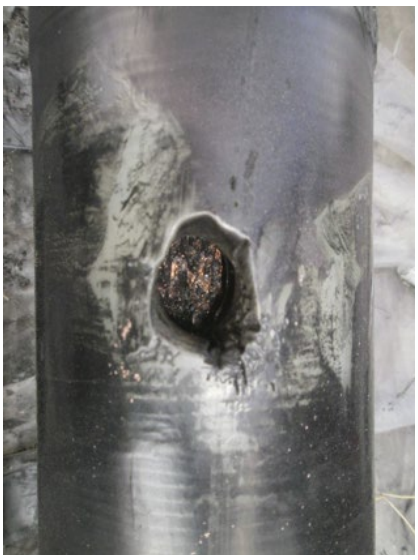
OMICRON

MONCABLO

Permanent on-line partial discharge monitoring system for high-voltage and extra-high-voltage cables

Permanent PD monitoring prevents cable system failures



Insulation breakdown at a cable termination

Preventing in-service failure of of HV und EHV cables

High-voltage (HV) and extra high-voltage (EHV) cables, terminations and joints are factory-tested before installation to ensure quality and reliability according to customer requirements and standards.

However, cables can be damaged during transportation, laying and during the installation of terminations and joints. These defects may not cause initial failure under voltage but can create partial discharge (PD) in the insulation system.

Partial discharge destroys cable insulation

If allowed to continue, PD will degrade the insulation and result in flashovers and cable system failures. This causes unplanned power outages, loss of plant production, damage to adjacent equipment, and in the worst case, personal injury.

Detect and remove defects prior to failure

By detecting and trending PD activity with a permanent on-line PD monitoring system, it is possible to continuously observe its development over time. This information helps you to make important decisions regarding the timely replacement of the HV cable or cable accessory before a failure occurs.

PD monitoring of cable accessories in short and long cable systems

Terminations of a 230 kV short cable system

Terminations of a 380 kV buried cable system

Joints of a 380 kV tunnel cable system

MONCABLO at a glance

Continuous PD detection in HV and EHV cables

Our MONCABLO permanent on-line PD monitoring system combines advanced hardware and software technologies for continuous condition assessment of electrical insulation in HV cables, terminations and joints.

Condition-based action trigger

The system's condition-based action trigger determines when surrounding conditions, such as rain or increased humidity are present, and gates out their effect so they do not compromise measurement evaluation.

Intuitive web-based user interface

The MONCABLO software web-based user interface allows you to remotely configure the monitoring system, view real-time PD data and historical trends, and to analyze the collected raw data.

The software also allows you to correlate the PD data with data from other sensors (e.g. temperature, oil pressure, etc.) also installed on the cable system.

PD data evaluation

Multiple PD sources are automatically separated from each other and from external noise through techniques such as our 3-Phase Amplitude Relation Diagram (3PARD) and automatic PD cluster separation.

Automatic notification of PD activity status

You are automatically notified by email whenever PD activity exceeds pre-set warning or alarm thresholds. The generation of false alarms triggered by external events, for example by noise, are prevented.

Customizable, automatic reporting

You can customize templates for different types of reports with relevant measurement and alarm data for a specified time period and manage email recipient lists. The reports are automatically generated and distributed.

Suitable for cable system after-installation testing

MONCABLO can also be used to perform simultaneous PD measurements at each cable accessory during the AC voltage after-installation test of the cable system. Potential defects are quickly detected and localized using a patented feature.

Your benefits

- Synchronous data acquisition at all cable accessories for after-installation testing and monitoring of the cable system
- Advanced on-line defect localization along the entire cable length
- Seamless integration with third-party monitoring devices and SCADA systems
- Web-based data access, management and visualization
- Email notification of alarms
- Automatic report generation and distribution

www.omicronenergy.com/moncablo

One system for complete on-line PD monitoring

MONCABLO system components

1 MCT 120 high-frequency current transformer

- Designed for permanent installation at cable terminations and joints
- Split core for easy installation on the cable sheaths or grounding connections
- Ensures sensitive measurements even when there are high currents on the cable sheath or grounding connections

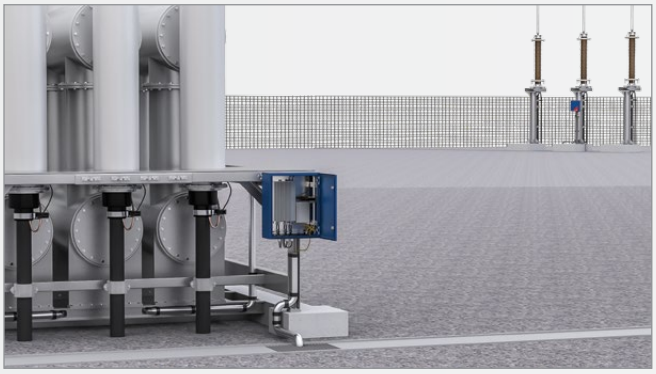
2 OMS 841 acquisition unit and protective enclosure

- 4-synchronous channels, IEC 60270 certified PD data acquisition
- Fully digital bandpass filter with adjustable bandwidth and center frequency
- Robust enclosure (IP65) protects data acquisition unit from dust, moisture and unauthorized access

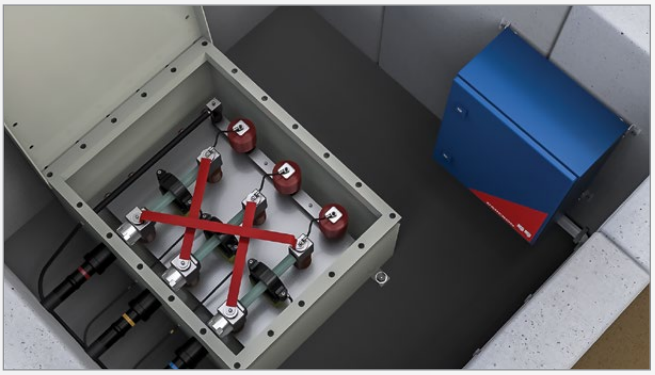
PD monitoring system architecture

MONCABLO has a modular and flexible design, which can be easily customized to match different layout requirements of tunnel or buried cable systems.

PD monitoring at the cross-bonded joints of a tunnel cable system



PD monitoring at the cable terminations



PD monitoring at the cross-bonded joints of a buried cable system

3 IPS 820 inductive power supply

> Installed on one phase of the power cable
> Inductive power supply for tunnel cable systems where conventional low-voltage sources are not allowed or available
> Ensures stable output voltage for the monitoring system supply, even under low cable loads

4 Fiber optic communications

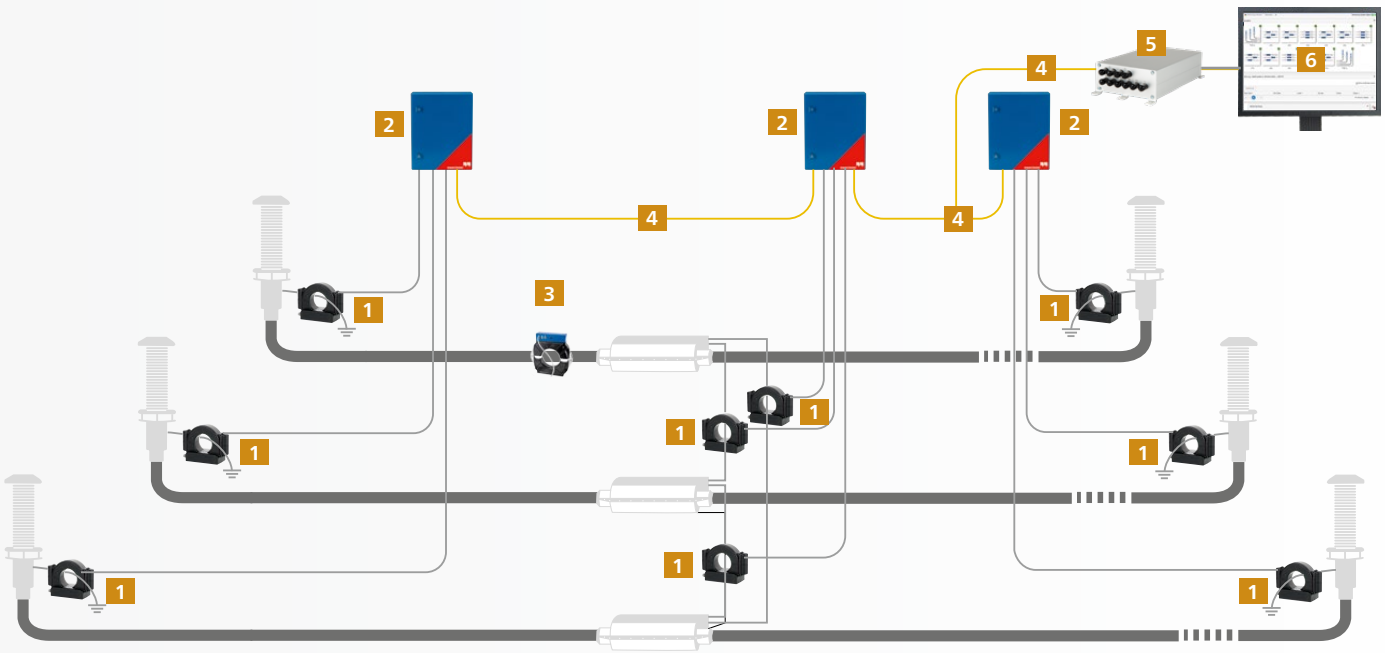
> Enables uninterrupted data transmission over long distances
> Ensures the synchronicity of PD data acquisition
> Guarantees operator personal safety due to complete galvanic isolation

5 MCU master control unit

> Converts the optical signal to an electrical signal and transfers it to the computer via the USB
> Can operate with both single-mode and multi-mode fiber optics

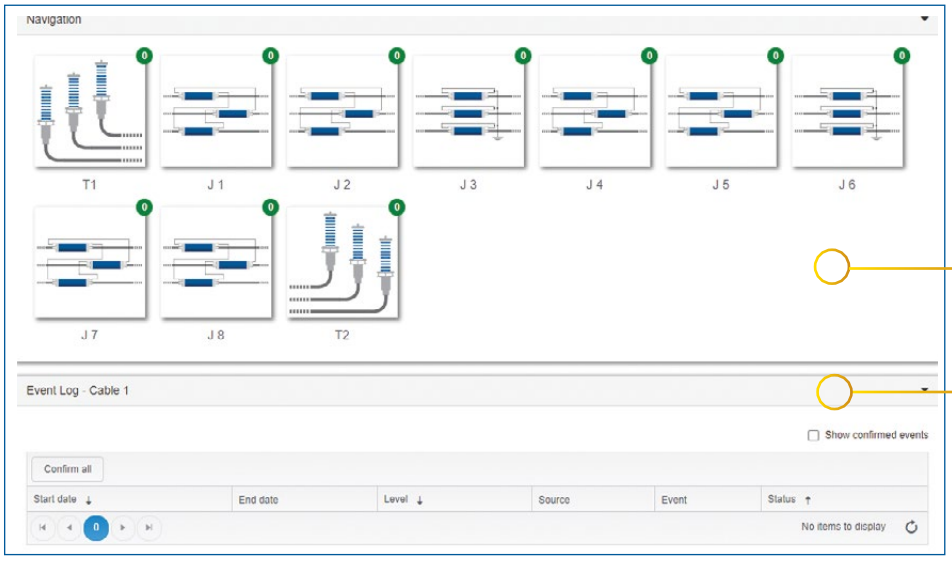
6 Central controller with monitoring software

> State-of-the art database system for long-term data storage and retrieval
> Web-based data access & visualization
> Customizable integration of third-party sensors and export to SCADA systems



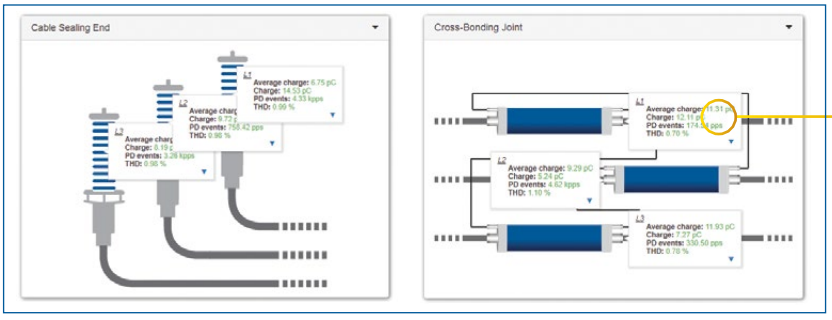
Software for complete PD monitoring and analysis

Real-time data display

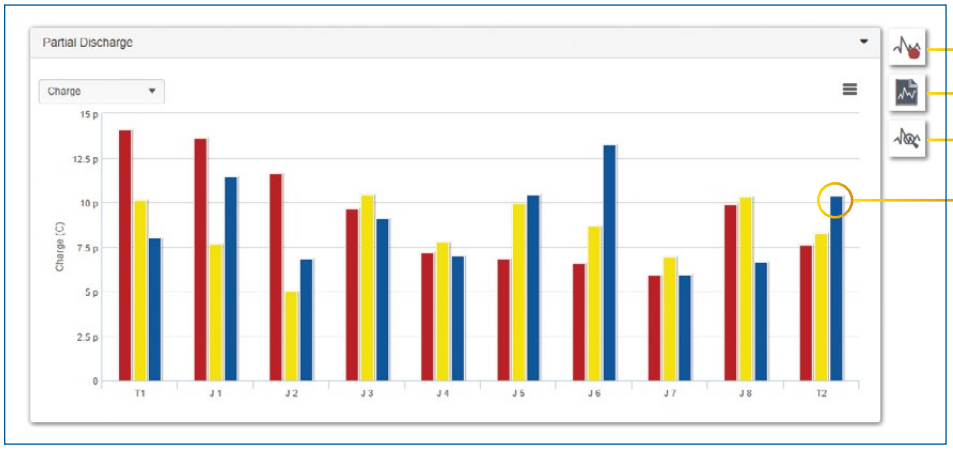


Real-time condition visualization of all monitored cable accessories

Event Log displays and manages the warnings and alarms for the selected asset



Real-time data displayed next to the individual measuring points



a

b

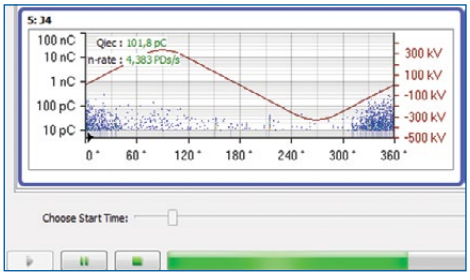
c

Scroll over the data points to view date, time and PD values for each phase

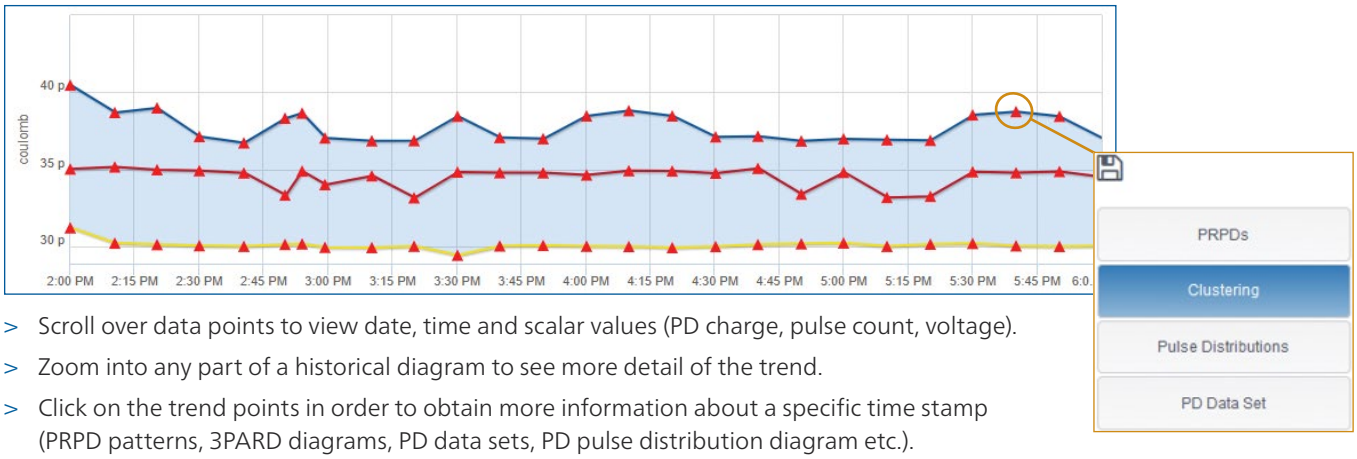
a Recording PD data sets

MONCABLO allows the recording of raw PD data sets for detailed analysis. They can be recorded periodically, when triggered by a threshold violation or by the user.

The main measurement values can be stored per channel in a .csv file during replay of a recorded PD Dataset. This enables you to perform further analysis and generate charts, for example with MS Excel.



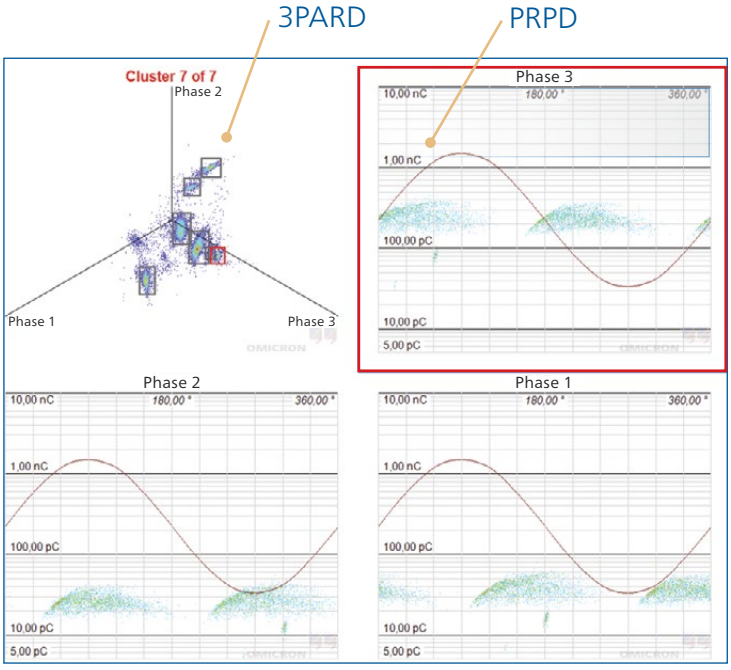
b Historical trend display



> Scroll over data points to view date, time and scalar values (PD charge, pulse count, voltage).

> Zoom into any part of a historical diagram to see more detail of the trend.

> Click on the trend points in order to obtain more information about a specific time stamp (PRPD patterns, 3PARD diagrams, PD data sets, PD pulse distribution diagram etc.).



Automatic PD cluster separation

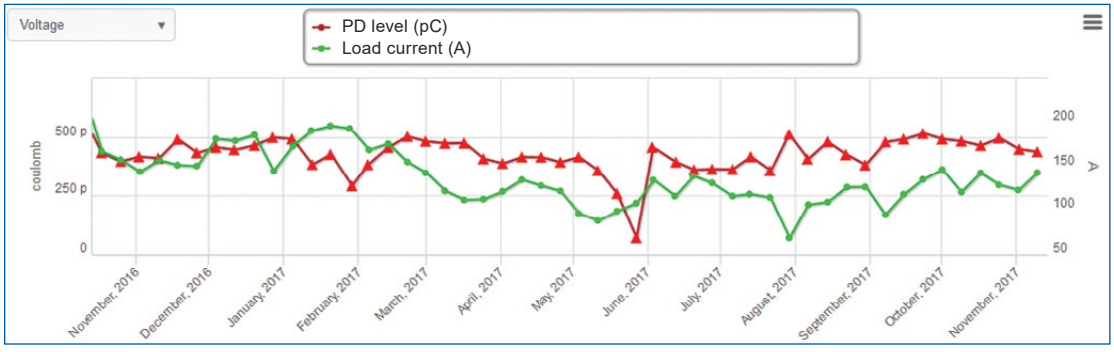
> Performed either regularly, when triggered by an event (violation of pre-set warning/alarm threshold), or when triggered by the user.

> Click on a separated cluster to obtain its individual PRPD pattern.

> For each cluster, the most probable phase of signal origin is identified.

> Available via the web interface.

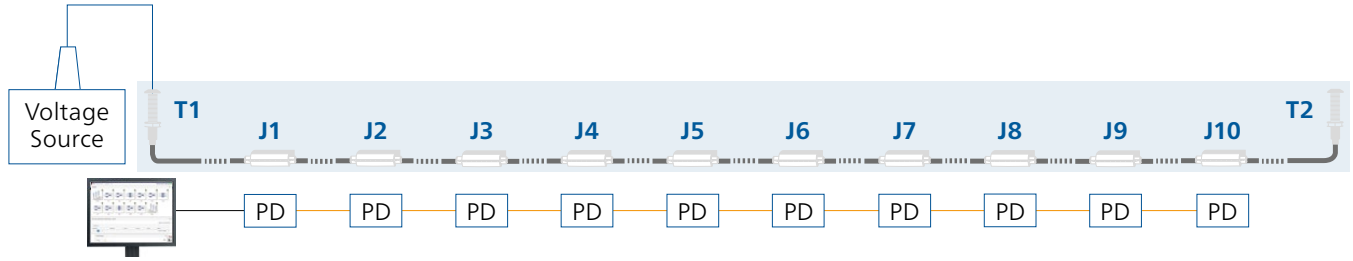
c Data analysis

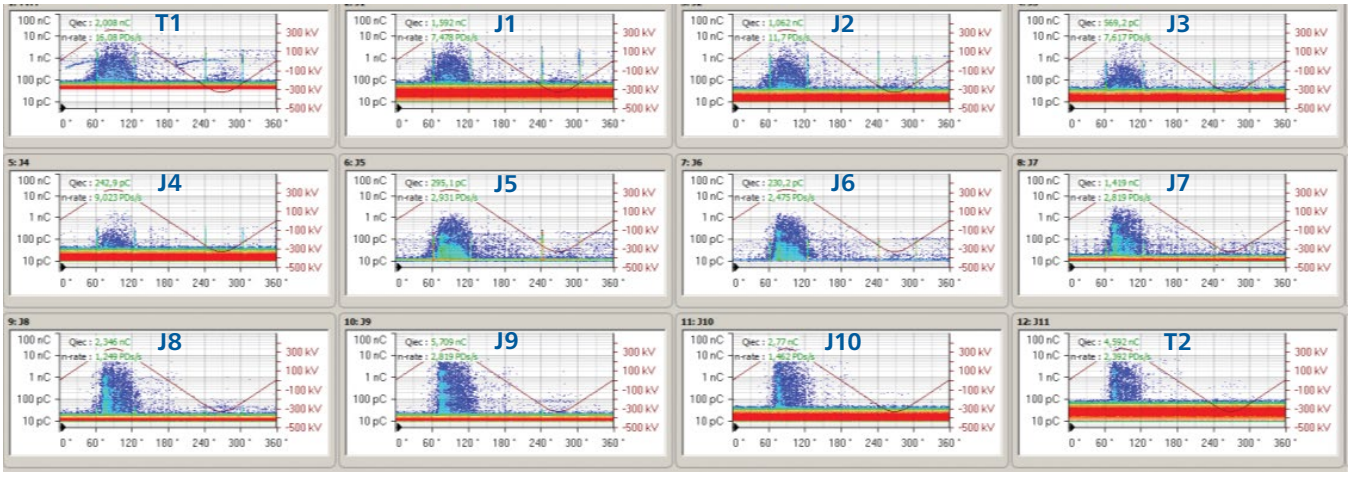


The software enables the correlation of multiple monitored parameters in one graph.

Comprehensive cable diagnosis

AC voltage after-installation testing of cable systems

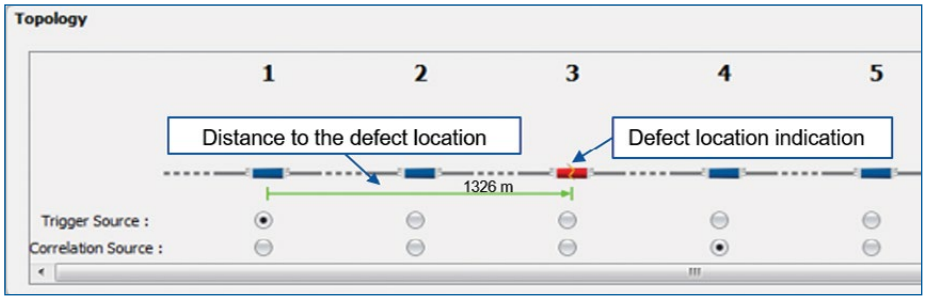




- Simultaneous PD measurement performed directly at each cable accessory during the AC voltage after-installation test of the cable system.
- Synchronization with the test voltage source is performed.
- Complete recording of PD activity is available during the commissioning test.

Defect localization

A unique, patented technology based on dual-end statistical Time Domain Reflectometry (sTDR) pinpoints the location of PD defects along the entire length of HV cables.



OMICRON support during project realization

A complete range of services to ensure monitoring project success

Our service engineers support you in all stages of your cable monitoring project with a wide range of services to ensure its success, from requirements evaluation and system design to installation, site acceptance testing, user training, and help with data evaluation.

Cable monitoring project

Phase 1

Monitoring system design for buried or tunnel cable systems

- Solutions for monitoring system power supply:
  - Customer designed and installed low voltage circuitry
  - Inductive power supply for tunnel cable systems
- Safe positioning and installation of PD sensors in the link boxes
- Monitoring system installation
- Integration of data from other sensors and export to SCADA

Phase 2

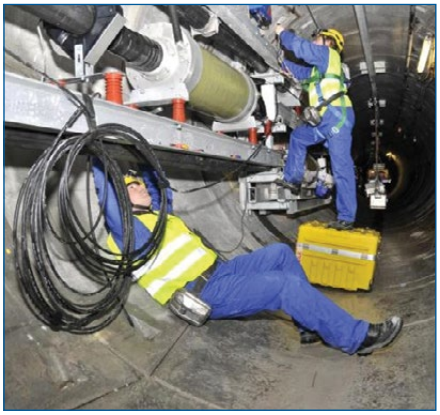
AC voltage after-installation testing of cable system

- Perform PD measurements simultaneously at all cable accessories during the AC voltage after-installation test of the cable system

Phase 3

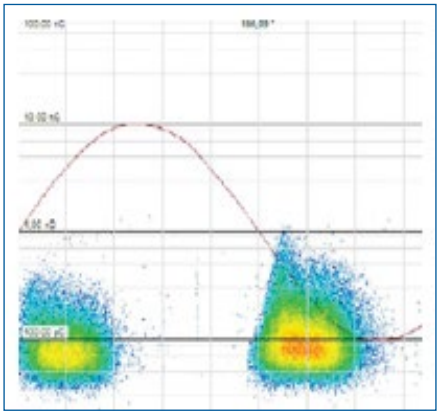
Services during cable system operation

- Data evaluation (periodic or on request)
- Software updates



Support with design and installation

High quality and safe design



Support with data evaluation

Technical specifications

MCT 120 high-frequency current transformer

Frequency Range (-6 dB)	80 kHz ... 40 MHz
Inner hole dimensions	ø ~53.5 mm / 2.11 in
Outer dimensions	114 x 154 x 62 mm / 4.49 x 6.07 x 2.45 in
Ferrite core	Split
Connector	BNC, 50 Ohm, female
Weight	1.2 kg / 2.65 lb
Operating temperature	-30 °C...100 °C / -22 °F...212 °F

OMS 841 acquisition unit

Number of input channels	4
Connector type	BNC
Frequency range	Hardware: AC: DC ... 16 kHz Software: Selectable, 10 Hz ... 450 Hz PD: 16 kHz ... 30 MHz
Sampling rate	AC: 31.25 kS/s PD: 125 MS/s
Peak input levels	AC: 200 mA PD: 80 V
Measurement accuracy	AC: ±0.25% (40 Hz < f < 70 Hz) PD: ±5 % (f = 300 kHz, Δf = 150 kHz)
Maximum double pulse resolution	< 200 ns
PD event time resolution	< 2 ns
PD filter bandwidth	9 kHz … 5 MHz (10 bandwidth settings)
System noise	< 1 pC
Power supply requirements	24 V DC / 0.5 A

OMS 841 protective enclosure

Dimensions (W × H × D)	400 × 500 × 250 mm / 15.7 × 19.7 × 9.8 in.
Weight	~15 kg / 33 lb.

OMS 841 external power supply

AC	DC
110 V AC … 240 V AC / 50/60 Hz	110 V DC … 300 V DC

IPS 820 inductive power supply

Current range	> 100 A
Frequency	45 Hz…65 Hz
Output voltage	8.5 V DC…18.5 VDC
Operating temperature	-40 °C … + 65 °C / -40 °F … + 149 °F
Dimensions (W × H × D)	35.8 × 36.8 × 8 cm / 14.1 × 14.5 × 3.1 in.
Weight	15 kg / 33.1 lb

Fiber optic connection

Medium	Standard: Duplex multi-mode fiber optic cables 50/125 µm (OM3 or better) Optional: Duplex single-mode fiber optic cables 9/125 µm (OS1 or better)
Wavelength	1300 nm
Maximum cable length	4 km (multi-mode), 40 km (single mode)
Connector type	LC

MCT 120

OMS 841

Protective enclosure

IPS 820

MCU master control unit

Data output	USB 3.0
Power supply	24 V / 1.67 A DC

Environmental specifications

Operating temperature	-30 … +55 °C / -22 … +131 °F
Storage temperature	-40 … +80 °C / -40 … +176 °F
Humidity	Up to 95 % r.H. (non-condensing)

Vibration, shock and protection class

	Standard	Rating
Vibration	EN 60068-2-6	Frequency range: 10 Hz … 150 Hz Acceleration: 2 g continuous (20 m/s2), 10 cycles per axis
Shock	EN 60068-2-27	15 g/11 ms, half-sinusoid, per axis
Protection class	EN 60529	IP50 (OMS 841) IP65 (OMS enclosure)
	Optional	IPX8 (OMS type 316L stainless steel enclosure)

Electromagnetic compatibility

Emission	EN 55011/22, 30 MHz … 3 GHz FCC Subpart B, 30 MHz … 1 GHz
Immunity	EN 61000-6-5: MV/HV substations

Safety requirements

Safety requirements for electrical equipment for measurement, control and laboratory use	EN 61010-1

Software requirements

OMS System & Monitoring Software

The minimum system requirements for running the OMS System Software and the Moitoring Software are:

- Win 10 or Win Server 2016 and above
- Processor: 6 Cores / 12 Threads
- RAM: 32 GB
- USB 3.0
- Screen resolution (minimum): 1024 x 768 pixels

A central computer that meets these software requirements is provided by OMICRON.

Communication protocols

RS485	ModBus RTU
Ethernet/TCP IP	ModBus TCP
	DNP3
	IEC 61850

MCU

Central controller with OMS System & Monitoring Software

We create customer value through ...

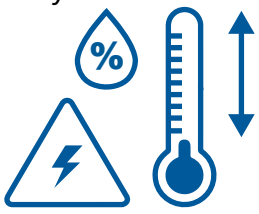
Quality

We always want you to be able to rely on our testing solutions. This is why our products have been developed with experience, passion and care and are continually setting ground-breaking standards in our industry sector.

You can rely on the highest safety and security standards

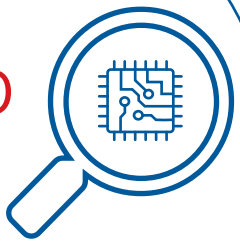
Superior reliability with up to

72



hours burn-in tests before delivery

100%



routine testing for all test set components

ISO 9001
TÜV & EMAS
ISO 14001
OHSAS 18001

Compliance with international standards

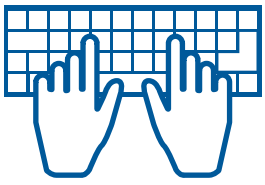
Innovation

Thinking and acting innovatively is something that's deeply rooted in our genes. Our comprehensive product care concept also guarantees that your investment will pay off in the long run – e.g. with free software updates.

... a product portfolio tailored to my needs

More than

200



developers keep our solutions up-to-date

More than

15%

of our annual sales is reinvested in research and development

Save up to

70%

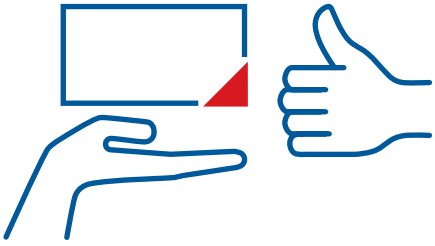
testing time through templates, and automation

We create customer value through ...

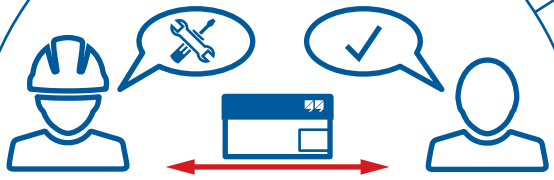
Support

When rapid assistance is required, we're always right at your side. Our highly-qualified technicians are always reachable. Furthermore, we help you minimize downtimes by lending you testing equipment from one of our service centers.

Professional technical support at any time



Loaner devices help to reduce downtime



Cost-effective and straight-forward repair and calibration

offices worldwide for local contact and support

Knowledge

We maintain a continuous dialogue with users and experts. Customers can benefit from our expertise with free access to application notes and professional articles. Additionally, the OMICRON Academy offers a wide spectrum of training courses and webinars.

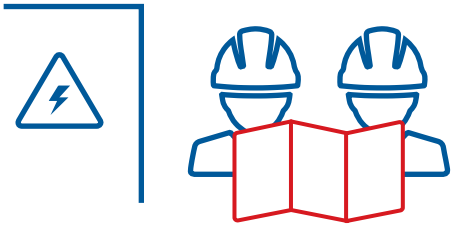
More than

300

Academy and numerous hands-on trainings per year

Frequently OMICRON hosted user meetings, seminars and conferences

to thousands of technical papers and application notes



Extensive expertise in consulting, testing and diagnostics

OMICRON is an international company that works passionately on ideas for making electric power systems safe and reliable. Our pioneering solutions are designed to meet our industry's current and future challenges. We always go the extra mile to empower our customers: we react to their needs, provide extraordinary local support, and share our expertise.

Within the OMICRON group, we research and develop innovative technologies for all fields in electric power systems. When it comes to electrical testing for medium- and high-voltage equipment, protection testing, digital substation testing solutions, and cybersecurity solutions, customers all over the world trust in the accuracy, speed, and quality of our user-friendly solutions.

Founded in 1984, OMICRON draws on their decades of profound expertise in the field of electric power engineering. A dedicated team of more than 900 employees provides solutions with 24/7 support at 25 locations worldwide and serves customers in more than 160 countries

The following publications provide further information on the solutions described in this brochure:

For more information, additional literature, and detailed contact information of our worldwide offices please visit our website.

www.omicronenergy.com