MPD 800* acquisition units 1 x *UHF 800* 1 x *CAL 542* 1 x *RIV1* 1 x *MCU2* 6 x *RBP1* Option B: 3 x *MPD 800* acquisition units 1 x *UHF 800* 1 x *CAL 542* 1 x *RIV1* 1 x *MCU2* 4 x *RBP1*	

3 Technical specifications

3.1 Care and cleaning

The *MPD 800* system does not require any special maintenance or care. Always use dry and clean fiber-optic cables which are approved by OMICRON electronics.

Clean the devices and accessories from time to time or as necessary. To clean the *MPD 800* system and fiber-optic cables, use a cloth dampened with isopropanol alcohol.

DANGER

Death or severe injury caused by high voltage or current

► Always observe the five safety rules (see 1.2.2 "Safety rules" on page 6) before cleaning the *MPD 800* system.

3.2 *MPD 800* acquisition unit

3.2.1 Accuracy, resolution, display and measuring range

Table 3-1: Accuracy, resolution, display and measuring range

Parameter	Value
Dynamic range overall PD input	140 dB
Dynamic range per range PD input	70 dB
Dynamic range overall AC input	170 dB
Dynamic range per range AC input	107 dB
Measurement accuracy of current AC input (0.1 Hz … 100 Hz)	0.02 %
Measurement accuracy of PD input	±2 %
Measurement accuracy of frequency	±1 ppm
System noise PD input (time domain integration)	< 9 fC
Partial discharge event resolution PD input	2 ns
Partial discharge double pulse resolution PD input (BW = 20 MHz)	< 80 ns

3.2.2 Device data

Table 3-2: Device data

Parameter	Value
Analog PD bandwidth (Nyquist frequency)	62 MHz
Frequency range PD input (-6 dB)[1], internal quadripole enabled	6 kHz … 35 MHz
Frequency range PD input (-6 dB)[1], internal quadripole disabled	0 Hz … 35 MHz
Bandwidth	4.5 kHz, 9 kHz, 30 kHz, 100 kHz, 200 kHz, 300 kHz,400 kHz, 600 kHz, 900 kHz, 1 MHz, 2 MHz, 5 MHz, 10 MHz, 20 MHz
Frequency range AC input (±0.01 dB)	0 Hz … 10 kHz
Input impedance PD input (2.5 MHz … 40 MHz) (internal quadripole enabled)	50 Ω ±20 %
Input impedance PD input (≤ 40 MHz) (internal quadripole disabled)	50 Ω ±20 %
Input impedance AC input (≤ 4 kHz)	5 Ω ±20 %
Input power PD input (max. continuous)	500 mW
Input voltage PD input (max. RMS continuous)	5 V_{RMS}
Voltage range PD input (max. peak)	80 V, 40 V, 20 V, 10 V, 5 V, 2.5 V, 1.28 V, 640 mV, 320 mV, 160 mV, 80 mV, 40 mV, 20 mV, 10 mV
Input partial discharge impulse voltage PD input (max. 100µs)	80 V_{peak}
Input current AC input (max. RMS continuous)	250 mA_{RMS}
Input current AC input (max. peak)	400 mA_{peak}
Current range AC input (max. peak)	400 mA, 200 mA, 20 mA, 2 mA, 200 µA
Input current AC input (min. RMS)[2]	20 nA_{RMS}
Input surge current withstand capability PD input (internal quadripole enabled)	≤ 4.5 kA (≤ 30A^2s)
Input current withstand capability PD input (1 s, 50 Hz, 10 operations) (internal quadripole enabled)	20 A
Input current withstand capability AC input (100 s, 50 Hz)	5 A

Table 3-2: Device data (continued)

Parameter	Value
Sampling rate PD input	125 MS/s
Sampling rate AC input	31.25 kS/s
Resolution PD input	14 Bits
Resolution AC input	24 Bits
Impedance OUT connector	50 Ω ±10 %
Output voltage OUT connector	5 V ±0.5 %
Wavelength FO1, FO2	1308 nm
Wavelength TRIGGER	820 nm
Maximum fiber-optic cable length and type FO1, FO2	≤ 2.5 km, 50/125 µm OM3, LC compatible
Maximum fiber-optic cable length and type TRIGGER	≤ 50 m, 50/125 µm OM2, ST connector

1. Relative to 1 MHz
2. In order to be more than 60 dB above the internal noise, the measuring current without external quadripole should be at least 20 nA_{RMS}.

3.2.3 Power data

Table 3-3: Power data

Parameter	Value
Supply voltage POWER input	9 V … 24 V DC
Power consumption POWER input standby mode	≤ 25 mW
Power consumption POWER input active mode	≤ 6 W
Supply voltage OMICRON 24 W DC supply	100 V … 240 V
Supply voltage frequency range OMICRON 24 W DC supply	50 Hz … 60 Hz

3.2.4 Mechanical data

Table 3-4: Mechanical data

Parameter	Value
Dimensions (W × D × H)	119 mm × 190 mm × 55 mm (4.69 inch × 7.48 inch × 2.17 inch)
Weight	870 g

3.2.5 Environmental conditions

Table 3-5: Environmental conditions

Parameter	Value
Humidity	5 % … 95 %, non-condensing
Operating time at -20°C / 23°C / 55°C (using one *RBP1*)	13 hours / 16 hours / 16 hours
Ambient temperature (operating)	-20 °C … +65 °C
Ambient temperature (storage)	-40 °C … +85 °C
Maximum operating altitude	4000 m
Maximum storage altitude	12000 m
Ambient temperature OMICRON 24 W DC supply	+10 °C … +55 °C

3.2.6 Standards

Table 3-6: Standards

Parameter	Standard	Value
EMC	IEC/EN 61326-1 (industrial electromagnetic environment) FCC subpart B of part 15, class A	CE
Safety	IEC/EN/UL 61010-1 IEC/EN/UL 61010-2-030	TÜV SÜD C US
Laser class	EN 60825-1:2007 EN 60825-2:2007	Eye-safe laser class 1
Ingress protection (connectors mated)	IEC/EN 60529	IP4x
Partial discharge measurement	IEC 60270	

3.3 *CPL1* and *CPL2* external quadripole

3.3.1 Accuracy

Table 3-7: Accuracy

Parameter	Value
Current divider ratio accuracy IN input to AC output	1:250
Phase deviation IN input to AC output	< 1°

3.3.2 Device data

Table 3-8: Device data

Parameter	Value
Frequency range PD output (-6 dB) (Option *IEC*, Z_i = 50 Ω)	5 kHz … 35 MHz
Frequency range PD output (-6 dB)[1] (Option *NEMA ANSI IEC CISPR,* Z_i = 150 Ω)	20 kHz … 40 MHz
Frequency range PD output (-6 dB)[1] (Option *CISPR IEC*, Z_i = 300 Ω)	20 kHz … 40 MHz
Frequency range AC output (1 dB)	5 Hz … 14 kHz
Input impedance IN input (20 kHz… 7 MHz) (Option *IEC*)	50 Ω ±20 %
Input impedance IN input (20 kHz… 3 MHz) (Option *NEMA ANSI IEC CISPR*)	150 Ω ±20 %
Input impedance IN input (35 kHz… 2 MHz) (Option *CISPR IEC*)	300 Ω ±13 %
Input impedance IN input (15 Hz… 400 Hz)	1.3 mH ±10 % + 90 mΩ ±10 %
Required termination impedance PD output	50 Ω
Required termination impedance AC output	≤ 7.5 Ω
Input current (15 Hz… 400 Hz, max. RMS continuous)	7 A_{RMS}
Input current (50 Hz, min. RMS)[2]	5 µA_{RMS}
Short term input current IN input (50 Hz, max. 60 seconds)	14 A_{RMS}
Short term duty factor of input current IN input	10 %
Current divider ratio IN input to AC output	250:1

Table 3-8: Device data (continued)

Parameter	Value
Output partial discharge impulse voltage PD output (max.)	80 V_{peak}
Input surge current withstand capability	≤ 8 kA (≤ 500A^2s)
Maximum voltage between RTN/OUT connector and GND connector (applies to *CPL2* only)[3]	140 V_{RMS}

1. Relative to 1 MHz
2. In order to be more than 60 dB above the internal noise, the measuring current should be at least 5 μA_{RMS}.
3. The voltage drop across the input impedance of the equipment connected to OUT/RTN should not exceed 140 V_{RMS} with the maximum input current applied.

3.3.3 Mechanical data

Table 3-9: Mechanical data

Parameter	Value
Dimensions (W × D × H)	119 mm × 175 mm × 55 mm (4.69 inch × 6.89 inch × 2.17 inch)
Weight	1270 g

3.3.4 Environmental conditions

Table 3-10: Environmental conditions

Parameter	Value
Humidity	5 % … 95 %, non-condensing
Ambient temperature (operating)	-20 °C … +65 °C
Ambient temperature (storage)	-40 °C … +85 °C
Maximum operating altitude	4000 m
Maximum storage altitude	12000 m

3.3.5 Standards

Table 3-11: Standards

Parameter	Standard	Value
EMC	IEC/EN 61326-1 (industrial electromagnetic environment) FCC subpart B of part 15, class A	CE
Safety	IEC/EN/UL 61010-1 IEC/EN/UL 61010-2-030	TÜV SÜD C US
Ingress protection (connectors mated)	IEC/EN 60529	IP4x
Partial discharge measurement	IEC/EN 60270	

3.4 *MCU2* multi-device control unit

3.4.1 Device data

Table 3-12: Device data

Parameter	Value
Wavelength FO 1	1308 nm
Wavelength FO 2 (if present)	1308 nm
Wavelength FO 3 (if present)	820 nm (*MPD 600* version) 1308 nm (*MPD 800* version)
Wavelength TRIGGER	430 nm … 1100 nm
Maximum fiber-optic cable length and type FO 1, FO 2, FO 3	2.5 km, 50/150 µm OM3
Connector types	2 x LC (duplex) and 1 x ST (duplex)

3.4.2 Power data

Table 3-13: Power data

Parameter	Value
Power supply	5 V ±5 % according to USB 3.0 specification
Power consumption	≤ 4.5 W

3.4.3 Mechanical data

Table 3-14: Mechanical data

Parameter	Value
Dimensions (W × D × H)	119 mm × 175 mm × 55 mm (4.69 inch × 6.89 inch × 2.17 inch)
Weight	750 g

3.4.4 Environmental conditions

Table 3-15: Environmental conditions

Parameter	Value
Humidity	5 % … 95 %, non-condensing
Ambient temperature (operating)	-20 °C … +55 °C
Ambient temperature (storage)	-40 °C … +85 °C
Maximum operating altitude	4000 m
Maximum storage altitude	12000 m

3.4.5 Standards

Table 3-16: Standards

Parameter	Standard	Value
EMC	IEC/EN 61326-1 (industrial electromagnetic environment) FCC subpart B of part 15, class A	CE
Safety	IEC/EN/UL 61010-1 IEC/EN/UL 61010-2-030	TÜV SÜD C US
Laser class	EN 60825-1:2007 EN 60825-2:2007	Eye-safe laser class 1
Ingress protection (connectors mated)	IEC/EN 60529	IP4x

3.5 *RBP1* rechargeable battery pack

3.5.1 Device data

Table 3-17: Device data

Parameter	Value
Output voltage OUTPUT	9 V…24 V DC
Output current OUTPUT	≤ 4 A DC[1]
Nominal battery voltage	11.1 V
Energy (900 mA discharge current, 25 ºC ambient temperature)	80 Wh
Nominal energy (theoretical value)	(96.6 Wh)
Charge cut-off voltage[2]	12.5 V
Discharge cut-off voltage[3]	9 V
Cell chemistry	Lithium-ion
Battery life cycle[4]	1000 cycles or 5 years

1. Short-circuit protected. The current cannot be increased by multiple *RBP1* devices.
2. Defined by internal charger circuitry. The charging process is stopped at the overcharge cut-off voltage.
3. Defined by internal charger circuitry. Discharging the *RBP1* is stopped at the overdischarge cut-off voltage.
4. Whichever occurs first. Remaining 50 % SoH equals 40 Wh remaining energy.

3.5.2 Power data

Table 3-18: Power data

Parameter	Value
Supply voltage INPUT input	9 V … 24 V DC ±5 %
Power consumption INPUT input: Supply voltage ≤20 V Supply voltage >20 V	 ≤ 24 W ≤ 75 W
Supply voltage OMICRON 24 W DC supply	100 V … 240 V
Supply voltage frequency range OMICRON 24 W DC supply	50 Hz … 60 Hz

3.5.3 Mechanical data

Table 3-19: Mechanical data

Parameter	Value
Dimensions (W × D × H)	115 mm × 175 mm × 38 mm (4.53 inch × 6.89 inch × 1.50 inch)
Weight	910 g (2 lb)

3.5.4 Environmental conditions

Table 3-20: Environmental conditions

Parameter	Value
Humidity	5 % … 85 %, non-condensing
Ambient temperature (operating/discharge)	-20 °C … +55 °C
Ambient temperature (charge)	0 °C … +40 °C
Ambient temperature (storage)	-20 °C … +30 °C
Maximum operating altitude	4000 m
Maximum storage altitude	12000 m
Ambient temperature OMICRON 24 W DC supply	+10 °C … +55 °C

3.5.5 Standards

Table 3-21: Standards

Parameter	Standard	Value
EMC	IEC/EN 61326-1 (industrial electromagnetic environment) FCC subpart B of part 15, class A	CE
Safety	IEC/EN/UL 61010-1 IEC/EN/UL 61010-2-030	TÜV SÜD C US
Ingress protection (connectors mated)	IEC/EN 60529	IP4x

3.6 *V-to-AC-adapter* 100kOhm

3.6.1 Device data

Table 3-22: Device data

Parameter	Value
Nominal resistance	100 kΩ
Initial resistance accuracy	±0.02 %
Typical temperature coefficient	2 ppm/K
Maximum power dissipation	200 mW
Maximum working voltage	200 V_{peak} / 140 V_{RMS} continuous
Maximum withstand voltage (open circuit)	300 V_{peak} (overvoltage CAT I)
Long term resistance deviation (1000 full load cycles / 2 years)	< ±0.15 %

3.6.2 Mechanical data

Table 3-23: Mechanical data

Parameter	Value
Dimensions (W × Ø)	72 mm × 24 mm (2.83 inch × 0.94 inch)
Weight	55 g

3.6.3 Environmental conditions

Table 3-24: Environmental conditions

Parameter	Value
Humidity	5 % … 95 %, non-condensing
Ambient temperature (operating)	-20 °C … +55 °C
Ambient temperature (storage)	-40 °C … +85 °C
Maximum operating altitude	4000 m
Maximum storage altitude	12000 m

3.7 *MPC1* measurement protection case

3.7.1 Mechanical data

Table 3-25: Mechanical data

Parameter	Value
Dimensions (W × H × D)	477 mm × 174 mm × 330 mm (18.80 inch × 6.85 inch × 13.00 inch)
Weight (empty)	3900 g

3.7.2 Environmental conditions

Table 3-26: Environmental conditions

Parameter	Value
Humidity	5 % … 95 %, non-condensing
Ambient temperature (operating *MPD 800* system) Option A, B and C Option D and E	 -20 °C … +45 °C -20 °C … +50 °C
Ambient temperature (storage for the *MPD 800* system)	-20 °C … +30 °C
Ambient temperature (charging *RBP1*)	0 °C … +40 °C
Maximum operating altitude	4000 m
Maximum storage altitude	12000 m

3.7.3 Standards

Table 3-27: Standards

Parameter	Standard	Value
Ingress protection (connectors mated)	IEC/EN 60529	IP65

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

www.omicronenergy.com/support

At our technical support hotline, you can reach well-educated technicians for all of your questions. Around the clock – competent and free of charge.

Make use of our 24/7 technical support hotlines:

Americas: +1 713 830-4660 or +1 800-OMICRON

Asia-Pacific: +852 3767 5500

Europe / Middle East / Africa: +43 59495 4444

Additionally, you can find our Service Center or Sales Partner closest to you at www.omicronenergy.com.

Customer Portal – stay informed

www.omicronenergy.com/customer

The Customer Portal on our website is an international knowledge exchange platform. Download the latest software updates for all products and share your own experiences in our user forum.

Browse through the knowledge library and find application notes, conference papers, articles about daily working experiences, user manuals and much more.

OMICRON Academy – learn more

www.omicronenergy.com/academy

Learn more about your product in one of the training courses offered by the OMICRON Academy.

OMICRON electronics GmbH, Oberes Ried 1, 6833 Klaus, Austria, +43 59495