Installation- / Monitoring Technique

VARIMETER IMD
Insulation Monitor
RP 5888

Product Description
The insulation monitor RP 5888 of the VARIMETER IMD family provides best and up to date insulation monitoring of AC-IT systems. The measuring principle is overlay with DC-measuring voltage. The setting of the parameters and the switching values is done by simple and operator friendly rotational switches on front of the device. The operating status is indicated user friendly via three multicolour LEDs. In addition the actual insulation resistance value is available on an analogue output.

Function Diagram
Function: de-energized on trip
With function energized on trip, the status of the relay contacts 11, 12, 14 and 21, 22, 24 is inverted

Approvals and Markings

Application
• Monitoring of insulation resistance of ungrounded voltage systems to earth
• Can also be used to monitor standby devices for earth fault, e.g. motor windings of devices that have to function in the case of emergency
• Other resistance monitoring applications
**Function**

The device is connected to the supply via terminals A1-A2. The unit can either be supplied from the monitored voltage system or from a separate auxiliary supply. Terminal L is connected to the monitored voltage and PE to earth. If the insulation resistance $R_i$ drops below the adjusted alarm value $R_{al}$, the red LED goes on and the output relay switches off (de-energized on trip) or switches on (energized on trip). If the unit is on auto reset (bridge between LT1-LT2) and the insulation resistance gets better ($R_i$ rises), the insulation monitor switches on (de-energized on trip) or switches off (energized on trip) again with a certain hysteresis and the red LED goes off. Without the bridge between LT1-LT2 the insulation monitor remains in faulty state even if the insulation resistance is back to normal. The reset is done by pressing the internal or external reset button or by disconnecting the auxiliary supply. By activating the "Test" button an insulation failure can be simulated to test the function of the unit.

5 measuring ranges can be selected by rotary switch. 5 ... 50 kOhm; 10 ... 100 kOhm; 50 ... 500 kOhm; 100 K ... 1 MOhm and 0.5 M ... 5 MOhm. The fine tuning is done with potentiometer $R_{al}$ x Bereich. With the range selector also the relay function is set. The 5 ranges on the left are with function de-energized on trip, the 5 functions on the right with function energized on trip.

With the 4 smaller ranges up to max. 1 MOhm a pre-warning can be adjusted between setting value and 5 MOhms. On the range 0.5 ... 5 MOhm the pre-warning is adjustable between setting value and 10 MOhm. The pre-warning reacts on contact 21, 22, 24, the alarm value on contact 11, 12, 14. Turning $R_{al}$ fully anti clockwise contact 21, 22, 24 switches together with the alarm contact.

The pre-warning behaves similar as the alarm signal concerning manual reset. Hysteresis, energized or de-energized on trip

The devices have an analogue output that indicates the insulation resistance.

**Analogue output:**

<table>
<thead>
<tr>
<th>Terminal designation</th>
<th>Signal description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1(+)</td>
<td>L / +</td>
</tr>
<tr>
<td>A2</td>
<td>N / -</td>
</tr>
<tr>
<td>L</td>
<td>Connection for monitored IT-systems</td>
</tr>
<tr>
<td>PE</td>
<td>Connection for protective conductor</td>
</tr>
<tr>
<td>PT</td>
<td>Connection for external test button</td>
</tr>
<tr>
<td>LT1, LT2</td>
<td>Connection for external reset or for manual and auto reset: LT1/LT2 bridged: hysteresis function LT1/LT2 not bridged: manual reset</td>
</tr>
<tr>
<td>X1, X2</td>
<td>Changeover of the analog output range</td>
</tr>
<tr>
<td>X4, X5, U+, U-, I+, I-</td>
<td>Analogue output X4/X5 not bridged: U+/U- 0 ... 10 V, I+/I- 0 ... 20 mA X4/X5 bridged: U+/U- 2 ... 10 V, I+/I- 4 ... 20 mA</td>
</tr>
<tr>
<td>11, 12, 14</td>
<td>Alarm signal relay (1 changeover contact)</td>
</tr>
<tr>
<td>21, 22, 24</td>
<td>Alarm signal relay (1 changeover contact)</td>
</tr>
</tbody>
</table>

**Terminal X1-X2, Analogue output:**

Insulation value within the adjusted measuring range $R_i$, e.g. 50 ... 500 kOhm is proportional to 0 ... 10 V on terminals u+/u- (x4-X5 is open). The analogue value in relation to the insulation resistance can be seen in the diagrams M9605, M9606 (page 3 Setting aid).

X1-X2 bridged: insulation value from 5 times the measuring range max 10 MOhm down to $R_{al}$ setting. e.g. range $R_i = 5$ kOhm x 10 (max fine tuning) x 5 = 250 kOhm setting value range 5 kOhm x 4 (fine tuning) = 20 kOhm

Analogue output 4 ... 20 mA is proportional to 20 ... 250 kOhm
**Indication**

<table>
<thead>
<tr>
<th>LED</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green LED &quot;ON&quot;:</td>
<td>On, when supply voltage connected (readiness for operation)</td>
</tr>
<tr>
<td>Yellow LED &quot;VW&quot;:</td>
<td>On, when insulation resistance is under prewarning value, $R_E &lt; R_W$</td>
</tr>
<tr>
<td>Red LED &quot;AL&quot;:</td>
<td>On, when insulation fault detected, $R_E &lt; R_AL$ (value has fallen below alarm level)</td>
</tr>
</tbody>
</table>

**Notes**

**Warning**

Risk of electrocution! Danger to life or risk of serious injuries.

- Disconnect the system and device from the power supply and ensure they remain disconnected during electrical installation.
- The terminals of the control input PT, LT1, LT2, X1 and X2 have no galvanic separation to the measuring circuit L and are electrically connected together, therefore they have to be controlled by volt free contacts or bridge. These contacts or bridges must provide a sufficient separation depending on the mains voltage on L.
- No external potentials may be connected to control terminals PT, LT1, LT2, X1, X2, X4 and X5.

**Attention!**

- Before checking insulation and voltage, disconnect the monitoring device RP 5888 from the power source!
- In one voltage system only one insulation monitor can be used. This has to be observed when interconnecting two separate systems.
- The auxiliary supply can be connected to a separate auxiliary supply or to the monitored voltage system. The range of the auxiliary supply input has to be observed.

**Attention!**

- The Insulation monitor RP 5888 is designed to monitor AC-voltage systems. Overlayed DC voltage does not damage the instrument but may change the conditions in the measuring circuit.
- Line capacitance $C_L$ to ground does not influence the insulation measurement, as the measurement is made with DC-voltage. It is possible that the reaction time in the case of insulation time gets longer corresponding to the time constant $R_E \times C_L$.
- The Insulation monitor can be used, because of it’s higher setting value, to monitor single or 3-phase loads for ground fault. If the load is operated from a grounded system the insulation resistance of the load can only be monitored when disconnected from the mains. This is normally the fact with loads which are operated seldom or only in the case of emergency but then must be function (see connection example).
- When monitoring 3-phase IT systems it is sufficient to connect the insulation monitor only to one phase. The 3-phases have a low resistive connection (approx. 3 - 5 $\Omega$) via the feeding transformer. So failures that occur in the non-connected phases will also be detected.
Technical Data

Auxiliary circuit

Auxiliary voltage $U_{H}$: AC/DC 24 ... 80 V, AC/DC 80 ... 230 V
Voltage range: DC 19 ... 110 V, AC 19 ... 90 V, DC 64 ... 300 V, AC 64 ... 265 V
Nominal frequency: AC 50 / 60 Hz
Nominal consumption
At AC: 5 VA
At DC: 2.5 W

Measuring circuit

Nominal voltage $U_{I}$:
Voltage range: 0 ... 1.1 $U_{I}$
Frequency range: 10 ... 1000 Hz
Alarm value $R_{AI}$:
Setting of ranges $R_{AI}$:
Setting $R_{AI}$:
Internal test resistor: Equivalent to earth resistance of $<$ 5 kΩ
Internal AC resistance: $>$ 250 kΩ
Internal DC resistance: $>$ 250 kΩ
Measuring voltage: Approx. DC 15 V, (internally generated)
Max. measuring current ($R_{L} = 0$): $<$ 0.1 mA
Max. permissible noise DC voltage: DC 500 V
Operate delay
At $R_{AI} = 50$ kΩ, $CE = 1$ μF
$R_{AI}$ from $to = 0.9 R_{AI}$: $<$ 2 s
$R_{AI}$ from $to = 0$ kΩ: $<$ 1.4 s
Response inaccuracy:
Hysteresis
At $R_{AI} = 50$ kΩ: Approx. 15 %

Output

Contacts:
1 changeover contact for alarm
2 changeover contacts for prewarning
Thermal current $I_{T}$: 4 A
Switching capacity
To AC 15
NO contacts:
5 A / AC 230 V IEC/EN 60947-5-1
NC contacts:
2 A / AC 230 V IEC/EN 60947-5-1
Electrical life
To AC 15 at 1 A, AC 230 V:
$\geq 5 \times 10^{4}$ switch. cycl. IEC/EN 60947-5-1
Short circuit strength
Max. fuse rating: 4 A gG / gL IEC/EN 60947-5-1
Mechanical life:
$\geq 30 \times 10^{4}$ switching cycles

General Data

Operating mode: Continuous operation
Temperature range
Operation: -20 ... + 60 °C
Storage: -25 ... + 70 °C
Altitude:
Clearance and creepage distances
Rated impulse voltage / pollution degree IEC 60664-1
Auxiliary supply /
measuring input / contacts: 6 kV / 2 IEC 60664-1
Measuring input / analogue output: 4 kV / 2 IEC 60664-1
Contacts 11,12,14 / 21,22,24: 4 kV / 2 IEC 60664-1
Insulation test voltage,
routine test: AC 4 kV; 1 s
AC 2.5 kW; 1 s
EMC
Electrostatic discharge(ESD): 8 kV (air) IEC/EN 61000-4-2
HF irradiation
80 MHz ... 1 GHz: 20 V / m IEC/EN 61000-4-3
1 GHz ... 2.7 GHz: 10 V / m IEC/EN 61000-4-3
Fast transients: 2 kV IEC/EN 61000-4-4
Surge voltages
Between A1 - A2: 1 kV IEC/EN 61000-4-5
Between L - PE: 2 kV IEC/EN 61000-4-5
HF-wire guided: 10 V IEC/EN 61000-4-6
Interference suppression: Limit value class B EN 55011
Degree of protection:
Housing: IP 40 IEC/EN 60529
Terminals: IP 20 IEC/EN 60529
Housing:
Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance:
Amplitude 0.35 mm
Frequency 10 ... 55 Hz, IEC/EN 60608-2-6
Climate resistance:
Frequency 20 / 060 / 04 IEC/EN 60608-1
Terminal designation:
EN 50005
Wire connection
DIN 46228-1/-2/-3/-4
Cross section: 1 x 2.5 mm² solid or 1 x 2.5 mm² stranded wire
Stripping length: 7.5 mm
Wire connection:
1 x 2.5 mm² solid or 1 x 2.5 mm² stranded wire
DIN 46228-1/-2/-3/-4
Wire fixing:
Box terminal with wire protection
Fixing torque:
0.5 Nm
Mounting:
DIN rail IEC/EN 60715
Weight:
Approx. 200 g
Dimensions
Width x height x depth: 70 x 90 x 71 mm

Standard Type
RP 5888.12 AC/DC 80 ... 230 V
Article number: 0060868
- Auxiliary voltage $U_{I}$: AC/DC 80 ... 230 V
- Setting alarm value: $R_{AI}$: 5 k ... 5 MΩ
- Width: 70 mm

Ordering Example
RP 5888 12 AC/DC 80 ... 230 V $R_{AI}$ 5 k ... 5 MΩ
Analogue output

X1-X2 open (displayed insulation resistance within measuring range)
X4-X5 open (0-10V, 0-20mA)

U+/-U- (V)

I+/-I- (mA)

5 10 15 20 25 30 35 40 45 50 60 70 80 90 100

k (Ω) range

(x10, x100)
Monitoring of motorwindings against ground.
The insulation of the motor to ground is monitored as long as contactor K does not activate the load.

*2) With bridge LT1 - LT2: Automatic reset
Without bridge LT1 - LT2: Manual reset, reset with button LT

Connection Examples

Monitoring of an ungrounded voltage system.
*1) Auxiliary supply $U_m$ (A1 - A2) can be taken from the monitored voltage system. The range of the auxiliary supply input must be observed.
*2) With bridge LT1 - LT2: Automatic reset
Without bridge LT1 - LT2: Manual reset, reset with button LT

Monitoring of an ungrounded voltage system.
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Without bridge LT1 - LT2: Manual reset, reset with button LT

Monitoring of a grounded system.
2) With bridge LT1 - LT2: Automatic reset
Without bridge LT1 - LT2: Manual reset, reset with button LT