



## VARIMETER

Insulation monitoring device (IMD)  
Insulation fault detection system (EDS)  
Residual current monitor (RCM)

Technical contribution:  
Insulation monitoring of  
disconnected consumers



# Insulation monitoring and residual current

## VARIMETER

### Does constant availability go without saying?

You know the situation: complex production systems, high requirements in terms of the quality, delivery time and reliability, permanent cost pressure. This requires more than ever a comprehensive operational readiness in order to be able to maintain and improve the competitiveness at the international level.

In practice, however, a comprehensive operational readiness is often given only conditionally, because insulation faults may slowly but progressively occur due to ageing, moisture, pollution, mechanical damage and other factors. Consequences of such undiscovered errors are costly plant shut-downs and operational downtime, repair costs and usually high costs resulting from production downtime. In the worst case these insulation faults are even a frequent cause of fires and personal injuries.

### The solution is simple:

Protection of people and machines by insulation monitoring and timely information about emerging critical operating conditions. DOLD Insulation and residual current monitoring systems have been successfully used for many years in most various areas.

### Automate the preventive maintenance.

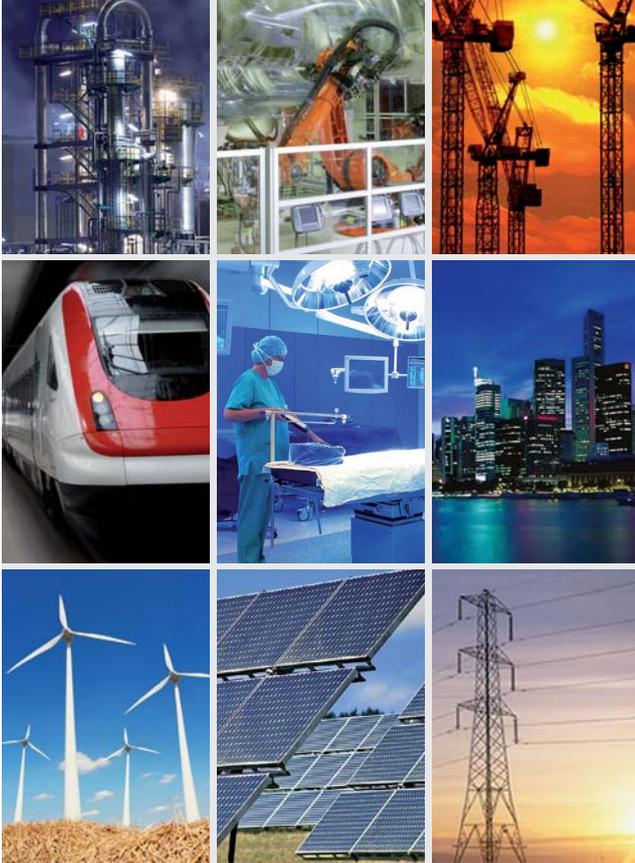
In other words, we provide monitoring devices that alert already in the development stage of even the smallest insulation fault. In this way the fault can be removed in due time - before it comes to a standstill of your plant or the people working are exposed to a danger.

### Various system architectures, various functioning principles:

System architecture:	Non-earthed systems IT systems	Earthed systems TN/TT system (TN-S system)
System type:	AC, DC, three-phase current and combined systems	AC, DC, combined systems
Measurement principle:	Measurement of the insulation resistance against the ground	Measurement of the residual current using residual current transformer. All monitored conductors (except for the protective conductor) go through one residual current transformer
Main reasons for monitoring:	Prevention of damages to the systems and system downtime, data losses, personal and fire protection	Prevention of damages to the systems and system downtime, data losses, personal and fire protection
Solution:	Insulation monitoring with the aid of VARIMETER IMD and VARIMETER EDS	Residual current monitoring with the aid of VARIMETER RCM
Field of application:	<ul style="list-style-type: none"> <li>• Mobile power generator</li> <li>• DC charging stations für electric vehicles</li> <li>• Areas used for medical purposes</li> <li>• Transportation technology (railway, airports, ships, ...)</li> <li>• Control circuits (robots, ...)</li> <li>• Main circuits (controlled drives)</li> <li>• Transportation systems with hoisting devices</li> <li>• Power supply (battery networks, ...)</li> <li>• Disconnected consumers (pumps, ...)</li> <li>• Emergency lighting</li> <li>• Power plants</li> <li>• Solar plants</li> </ul> <p>... and many other fields and areas</p>	<ul style="list-style-type: none"> <li>• Data centres, EDP devices and systems</li> <li>• Office and administrative areas</li> <li>• Power supply and distribution centres</li> <li>• Communication systems</li> <li>• Transportation technology (airports, ships, railway, ...)</li> <li>• Production processes (with controlled drives)</li> <li>• Machines and plants</li> <li>• Frequency inverters</li> <li>• UPS systems</li> <li>• Battery installations</li> <li>• Power plants</li> </ul> <p>... and many other fields and areas</p>
Standards:	<ul style="list-style-type: none"> <li>• Recurring inspection in accordance with DGUV specification 3 (BGV A3)</li> <li>• DIN EN 61851-23: Conductive charging systems for electric vehicles - Part 23: DC charging stations for electric vehicles</li> <li>• DIN VDE 0100-410: Low-voltage electrical installations, Part 4-41: Protective measures - Protection against electric shock</li> <li>• DIN VDE 0100-551: Low-voltage electrical installations Part 5-55: Selection and erection of electrical equipment - Other equipment - Clause 551: Low-voltage generating sets</li> <li>• DIN VDE 0100-710: Low-voltage electrical installations, Part 7-710: Requirements for industrial premises, areas and systems of special type - areas used for medical purposes</li> <li>• DIN EN 61557-8: Electric safety in low-voltage networks up to AC 1000 V and DV 1500 V - Devices for checking, measuring or monitoring the protective measures - Part 8: Insulation monitoring devices for IT systems</li> <li>• DIN EN 61557-9: Electric safety in low-voltage networks up to AC 1000 V and DV 1500 V - Devices for checking, measuring or monitoring the protective measures - Part 9: Installations for insulation fault detection in IT systems</li> <li>• DIN EN 62020: Electric insulation material - Devices for monitoring the residual current for indoor installations and similar applications (RCMs)</li> </ul>	

# Maximum availability, for more efficiency

## Advantages for you at a glance:



- ▶ **Better operational and industrial safety:** Preventive maintenance for protection of people and machines from dangers associated with electric current.
- ▶ **Better fire safety:** Timely detection of sneaky insulation faults. Minimisation of faulty electric arcs which represent a frequent cause of fires.
- ▶ **Better accident safety:** No malfunctions of machines and systems caused by short-circuits to the ground.
- ▶ **High efficiency:** Prevention of costly plant shut-downs, production downtime or data loss thanks to timely notification. Reduction of costs associated with maintenance, repair and re-commissioning.
- ▶ **Optimised maintenance:** Instant error localisation and information forwarding by centralised or decentralised alarm indication.
- ▶ **Everything from a single source:** In addition to variety of measurement and monitoring devices with standard function, we also offer you our long-standing experience in the development of individual, efficient problem solutions. Everything for protection of humans and machines.

And what can we do for you?

## Custom-made solutions for monitoring

Starting from economical standard devices for monitoring individual parameters with multi-functional devices all the way to flexible, expandable fault reporting systems. DOLD offers a custom-made solution for protection of your machines and systems.



Residual current monitor (AC/DC)  
RN 5897/010



Insulation monitors (AC/DC/PV)  
LK 5896



Residual current monitor (Typ A)  
IL 5882



Residual current monitor (Typ B)  
RN 5883

# Insulation monitoring of AC/DC networks

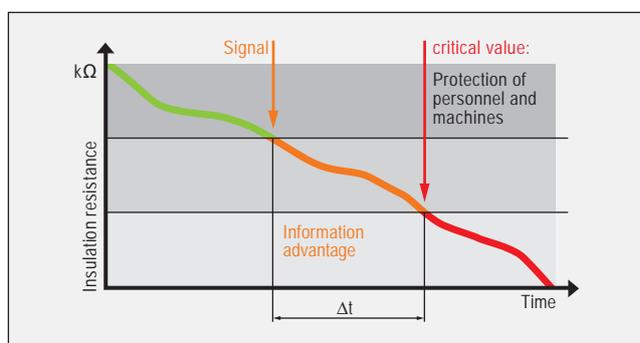
## VARIMETER IMD

Insulation monitoring device (abbreviated: IMD), monitors the insulation resistance in non-earthed systems (IT systems). DIN VDE 0100-410 and DIN VDE 0100-710 standards mandate the use of an insulation monitoring device in non-earthed systems, in order to detect a first occurring fault between an active conductor and a component or against the ground. The IMD has to emit an optical and / or acoustic signal if a first fault occurs. Disturbances which are the result of insulation faults and costly operational downtimes, personal and other damage associated with them are prevented.

### Timely information:

In non-earthed power supply systems (IT systems), no active conductors are connected directly to the ground. In case of an insulation fault, only a small residual current can flow for that reason, caused by the system leakage

capacitance. Devices protecting from over-current do not respond in this case and the voltage supply remains maintained. The working process, such as an operation, for instance, can be completed. Permanent monitoring of the insulation resistance carried out by the IMD ensures timely receipt of information about potential hazards. Faults can be removed early enough.



Information advantage obtained thanks to insulation monitoring

### Overview of the insulation monitoring device: Use in non-earthed systems (IT systems)

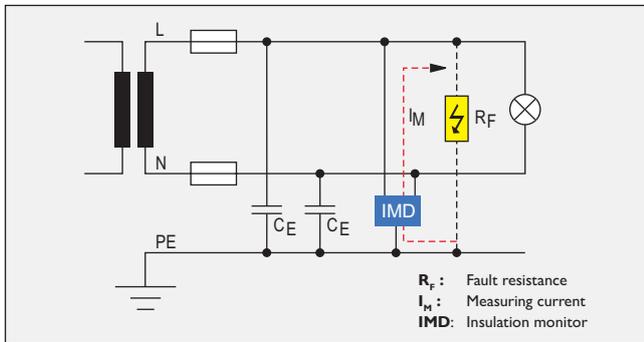
Device type	RN 5897	RN 5897/300	RN 5897/010	RN 5897/011	RN 5897/274	RN 5897/020
Classification   IMD type	Monitoring mobile power generators	AC/DC	Monitoring of modern industrial plants			AC/DC
Nominal voltage of the IT system	AC 0 ... 230 V DC 0 ... 230 V	AC 0 ... 230 V DC 0 ... 230 V	AC 0 ... 230 V (1000 V) DC 0 ... 230 V (1500 V) (with coupling device)	AC 0 ... 230 V (1000 V) DC 0 ... 230 V (1500 V) (with coupling device)	AC 0 ... 230 V (690 V) DC 0 ... 230 V (1000 V) (with coupling device)	AC 0 ... 230 V (690 V) DC 0 ... 230 V (1000 V) (with coupling device)
Measuring frequency	DC or 40 ... 1000 Hz	DC or 40 ... 1000 Hz	DC or 16 ... 1000 Hz	DC or 16 ... 1000 Hz	DC or 40 ... 1000 Hz	DC or 40 ... 1000 Hz
Response value	20 ... 500 kΩ 15 ... 100 kΩ	20 kΩ ... 1 MΩ 10 ... 250 kΩ	20 kΩ ... 2 MΩ 1 ... 250 kΩ	1 ... 2000 kΩ 1 ... 2000 kΩ	1 ... 500 kΩ	20 ... 500 kΩ 1 ... 100 kΩ
Contacts	2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact
Leakage capacitance up to	300 μF	30 μF	1000 μF	1000 μF	150 μF	5 μF
Temperature range	- 30 ... + 60 °C	- 40 ... + 70 °C	- 30 ... + 60 °C	- 30 ... + 60 °C	- 40 ... + 70 °C	- 30 ... + 60 °C
Interface	-	-	-	Modbus RTU	PWM output	-
Disable of measuring function	-	-	+ (variant /060)	+ (variant /061)	+	+
Indicator relay	K1: Alarm K2: Pre-alarm	K1: Alarm K2: Pre-alarm	K1: Alarm K2: Pre-alarm	K1: Alarm K2: Pre-alarm	K1: Alarm K2: Device error	K1: Alarm K2: Pre-alarm
Display	+	-	+	+ <sup>4)</sup>	-	+
Approval	UL	UL	UL <sup>3)</sup> , DNV	UL <sup>3)</sup> , DNV	UL	UL
Accessories	RK 8832 <sup>1)</sup>	RK 8832 <sup>1)</sup>	RK 8832 <sup>1)</sup> , RL/RP/RR 5898 <sup>2)</sup>	RK 8832 <sup>1)</sup> , RL/RP/RR 5898 <sup>2)</sup>	RK 8832 <sup>1)</sup> , RL/RP 5898 <sup>2)</sup>	RK 8832 <sup>1)</sup> , RL/RP 5898 <sup>2)</sup>

<sup>1)</sup> Buzzer <sup>2)</sup> Coupling device <sup>3)</sup> Voltage range UL see data sheet <sup>4)</sup> Variant /311 without display

# Operating principle

## Insulation monitor (IMD)

The insulation monitoring device is connected between the active mains conductors and the ground. When the measurement process is active, it supplies the mains with a measuring voltage. If an insulation fault occurs, the measuring circuit will close and a small current, proportional to the insulation fault will flow. This measuring current is evaluated by the electronic system of the device. If the insulation resistance falls below a certain value (response value), a message is issued via the device.



Principle in which the insulation monitoring device functions

Insulation monitoring devices of the **VARIMETER IMD** family are available for both the DC and the AC voltage as well as for combined systems, such as for instance, systems with floating voltage and frequency, high system leakage capacitance or the DC component of the current.

### Advantages

- ▶ Simple operation
- ▶ Tripping values can be adjusted via rotary switch/LCD display
- ▶ For mains with rated voltages up to AC 1000 V and DC 1500 V
- ▶ Monitoring of early warning alarm threshold value.
- ▶ For system leakage capacitance of up to 3000  $\mu\text{F}$
- ▶ Modbus RTU interfaces, analog or PWM output
- ▶ Extended operating temperature range from - 40 ... + 70 °C

And what can we do for you?



RN 5897/021



RN 5893



RN 5897/320



RN 5897/321



RN 5893/100



RN 5897/240

Monitoring of DC charging stations and mixed grids

AC/DC

AC 0 ... 230 V (690 V) DC 0 ... 230 V (1000 V) (with coupling device)	AC 0 ... 230 V (690 V) DC 0 ... 230 V (1000 V) (with coupling device)	AC 0 ... 690 V DC 0 ... 1000 V only with coupling device	AC 0 ... 230 V (690 V) DC 0 ... 230 V (1000 V) (with coupling device)	AC 0 ... 230 V (690 V) DC 0 ... 230 V (1000 V) (with coupling device)	AC 0 ... 230 V (690 V) DC 0 ... 230 V (1000 V) (with coupling device)
DC or 40 ... 1000 Hz	DC or 40 ... 1000 Hz	DC or 40 ... 1000 Hz	DC or 40 ... 1000 Hz	DC or 40 ... 1000 Hz	DC or 40 ... 1000 Hz
1 ... 500 k $\Omega$ 1 ... 500 k $\Omega$	1 ... 500 k $\Omega$ 1 ... 500 k $\Omega$	20 ... 500 k $\Omega$ 1 ... 100 k $\Omega$	1 ... 500 k $\Omega$ 1 ... 500 k $\Omega$	1 ... 500 k $\Omega$ 1 ... 500 k $\Omega$	1 ... 500 k $\Omega$
2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact
5 $\mu\text{F}$	5 $\mu\text{F}$ (30 $\mu\text{F}$ - variant /010)	5 $\mu\text{F}$	5 $\mu\text{F}$	5 $\mu\text{F}$ (30 $\mu\text{F}$ - variant /110)	5 $\mu\text{F}$
- 30 ... + 60 °C	- 30 ... + 60 °C	- 40 ... + 70 °C	- 40 ... + 70 °C	- 40 ... + 70 °C	- 40 ... + 70 °C
Modbus RTU	Modbus RTU	-	Modbus RTU	Modbus RTU	PWM output
+	+	+	+	+	+
K1: Alarm K2: Pre-alarm	K1: Adjustable K2: Adjustable	K1: Alarm K2: Pre-alarm	K1: Alarm K2: Pre-alarm	K1: Adjustable K2: Adjustable	K1: Alarm K2: Device error
+	+	-	-	-	-
UL	UL <sub>2231</sub>	UL	UL	UL <sub>2231</sub>	UL
RK 8832 <sup>1)</sup> , RL/RP 5898 <sup>2)</sup>	RK 8832 <sup>1)</sup> , RP 5898 <sup>2)</sup>	RK 8832 <sup>1)</sup> , RL/RP 5898 <sup>2)</sup>	RK 8832 <sup>1)</sup> , RL/RP 5898 <sup>2)</sup>	RK 8832 <sup>1)</sup> , RP 5898 <sup>2)</sup>	RK 8832 <sup>1)</sup> , RL/RP 5898 <sup>2)</sup>

# Insulation monitoring of AC/DC networks

## VARIMETER IMD

### VARIMETER IMD - Insulation monitor RL 5889

The RL 5889 insulation monitor from the VARIMETER IMD family is a solution for optimal insulation monitoring in modern IT systems. The device can be used flexibly in AC, DC, and mixed AC/DC networks. Device parameterization and response value adjustment are simple and user-friendly thanks to two rotary switches on the front of the device.

A multi-color device status LED provides user-friendly visualization of the operating states. A sealable transparent cover protects the device against unwanted manipulation.



#### Overview of the insulation monitoring device: Use in non-earthed systems (IT systems)

					
Device type	RL 5889	UH 5892	LK 5894	LK 5895	LK 5896
Classification	Monitoring of combined systems			... for higher system leakage capacitance e.g. solar systems	
IMD type	AC/DC			AC/DC	PV
Nominal voltage of the IT system	AC 0 ... 240 V DC 0 ... 240 V	AC 0 ... 400 V DC 0 ... 600 V	AC 0 ... 690 V DC 0 ... 690 V	AC 0 ... 1000 V DC 0 ... 1000 V	AC 0 ... 1000 V DC 0 ... 1000 V
Measuring frequency	DC or 40 ... 1000 Hz	DC or 40 ... 60 Hz	DC or 16 ... 1000 Hz		
Response value	1 ... 300 k	Fixed, in the range 10 ... 440 k	20 k ... 2 M 1 ... 250 k	20 k ... 2 M 1 ... 250 k	20 k ... 2 M 1 ... 250 k
Contacts	1 changeover contact	1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact	3 x 1 changeover contact
Line capacitance up to	30 µF	20 µF	1000 µF	3000 µF	3000 µF
Temperature range	- 40 ... + 70 °C	- 20 ... + 60 °C	- 25 ... + 60 °C	- 25 ... + 60 °C	- 25 ... + 60 °C
Interface	-	Analog output	-	Analog output <sup>3)</sup>	Analog output <sup>3)</sup>
Auxiliary voltage	+	+	+	+	+
Width	35 mm	45 mm	90 mm	90 mm	90 mm
Accessories	RK 8832 <sup>1)</sup>	RK 8832 <sup>1)</sup> , EH 5861/004 <sup>2)</sup>	RK 8832 <sup>1)</sup>	RK 8832 <sup>1)</sup> , EH 5861/005 <sup>2)</sup>	RK 8832 <sup>1)</sup> , EH 5861/005 <sup>2)</sup>

<sup>1)</sup> Buzzer <sup>2)</sup> Indicating instrument <sup>3)</sup> Also cascadable

# Insulation monitoring of photovoltaic systems

## VARIMETER IMD - Insulation monitor LK 5895

The LK 5895 insulation monitor from the VARIMETER IMD series is a solution for optimal insulation monitoring of modern IT systems. The device can be used flexibly in AC, DC, and mixed AC/DC networks, even with high network leakage capacities to PE.

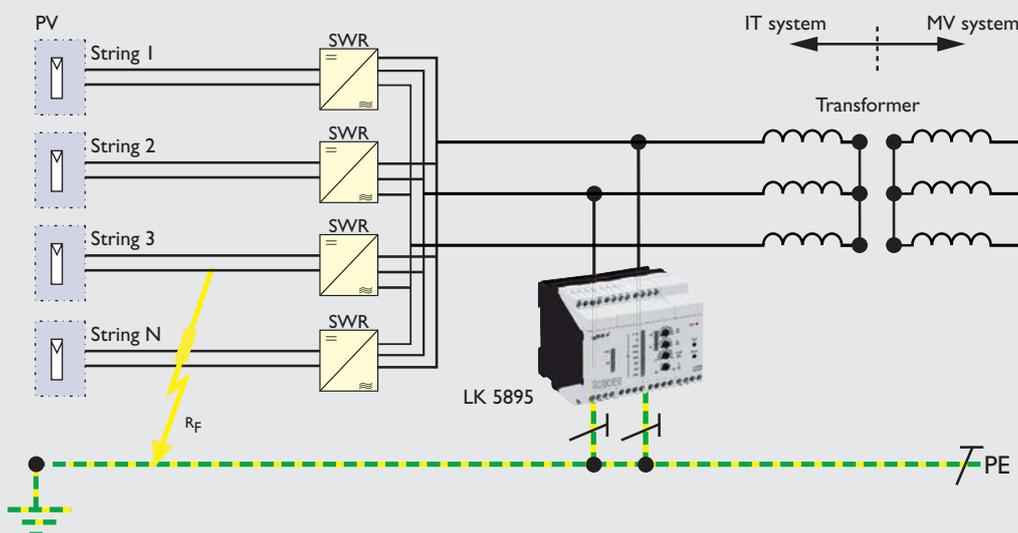
### Your advantages at a glance

- ▶ Preventive fire and system protection
- ▶ Fast fault localization through selective earth fault detection according to L+ and L-
- ▶ Universally applicable in unearthed AC, DC, and AC/DC networks up to 1000 V nominal voltage
- ▶ Suitable for large network leakage capacities up to 3000  $\mu\text{F}$



### Application example LK 5895 insulation monitor

Large-scale photovoltaic systems with a capacity of several megawatts are divided into individual strings, each of which has its own string inverter. When there is sufficient sunlight, an insulation measurement is first carried out within the string inverters before switching to grid operation. During grid operation, the LK 5895 insulation monitor continuously monitors the insulation level of the entire IT network.



# Insulation monitoring of AC networks

## VARIMETER IMD

### VARIMETER IMD - Insulation monitor MK 5880N

The MK 5880N insulation monitor from the VARIMETER IMD family is a standard-compliant solution for insulation monitoring of pure DC and AC IT systems. The response values can be set easily and conveniently using rotary switches on the front of the device.

#### Your advantages at a glance

- ▶ For pure DC and AC networks with 0 ... 500 V and 10 ... 1000 Hz
- ▶ Monitoring even when the network is de-energized
- ▶ Programmable for memory or hysteresis behavior
- ▶ LED indicators for operational readiness and insulation faults



#### Overview of the insulation monitoring device: Use in non-earthed systems (IT systems)

				
Device type	MK 5880N	IL 5880   IP 5880	MK 5880N/200	IL 5880/200   IP 5880/200
Classification	Monitoring of three-phase current and AC systems		Monitoring consumer switched off	
IMD type	AC			
Nominal voltage of the IT system	AC 0 ... 500 V	AC 0 ... 500 V	AC 0 ... 500 V	AC 0 ... 500 V
Measuring frequency	10 ... 1000 Hz	10 ... 10000 Hz	10 ... 1000 Hz	10 ... 10000 Hz
Response value	5 ... 100 k	5 ... 100 k 10 ... 500 k	5 ... 100 k 10 k ... 5 M	Like IL 5880 + 10 k ... 5 M
Contacts	1 x 2 changeover contact	1 x 2 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact
Temperature range	- 20 ... + 60 °C	- 20 ... + 60 °C	- 20 ... + 60 °C	- 20 ... + 60 °C
Auxiliary voltage	+	+	+	+
Width	22.5 mm	IL: 35 mm   IP: 70 mm	22.5 mm	IL: 35 mm   IP: 70 mm
Accessories	RK 8832 <sup>1)</sup>	RK 8832 <sup>1)</sup>	RK 8832 <sup>1)</sup>	RK 8832 <sup>1)</sup>

<sup>1)</sup> Buzzer

<sup>2)</sup> The conditions of the power grid must be checked by a specialist in each case during the design phase

# Insulation monitoring of DC networks

## VARIMETER IMD

### VARIMETER IMD - Insulation monitor RL 5881

The RL 5881 insulation monitor from the VARIMETER IMD family is a solution for optimal insulation monitoring of modern DC-IT systems. The response value can be set easily and conveniently using a rotary switch on the front of the device. A multi-color device status LED provides user-friendly visualization of the operating states. A sealable transparent cover protects the device against unwanted tampering.

#### Your advantages at a glance

- ▶ Can be used in ungrounded DC-IT networks up to max. 300 V
- ▶ For network leakage capacitances up to max. 30  $\mu$ F
- ▶ Monitoring even when the network is de-energized
- ▶ No additional ballast required



### Overview of the insulation monitoring device: Use in non-earthed systems (IT systems)

				
Device type	IL 5881	IL 5881/100	RL 5881	RL 5881/100
Classification	Monitoring of DC systems		Monitoring of DC systems	
IMD type	DC		DC	
Nominal voltage of the IT system	DC 12 ... 280 V DC 24 ... 500 V	DC 12 ... 280 V	DC 0 ... 240 V	DC 24 ... 240 V
Response value	5 k ... 200 k	5 k ... 200 k	1 ... 300 k	1 ... 300 k
Contacts	1 x 2 changeover contact	1 x 2 changeover contact	1 changeover contact	1 changeover contact
Temperature range	- 25 ... + 60 °C	- 25 ... + 60 °C	- 40 ... + 70 °C	- 40 ... + 70 °C
Auxiliary voltage	+	-	+	-
Detection of symmetrical insulation faults	-	-	+	+
Width	35 mm	35 mm	35 mm	35 mm
Accessories	RK 8832 <sup>1)</sup>	RK 8832 <sup>1)</sup>	RK 8832 <sup>1)</sup>	RK 8832 <sup>1)</sup>

<sup>1)</sup> Buzzer

# Insulation monitoring of DC charging stations

## VARIMETER IMD - Insulation monitor RN 5893

The RN 5893 insulation monitor from the VARIMETER IMD family is used specifically in DC charging stations in accordance with the UL 2231 standard and, in conjunction with the RP 5898 ballast, monitors the charging process from the charging station to the vehicle. The device is characterized by its short response delay, a rated voltage of up to DC 1000 V with coupling device, and the detection of both asymmetrical and symmetrical insulation faults. The RN 5893 insulation monitor also has a Modbus RTU interface. All measured values, device statuses, and parameters can be read out, set, and parameterized via Modbus.



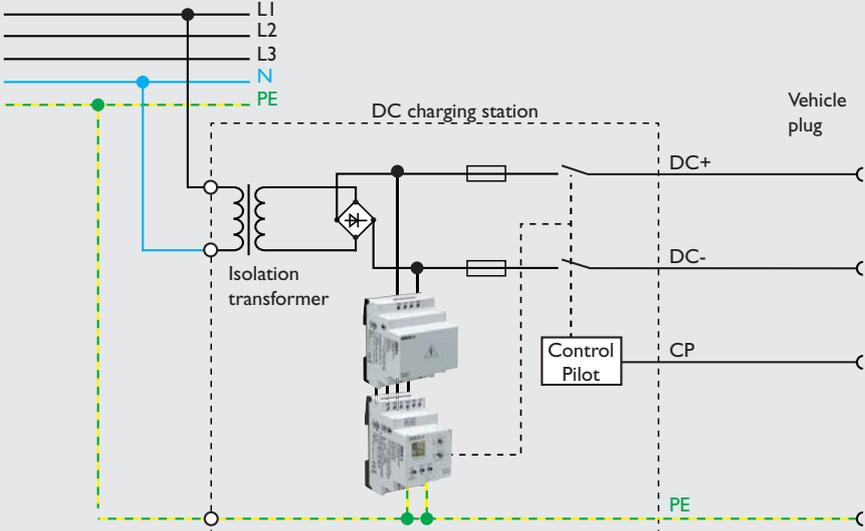
### Your advantages at a glance

- ▶ Nominal voltage of up to DC 1000 V
- ▶ Integrated voltage measurement
- ▶ Easy commissioning, control, and parameterization via Modbus RTU



### Application example RN 5893 insulation monitor

The RN 5893 insulation monitor offers a solution for monitoring the insulation resistance of DC charging stations. The charging station is powered by a grounded TN-S system and connects to an ungrounded IT system via an isolating transformer. This IT system can be effectively monitored for insulation faults using the RN 5893. When a vehicle is connected to the charging station, the insulation monitor takes over insulation monitoring of the entire system, including the charging station and vehicle.



# Insulation monitoring of mobile power generators

## VARIMETER IMD - Insulation monitor RN 5897/300

The RN 5897/300 insulation monitor from the VARIMETER IMD series was developed specifically for use in mobile power generators. In mobile applications, such as in emergency vehicles or on construction sites, personal injury and property damage caused by electrical energy must be reliably prevented. Nevertheless, the mobile power generator must be ready for immediate use, even without time-consuming setup of protective measures. For this reason, there is the possible protective measure „protective separation with insulation monitoring and shutdown.“ This requires automatic shutdown within  $< 1$  s if the insulation resistance drops below  $100 \Omega / V$ .

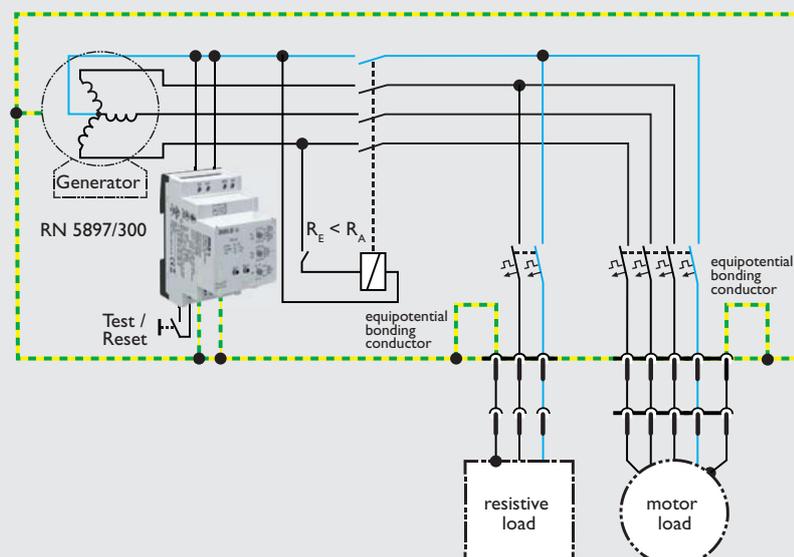


### Your advantages at a glance

- ▶ Increased protection for people and equipment
- ▶ Immediate operational readiness
- ▶ No electrician required to calibrate protective measures

### Application example RN 5897/300 insulation monitor

Monitoring of mobile power generators with the protective measure „Protective separation with insulation monitoring and shutdown“ in accordance with DIN VDE 0100-551. If the insulation resistance falls below the response value (standard requirement max.  $100 \Omega / V$ ), the insulation monitor triggers within  $< 1$  s and interrupts the power supply via a main switch.



# Insulation monitoring of modern power supplies

## VARIMETER IMD - Insulation monitor RN 5897/010

The RN 5897/010 insulation monitor from the VARIMETER IMD series was developed specifically for use in modern power supplies. These often contain converters, power converters, thyristor controllers, and directly connected DC components. EMC interference suppression measures usually result in high leakage capacitances to ground in these systems. The RN 5897/010 is suitable for mains leakage capacitances up to 1000  $\mu\text{F}$  and for voltages up to AC/DC 230 V. With the additional RR 5898 ballast, it can be used in systems with voltages up to AC 1000 V and DC 1500 V.

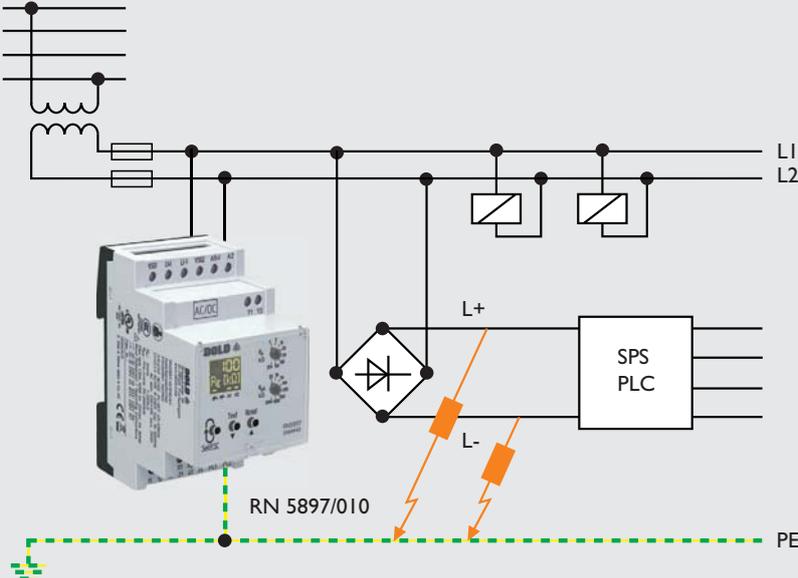


### Your advantages at a glance

- ▶ Universally applicable in mixed IT networks up to AC 1000 V / DC 1500 V
- ▶ Suitable for mains capacitance up to 1000  $\mu\text{F}$
- ▶ Trigger output for insulation fault detection system RR 5886 / RR 5887

## Application example: RN 5897/010 insulation monitor

Monitoring a mixed IT network for insulation faults with the RN 5897/010. The insulation monitor is connected to L1 and L2 on the AC side and measures the insulation resistance against PE. If the values fall below the threshold values (pre-alarm or alarm) set on the device, this is shown on the multicolor display of the RN 5897/010 and the signal relays K1 and K2 switch accordingly.



# Insulation monitoring with the Modbus RTU interface

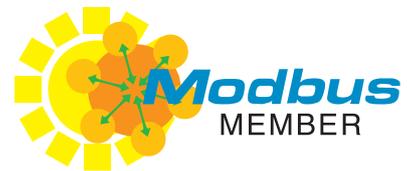
## VARIMETER IMD - Insulation monitor RN 5897/011

The Modbus protocol is an open communication standard based on a master/slave architecture that enables simple and reliable communication as well as user-friendly commissioning and control between automation and field devices.

The Modbus RTU connection is characterized by reduced wiring. It also offers extensive diagnostic options that improve reliability and increase system availability.

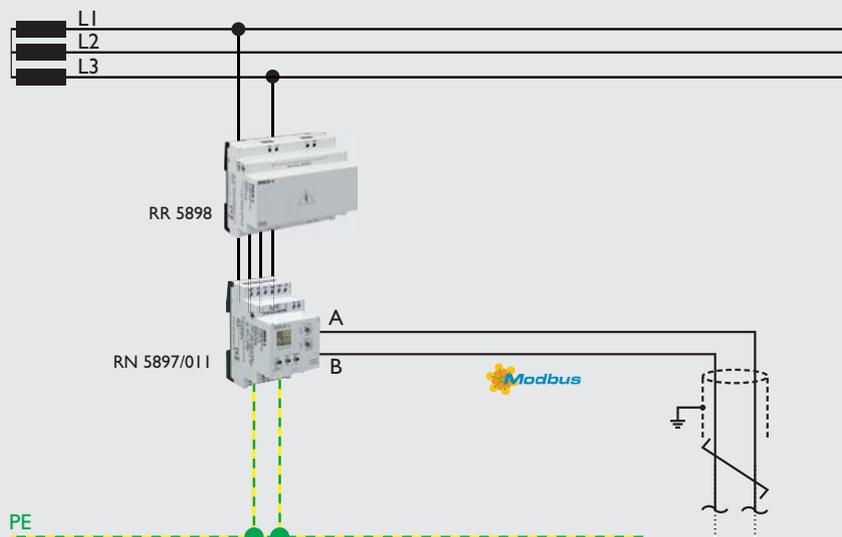
### Your advantages at a glance

- ▶ Simple commissioning, control, and parameterization via Modbus RTU
- ▶ Open communication standard
- ▶ Reduced wiring and low susceptibility to interference



### Application example RN 5897/011 insulation monitor

The RN 5897/011 insulation monitor offers a solution for monitoring the insulation resistance of an ungrounded network. The RN 5897/011 insulation monitor also features a Modbus RTU interface. With Modbus RTU, all measured values, device statuses, and parameters can be read, set, and parameterized via Modbus. The optional connection of an external RR 5898 ballast allows use for rated voltages up to AC 1000 V / DC 1500 V.



# Insulation fault detection

## VARIMETER EDS

The reliability of the systems can be improved by using nonearthed power supply systems (IT systems), since the onepole direct connection of the power supply to the ground remains maintained and the system can continue with its operation. Immediate removal of the fault is in this case necessary. DIN VDE 0100-410 also recommends the first insulation fault in IT systems to be removed as soon as possible.

A device for insulation fault detection, also known as IFLS (Insulation Fault Location System), enables a fast localisation of insulation faults in a non-earthed power supply system. It is used in addition to an insulation monitor and injects a test current in the event of a fault. The insulation fault will be localised with the aid of the residual current transformer in the consumer's outflow.

The insulation fault detection system of the **VARIMETER EDS** family (**E**arth-**F**ault **D**etection **S**ystem), which consists of the test current transformer RR 5886 and the insulation fault detection device RR 5887, will automatically localise the fault source.

You will receive all necessary information about the faulty circuit and consumer's outflow during operation, which is of particularly great importance in widely diffused and complex systems. The maintenance and repair of your system can be planned as optimally as possible thanks to it. VARIMETER EDS is appropriate to use in most various areas.



### Overview of the insulation fault detection system: Use in non-earthed systems (IT systems)

				
Device type	RR 5886	RR 5887	RR 5887/001	ND 5017
Classification	Test current generator	4-channel insulation fault location device	8-channel insulation fault location device	Residual Current Transformer
Nominal voltage of the IT system	DC, AC, 3 AC 24 ... 455 V	DC, AC, 3 AC 24 ... 455 V	DC, AC, 3 AC 24 ... 455 V	-
Fault memory	-	Can be selected via the control terminal		-
BUS interface	RS-485	RS-485	RS-485	-
Fieldbus connection	Modbus RTU	Modbus RTU	Modbus RTU	-
Operating mode	Master / Slave	Slave	Slave	-
Auxiliary voltage	AC/DC 24 ... 80 V AC/DC 85 ... 230 V	AC/DC 24 ... 80 V AC/DC 85 ... 230 V	AC/DC 24 ... 80 V AC/DC 85 ... 230 V	-
Overall width	105 mm	105 mm	105 mm	24 mm, 70 mm, 120 mm
Residual current transformer accessories	-	ND 5017	ND 5017	-

# Functioning principle of an insulation fault detection system (EDS)

The search procedure of the test current generator RR 5886 is normally activated by an insulation monitoring device when the response value is exceeded. The test current generator will then start supplying a test signal to the IT system. This limited test current will be evaluated in connection with the insulation fault detecting device RR 5887 and the residual current transformer connected to it, and the insulation fault will be in this way localised in the IT system. By connecting several insulation fault detection devices via one RS 485 bus connection, the number of measuring channels can be increased in increments of either 4 or 8 channels and the search for the insulation faults in widely diffused non-earthed power supply systems is refined in this way. Via the Modbus RTU interface, insulation fault current values can optionally be read out from the connected devices.

## Field of application

- ▶ Power plants and industrial systems
- ▶ Ship building industry
- ▶ Transportation technology
- ▶ Hospitals

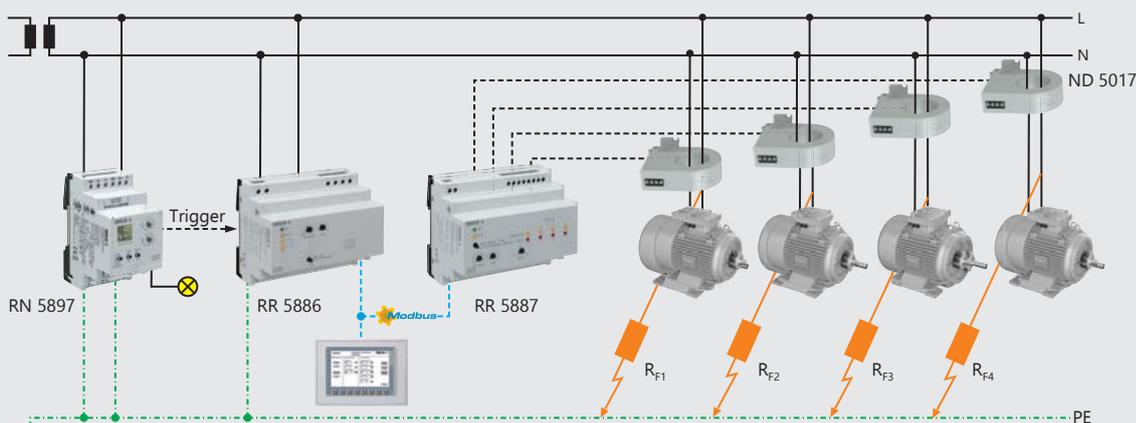
Two different alarm levels, pre-warning and alarm, enable an early detection of faulty consumers. The insulation fault detection system of the VARIMETER EDS family can be operated more intuitively and simply thanks to automatic adjustment of the residual current transformer and clear design of adjusting and displaying units. The early detection and localisation of insulation faults enable their fast and target oriented removal. As a user, you have many advantages from the operational safety and great availability of your IT system.

## Advantages

- ▶ Automatic and fast localisation of faulty circuits
- ▶ Increased reliability and availability of the system
- ▶ Optimal planning of maintenance and repair work
- ▶ No manual and time-consuming fault detection
- ▶ Simple operation
- ▶ Monitoring of complex systems

## Example of application of the insulation fault detection system RR 5886 / RR 5887

Devices for insulation fault detection can be easily used and are recommended in complex and widely diffused power supply systems. Industrial systems that are operated in an unearthed network (IT system) for reasons of availability and interference immunity also benefit from the use of an insulation fault detection system. Components with pre-existing insulation damage can be located as quickly as possible and replaced before they fail. Faulty circuits and consumer outflows are directly visualised on the insulation fault detection device RR 5887.

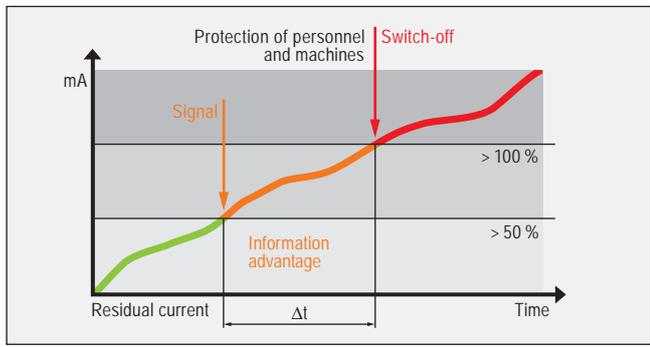


# Residual current monitoring

## VARIMETER RCM

Residual current monitors, also known as RCMs (**R**esidual **C**urrent **M**onitors), measure and monitor residual currents or fault currents in grounded power supply systems (TN and TT networks). Fault current monitoring is based on the principle of residual current measurement and serves primarily to avoid costly downtime and prevent fire hazards that are latent due to insidious insulation faults.

Residual current monitoring devices are used in systems where a fault is to be reported but not immediately shut down. Compared to residual current devices (RCDs), which trip at certain rated fault currents and cause an immediate shutdown, residual current monitors indicate a fault current at an early stage and report insulation deterioration, for example via an output contact.



Information advantage obtained thanks to residual current monitoring

Early detection of insulation faults and preventive maintenance and servicing outside operating hours help to avoid unexpected downtime of machines and systems, thus preventing unwanted interruptions to operations, damage to property, and high costs. Residual current monitors of the **VARIMETER RCM** (Residual Current Monitor) series are available as pure AC and pulsating DC (Type A according to IEC/TR 60755) as well as all-current-sensitive residual current monitors (Type B) for AC, pulsating, and smooth DC fault currents.

### Overview of the residual current monitor: Use in earthed systems (TN, TT systems)

			
Device type	IL 5882	IR 5882	RN 5883
Classification according to IEC/TR 60755	Typ A (AC, DC pulsating)		Typ B (AC, DC even and pulsating)
Residual operating current	Adjustable: 10 mA ... 10 A or 10 mA ... 30 A		Adjustable: 10 mA ... 3 A
Response delay	Adjustable		Adjustable
Auto / manual reset	Can be selected via the control terminal		+
Switching element / relay	2 x 1 c/o contact (pre-warning / alarm)		2 x 1 c/o contact (pre-warning / alarm)
Analogous output	-		0 - 10 V (optionally)
Auxiliary voltage	AC/DC 12 V, AC/DC 24 ... 230 V		AC/DC 24 ... 80 V, AC/DC 80 ... 230 V
Width	35 mm	105 mm	52.5 mm
Residual current transformer accessories	ND 5014, ND 5016, ND 5019	Integrated (Ø 28 mm)	ND 5015, ND 5018



- DGUV Regulation 3:
- ▶ Measure without switching off
  - ▶ Practical solution with differential current technology

Further information

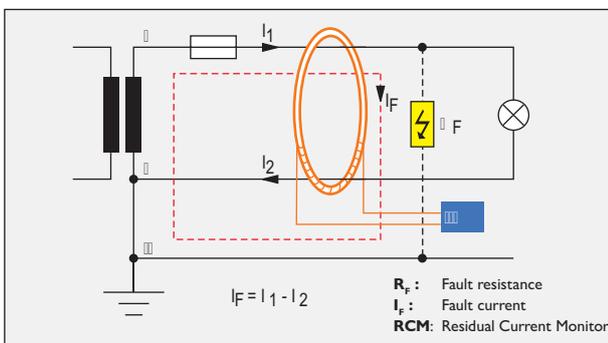
DGUV

www.dold.com



# Functioning principle of a residual current monitor (RCM)

All lines of the outflow which is to be protected (except for the protection line) will go through the residual current transformer. The sum of all currents equals zero in error-free mains; no voltage will be induced in the transformer. If a residual current flows via the ground, the difference in the current will be caused in the transformer. It will be recorded and evaluated by the electronic system of the residual current monitoring device.



Functioning principle of a residual current monitor

The measurement process is applied to residual current monitoring devices which are used with pure AC currents and pulsating DC currents (type A). All residual current monitoring devices sensitive to universal current (type B) require implementation of a special measurement process. They are suitable for measurement of residual current types in electrical systems: AC currents, pulsating and even DC residual currents.

## Advantages

- ▶ Simple operation
- ▶ Tripping values can be adjusted via a potentiometer
- ▶ Wire break detection
- ▶ External or integrated residual current transformer
- ▶ Standard or sensitive to universal current
- ▶ Customer-specific versions

And what can we do for you?

## Overview of the residual current transformer: Use in earthed systems (TN, TT systems)

			
Residual current transformer for device type	IL 5882		RN 5883
Inner diameter:	24 mm	ND 5016/024	ND 5015/024
	35 mm	ND 5016/035	ND 5015/035
	70 mm	ND 5016/070	ND 5015/070
	105 mm	ND 5019/105	ND 5018/105
	140 mm	-	ND 5018/140
	210 mm	-	ND 5018/210
Split current transformer for device type	IL 5882		
Inner diameter:	49 mm	ND 5014/050	
	79 mm	ND 5014/080	
	119 mm	ND 5014/120	

## Split current transformer ND 5014 - Quick mounting, easy to retrofit!

- ▶ Ideal for retrofitting, no need to cut the conductor
- ▶ Due to split mechanism especially suitable for existing plants
- ▶ Space-saving and quick installation due to split technology



# Residual current monitoring (Type B) with external current transformers

## VARIMETER RCM - Residual current monitor RN 5883

The RN 5883 residual current monitor from the VARIMETER RCIM family is sensitive to all currents and detects fault currents with both DC and AC components in earthed networks (type B). The residual current is measured using the external residual current transformer ND 5015. With a depth of 71 mm, the RN 5883 is also suitable for use in installation and industrial distribution boards.

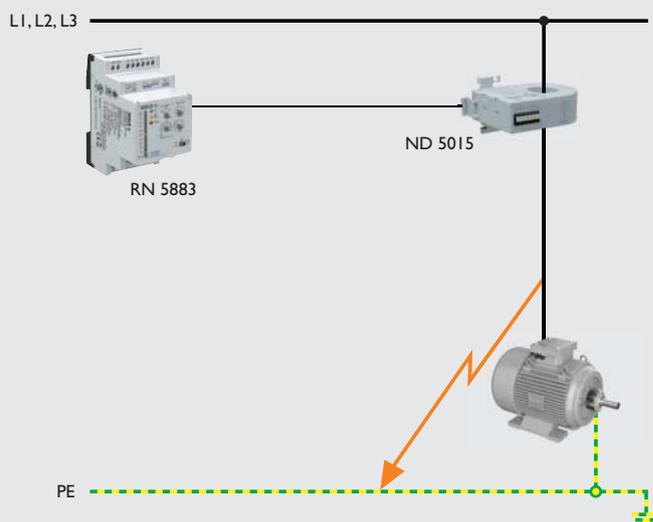
### Your advantages at a glance

- ▶ Space-saving control cabinet installation with a width of only 52.5 mm
- ▶ Time- and cost-optimized maintenance/servicing
- ▶ High system availability thanks to early fault detection
- ▶ Wire break detection in the measuring circuit
- ▶ 4 measuring ranges from 10 mA to 3 A



### Application example RN 5883 residual current monitor

The differential current is measured using an external differential current transformer. All conductors of the output to be protected (except PE) are routed through the transformer. In a fault-free network, the sum of all currents is zero, so that no voltage is induced in the differential current transformer. If a fault current flows through the earth due to an insulation fault, the current difference in the transformer causes a current that is detected and evaluated by the RN 5883. If the threshold value is exceeded, the device switches to alarm status and the pre-alarm and alarm LEDs flash.



# Residual current monitoring (Type A) with integrated current transformer

## VARIMETER RCM - Residual current monitor IR 5882

The compact IR 5882 residual current monitor from the VARIMETER RCM family detects alternating fault currents and pulsating direct fault currents. The device reports these via its potential-free changeover contacts, depending on the set response values for pre-warning and alarm. With an integrated residual current transformer and a depth of only 63 mm, the IR 5882 is also suitable for use in installation and industrial distribution boards.

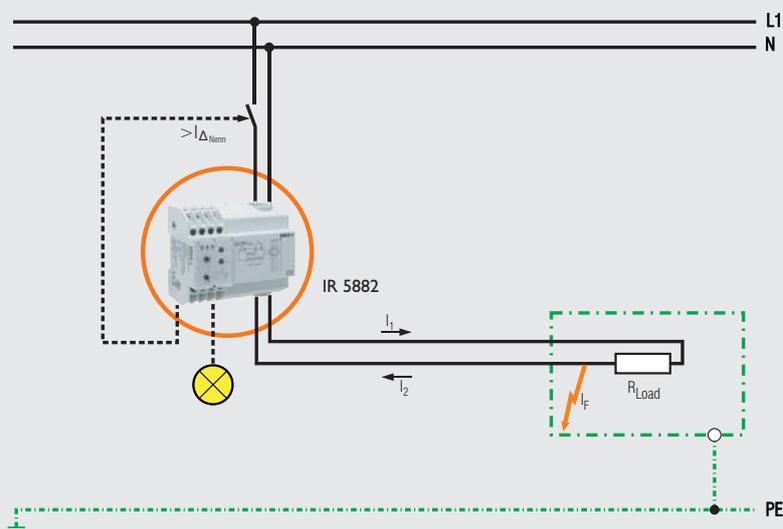
### Your advantages at a glance

- ▶ Integrated differential current transformer with  $\varnothing$  28 mm
- ▶ Time- and cost-optimized maintenance / servicing
- ▶ Preventive fire and system protection through early fault detection
- ▶ Wire break detection in the measuring circuit
- ▶ Large auxiliary voltage range AC/DC 24 ... 230 V



### Application example IR 5882 residual current monitor IR 5882

The compact IR 5882 residual current monitor is suitable for use in installation and industrial distribution boards. The integrated residual current transformer detects and evaluates alternating fault currents and pulsating direct fault currents. Machines and systems are continuously monitored for insulation deterioration. The IR 5882 residual current monitor is installed in addition to existing protective devices and increases system availability and operational safety by detecting insulation faults at an early stage.



# Our experience. Your safety.

## VARIMETER - Monitor, measure, control

### Innovative monitoring solutions

DOLD offers a universal program of measuring and monitoring solutions which have been successfully in use worldwide for several decades already. DOLD develops tailored products for protection of your machines and systems, in addition to mono-functional standard devices for monitoring individual measurement variables and multi-functional solutions.

We will be happy to inform you about other monitoring solutions.

Please contact us for further advice.



### VARIMETER PRO

Universal measurement relays MK 9300N / MH 9300 of the VARIMETER PRO series can monitor up to 9 different parameters at a time. Quite simply and without any extensive wiring.



### VARIMETER EX

Thermistor engine-protective relays MK 9163N ATEX and MK 9003 ATEX of the VARIMETER EX series reliably prevent thermal overload of the engine. The devices monitor and protect the standard engines equipped with PTC thermistors and explosion-protected engines in accordance with the standard 2014/34/EU.



### VARIMETER PRO

The multifunctional UG 9400 measuring relay from the VARIMETER PRO series allows easy parameterization, monitoring, and diagnostics via a Modbus RTU interface. It simultaneously monitors up to 9 different measured variables such as voltage, voltage asymmetry, current, cos phi, active, apparent, and reactive power, as well as frequency and phase sequence.



### VARIMETER

The space-saving phase monitoring device RK 9872 from the VARIMETER family monitors the under-voltages as well as over-voltage, and the phase sequence in the three-phase mains at the same time. For instance, in all applications of AC engines and machines.

### More information

ProductFinder



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