Monitoring Technique

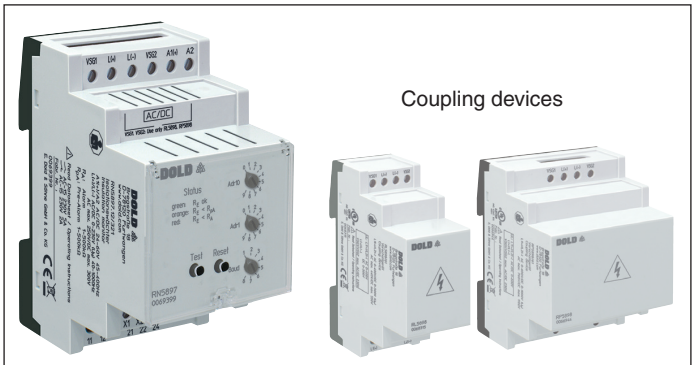
VARIMETER IMD
Insulation monitor
RN 5897/321

Translation
of the original instructions

Modbus MEMBER

DOLD

0280968

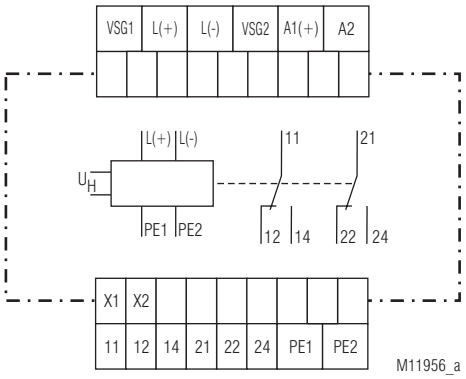


RN 5897/321 RL 5898 RP 5898

Product Description

The insulation monitor RN 5897/321 of the VARIMETER IMD family provides best and up to date insulation monitoring of modern IT systems in an optimum and state of the art way fulfilling the relevant standards. The device can be used in the most flexible way for AC, DC and AC/DC systems. Mains areas of applications are non-earthed DC charging stations for electric vehicles with mains voltages up to DC 1000 V, that need an extended temperature range. The setting of the parameters and the switching values is done via Modbus. All measured values, device statuses and parameters can also be read out via Modbus. All functions of the device can also be operated via Modbus. The operating status is indicated user friendly via a multicolour LED. With a sealable transparent cover the device is protectet against manipulation.

Circuit Diagram



Connection Terminals

Terminal designation	Signal description
A1(+), A2	Auxiliarx voltage AC or DC
L(+), L(-), VSG1, VSG2	Connection for coupling device
PE1, PE2	Connection for protective conductor
X1, X2	Control input (combined external Test- and Reset-input with additional Stop of the measuring function)
11, 12, 14	Alarm signal relay K1(1 changeover contact)
21, 22, 24	Prewarning signal relay K2 (1 changeover contact)

Your Advantages

- Suitable for DC charging stations for electric vehicles acc. to IEC/EN 61851-23:2014/AC:2016-06
- Insulation monitoring according to IEC/EN 61557-8
- Universal application in non-earthed AC-, DC-, AC/DC networks up to AC max. 250 V resp. DC max. 300 V
- Connection of an external coupling device RL 5898 for voltages up to AC 400 V / DC 500 V or RP 5898 for voltages up to AC 690 V / DC 1000 V possible
- Extended operating temperature range of - 40 ... + 70 °C
- Very fast reaction time ≤ 1 s
- Optimised insulation resistance monitoring also during mains voltage variation
- Self-test every full operating hours
- Preventive fire and system protection
- Detection of symmetric and asymmetric insulation faults
- Easy adjustment of response values and setting parameter via Modbus
- Suitable for large leakage capacitances up to 5 µF
- Monitoring also with voltage-free mains
- Measuring circuit L(+)/L(-) with broken wire detection (can be switched off)
- Protective conductor PE1/PE2 with broken wire detection (can't be switched off)
- With galvanic separated Modbus RTU interface

Features

- 2 separate adjustable response thresholds (using e.g. for pre-alarm and Alarm)
- Setting range of 1st response value (Pre-alarm): 20 kΩ … 500 kΩ
- Setting range of 2nd response value (alarm): 1 kΩ … 100 kΩ
- 1 changeover contacts each for insulation failures-Pre-alarm and -alarm
- Energized or de-energized on trip can be selected for indicator relay
- With multicolour status LED to indicate the state of operation.
- Automatic and manual device self-test
- Alarm storage selectable
- Protection against manipulation by sealable transparent cover
- External control input for combined test- / reset-button with additional Stop of the measuring function
- 2 wide voltage input for auxiliary voltage
- Width 52.5 mm

Approvals and Markings

CE AC/DC

Applications

Insulation monitoring of:

- Non-earthed AC, DC, AC/DC networks
- DC charging stations for electric vehicles
- UPS systems
- Networks with frequency inverters
- Battery networks
- Networks with direct current drives
- Hybrid and battery-powered vehicles
- Mobile generator sets

All Technical Data in this list relate to the state at the moment of edition. We reserve the right for technical improvements and changes at any time.

The device is supplied with DC auxiliary voltage via terminals A1(+) / A2. Switching on the auxiliary voltage (Power-On) is followed by an internal self-test for 12 s (see „Device test functions“). The test process is visible with the status LED. After this, measurement of the insulation resistance in the measuring circuits begins and the status LED changes into green.

Measuring circuit
(Insulation measurement between terminals L(+)/L(-) and PE)
The insulation monitor RN 5897/321 can only be used with a coupling device. Max. mains voltage and connection diagrams have to be observed!
To connect the insulation Monitor RN5897/320 to a coupling device the terminals with identical designations are connected (VSG1/L(+) and VSG2, L(-)). The votage system to be monitored is connected to L(+) and L(-) of the coupling device.
The type of the voltage system or the connection method (AC, DC, 3NAC) has to be correctly adjusted via Modbus.
Also the terminals PE1 and PE2 have to be connected with 2 separate wires to the protective earth. An interruption of a wire also causes a fault signal (see section ”Behavior on faulty connection”). The monitoring of the PE connection cannot be de-activated.
To measure the insulation resistance an active measuring voltage with changing polarity is connected between L(+)/L(-) and PE1/PE2.
At the end of a measuring cycle the actual insulation resistance is produced and indicated. The relays for alarm K1 and pre-alarm K2 switch when dropping under the adjusted response values. In addition the status LED changes to orange color on pre-alarm or to red color on alarm.
The current measured value is output via Modbus. An asymetric insulation resistance against „+“ or „-“ is also output via Modbus (only with DC networks resp. insulation faults on the DC side).

Manual reset of fault message
The manual reset of insulation fault messages can be set via Modbus (alarm memory). If the manual reset is activated, the insulation fault signals of the measuring circuit remain saved when the adjusted response value is not reached, even if the insulation resistance later goes back to healthy state again. The minimum value of the insulation resistance is stored and can be read out via Modbus. Pressing the „Reset“ button on the front side for 2 s, the alarm signal and the stored minimum value are reset if the actual insulation resistance is in healthy state.
The device can also be reset with a Modbus command.

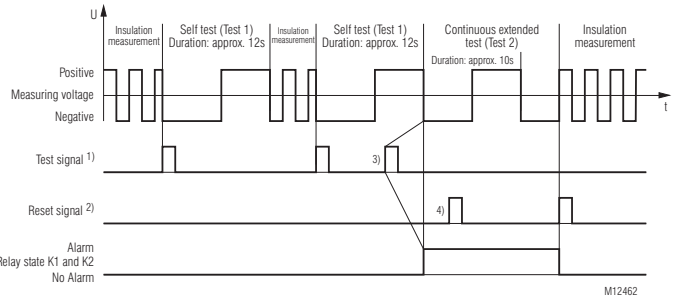
Indicator relay for insulation fault signal
For the indicator relays K1 (contacts 11-12-14, for alarm) and K2 (contacts 21-22-24, for pre-alarm) the function can be set via Modbus to energized on trip or de-energized on trip. When energised on trip the relays energize when the value drops below the setting, when de-energised on trip, the relays de-energize when the value drops below the setting. The status of the indicator relays is also shown via Modbus.

Disable the measuring function
Using the external control input X1/X2 or via Modbus command the measuring function of the RN 5897/321 can be disabled. This could be used when several isolated voltage systems with individual insulation monitors need to be coupled.
The measuring voltage is set to -90V (negative measuring phase) and the evaluation of the measurement is stopped. The output relays switch according to the current measured values. If the measurement is disabled the status LED flashes continuously orange. Please be aware, only the evaluation of the measurement is stopped and the measuring pulse is interrupted! A high resistive disconnection to PE does not take place (see internal resistance).

Function

Broken wire detection
As described in section "Measuring circut", the measuring circuits L(+) / L(-) and the protective conductors PE1/PE2 are constantly monitored for wire breaks – not only at Power-On or a manual or occasional automatic test. The response time of PE1/PE2 monitoring is only a few seconds. The response time of monitoring of L(+)/L(-) can be up to approx. 2 min. Broken wire detection between L(+)/L(-) is performed via coupled alternating voltage. This alternating voltage is short-circuited if the terminals are connected to the connected mains at low-resistance. The device detects that the mains to be monitored is properly connected.
Since this broken wire detection is carried out with alternating voltage, large capacitances should be avoided between L(+)/L(-), since the capacitive reactance of these capacitances also short-circuits this alternating voltage. The device would no longer detect a connection fault on L(+)/L(-).
Especially parallel lines should be prevented over larger distances.
If larger capacitances between L(+)/L(-) cannot be avoided or if the coupled alternating voltage interferes with the system, the broken wire detection can be de-activated via Modbus. Monitoring deactivated, monitoring only during device test or continuous monitoring (every 2 minutes for 10 s) are the possible options. If the broken wire detection on L(+)/L(-) is de-activated no AC voltage is injected. The broken wire detection on PE1/PE2 cannot be de-activated.

Device test functions
Principally, 2 different test functions are implemented: The "self-test" and the "expanded test":
The self-test of the device is performed automatically after Power-On and every full operating hours. It can also be triggered manually at any time by pressing the "Test" button at the device front for 2 s or via Modbus command. With the self-test, contrary to the expanded test, the status of the Indicator relays is not affected; the sequence is as follows:
The self test is indicated by the status LED with flash code 1 in orange colour. Additionally, it is output via Modbus that the device is in test mode. First the negative measuring pules is activated for about 5 s and the internal measuring circuit is checked on failures. Then the positive measuring pulse is activated for about 5 s and more internal tests are performed. If no failures are detected, the normal measurement continuous. The extended test is started, when during or at the end of above procedure (12 s) the button "Test" is pressed again for 2 s or triggered via a Modbus command. The procedure is the same as above (2 measuring phases with 5 sec each) but in addition the output relays K1 and K2 go into alarm state. The Status LED shows flash code 2 in orange colour and via Modbus it is signalled that the device is in extended test mode. The test phases will be continuously repeated. The extended test can be finished after the first complete sequence (approx. 10 sec) by pressing the "reset" button for 2 seconds. The device starts the insulation monitoring again. The extended test can also be ended via a Modbus command.



1) Test signal: Button Test > 2 s or X1/X2 > 1.5 s and < 10 s or via Modbus command
2) Reset signal: Button Reset > 2 s or X1/X2 < 1.5 s or via Modbus command
3) To initiate the extended test (Test 2) the test signal must be operated within the self test (Test 1) again.
4) The reset signal has here no function, as the first complete sequence of extended test (Test 2) is not finished.

Function

Behaviour with internal device faults
If internal device faults were detected during the test function, the status LED flashes with flash code 3. The indicator relays K1 and K2 switch to the alarm state. The device faults are also indicated via Modbus.

Behavior on faulty connection
When detecting broken wire on terminals L(+)/L(-), the measurement is disabled. The reaction time could be up to 2 min. The monitoring relays K1 and K2 go in alarm state, the status LED shows flash code 1 in red colour. After removing the interruption the fault is automatically reset (max. reaction time up to 2 min) and the measurement of the insulation resistance is continued. Stored alarm values remain stored. An interruption of the protective earth connections PE1/PE2 causes the same reaction as interrupting the measuring circuit, only the status LED shows flash code 2 in red colour. Broken wire detection on terminals L(+)/L(-) and PE1/PE2 are also indicated via Modbus.

External control input
To terminals X1/X2 an external combined Test-/Reset button can be connected. If the terminals X1/X2 are bridged for approx. > 1,5 s and < 10 s the test mode is started. This has the same function as pressing the internal test button. When bridging X1/X2 for < 1,5 s, a stored alarm will be reset. This has the same function as pressing the internal reset button. If X1/X2 is activated for > 10 s, the measuring function is stopped.
The measuring function remains suspended for the duration of the control of X1/X2. The measuring function can also be stopped via Modbus command.

Connection of an external coupling device
An external coupling device (VSG) RL 5898 or RP 5898 can be connected to extend the input voltage range of the monitored voltage system on RN 5897/321. The terminals with the same legend of the insulation monitor and the coupling device RL 5898 or RP 5898 (VSG1, VSG2, L(+), L(-)) are connected together.
The network to be monitored is connected to terminals L1(+) und L2(-) on the coupling device. Using the display menu in programming mode or via Modbus the connection of the coupling device has to be selected and activated. The broken wire detection is active on the terminals L1(+)/L2(-) on the coupling device. A broken wire between coupling device and insulation monitor cannot be detected immediately but the measured values on interruption of 1 or 2 wires between coupling device and insulation monitor are much lower as the real values, which will cause an early response of the device.

Programming/setting of parameters/set-up of the insulation monitor
All settings are made via Maodbus. It is possible to adjust the response values for alarm and pre-alarm, the relay operation principle, the alarm memory, the broken wire detection, the type of network connection and the activation/ deactivation of the coupling device. The setting of the Modbus address and baud rate is done via the three rotary switches on the front of the device. The first two rotary switches ("Adr10" and "Adr1") set the Modbus address between 1 and 99 in steps of 10 and 1, the third rotary switch (“Baud”) sets the baud rate.

Possible setting values are:

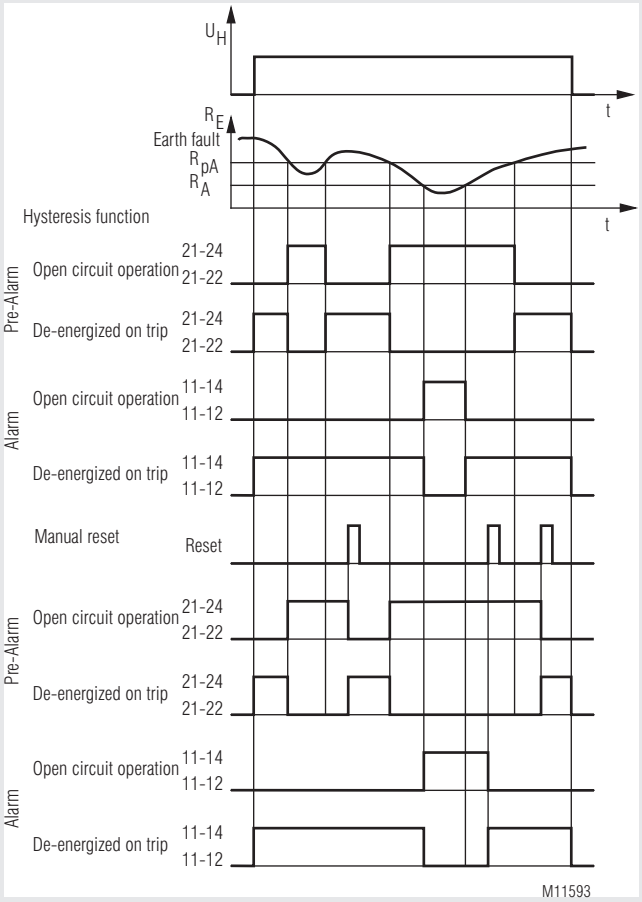
Position potentiometer Baud	1	2	3	4	5	6	7	8
Baud rate kBaud	1.2	2.4	4.8	9.6	19.2	38.4	57.6	115.2

To avoid unauthorized manipulation, all three rotary switches are located behind a sealable transparent cover.

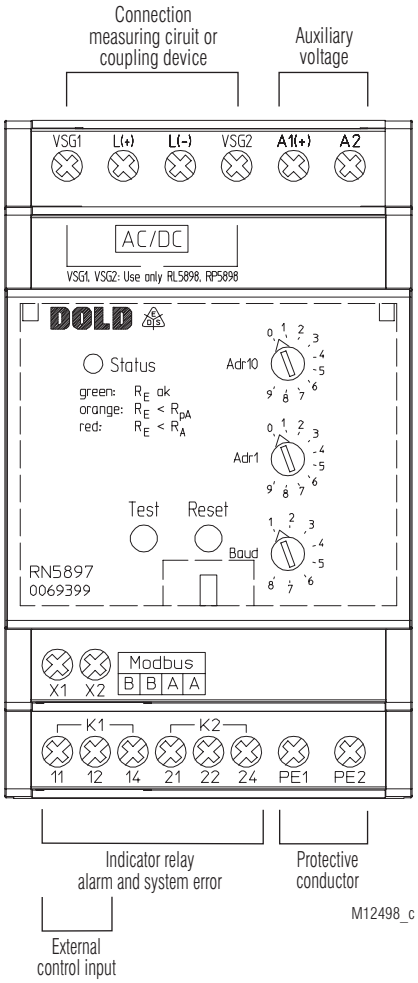
Modbus RTU

For communication between motor controller and a supervising control the Modbus RTU protocol according to Specification V 1.1b3 is used.

Function Diagram



Indicators



RN 5897/321

Indicators

The operational status of the device is indicated on a 3-colour LED:

Off: No auxiliary voltage connected
Green: Normal operation (Insulation resistance in healthy state)
Red: Alarm (measured value below alarm response value)
Orange: Warning (measured value below pre-alarm response value)
Orange flashing: Test mode / Measurement stopped procedure (see table flashing code)
Red flashing: Failure code (see table flashing code)

Flash code orange Status-LED	Description
1	Selftest (measuring circuit, measuring voltage, internal tests)
2	Advanced Test (additional control of indicator relays)
continously flashing	Measuring function stopped

Error Indication

Flash code red Status-LED	Failure cause	Failure recovery
1	Broken wire detection on L(+)/L(-).	Check measuring circuit L(+) and L (-)
2	Broken wire detection on PE1/PE2.	Check protective earth connections PE1 and PE2
3	Internal failure detected in test mode	Press test button again or restart the unit by interrupting the auxiliary supply temporarily. If the fault remains permanent, send device back to manufacturer for examination.
9	Modbus timeout detected	Lock Modbus timeout, extend timeout time, or adjust communication with the master.
10	Faulty calibration values detected in device memory.	Send device back to manufacturer for recalobration and examination.
11	Internal communication error occured	Restart the unit by interrupting the auxiliary supply temporarily. If the fault remains permanent, send device back to manufacturer for examination.
12	Internal software error occured	Restart the unit by interrupting the auxiliary supply temporarily. If the fault remains permanent, send device back to manufacturer for examination.

Notes

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 display of the voltage is not in real time. The Value on the display is updated at the end of a measuring cycle. The absence of voltage of the system and the device have to be checked with suitable measuring devices!
- The terminals of the control input X1-X2 have no galvanic separation to the measuring circuit L(+) / L(-) and are electrically connected together, therefore they have to be controlled by volt free contacts or bridge. These contacts ore bridges must provide a sufficient separation depending on the mains voltage on L(+)/L(-).
- Please do not connect external voltage to terminals X1/X2. The control must only be made by bridging X1 and X2.
- The coupling unit RL 5898 or RP 5898 must only be used in conjunction with the RP5897/321 on a voltage system and not just by itself.

Attention!

- Before checking insulation and voltage, disconnect the monitoring device RN 5897/321 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..
- Device terminals PE1 and PE2 must always be connected via separate lines to different terminal points of the protective-conductor system.
- The device must not be operated without PE1/PE2 connection!
- If telegrams fail in the bus communication due to EMC interference, grounding the bus cable screening on both sides could be a remedy. With this earthing, attention must be paid to possibly occuring equalizing currents, which could occur with larger potential differences between the bus participants.

Attention!

- The main measuring circuit can be connected with its terminals L(+) and L(-) both to the DC and also AC side of a mixed network; it is done most practically where the primary incoming power supply takes place e.g. with battery networks with connected inverters on the DC side, with Generators/Transformers with connected Rectifiers or inverters on the AC-side. To monitor a 3NAC system the device can be connected single pole, (L(+) and L(-) are bridged, to the neutral of the 3p4w system. The 3 phases have a low-Ωic (approx. 3 – 5 Ω) connection via the transformer windings so also insulation failures of the not directly connected phases are detected. Via Modbus the correct type of network must be selected (see „Connection Examples“).
- If a monitored AC system includes galvanically connected DC circuits (e.g. via a rectifier), an insulation failure on the DC side can only be detected correctly, when a current of min 10 mA can flow via the semiconductor connections.
- If a monitored DC system includes galvanically connected AC circuits (e.g. via an inverter), an insulation failure on the AC side can only be detected correctly, when a current of min 10 mA can flow via the semiconductor connections.
- For the register of the Insulating resistance the value 0xFFFF is transmitted via Modbus if R_E > 2 MΩ. If no valid mains voltage value was measured or the mains voltage is < 5 V, the value 0xFFFF is transmitted for the register of the measured mains voltage via Modbus. (See Parameter table).

Technical Data

Measuring ciruit L(+)/L(-) to PE1/PE2 (with coupling device)

Nominal voltage U_N:	AC / DC 0 ... 230 V	
Max. max. voltage range U_N:	AC 0 ... 250 V DC 0 ... 300 V	
Frequency range:	DC oder 40 ... 1000 Hz	
Max. line capacitance:	5 µF	
Internal resistance (AC / DC):	> 90 kΩ	
Measuring voltage:	Ca. ± 90 V	
Max. mesured current (R_E = 0):	< 1,10 mA	
Response inaccuracy:	± 15 % ± 1,5 kΩ	IEC 61557-8
Response value hysteresis:	Approx. + 25 %; min. + 1 kΩ	
On delay		
At C_E = 1µF, response value ≤ 100 kΩ, R_E of ∞ to 0.5 * response value:	≤ 1 s	
At C_E = 1µF, response value > 100 kΩ, R_E of ∞ to 0.5 * response value:	< 2 s	
Measuring time:		
At C_E = 1 … 5 µF	< 5 s	
Min. operate time:	> 0.2 s	
Response value		
Adjustable via Modbus		
Pre-warning "R_{pA}":	In the range of 1 ... 500 kΩ in 1 kΩ steps	
Alarm "R_A":	In the range of 1 ... 500 kΩ in 1 kΩ steps	
Response value broken wire detection L(+)/L(-):	> Approx. 90 kΩ	
Response value broken wire detection PE1/PE2:	> Approx. 0.5 kΩ	

Meas. ciruit L(+)/L(-) to PE1/PE2 (with coupling device RL / RP 5898)

	RL 5898	RP 5898
Nominal voltage U_N:	AC 0 ... 400 V DC 0 ... 500 V	AC 0 ... 690 V DC 0 ... 1000 V
Max. max. voltage range U_N:	AC 0 ... 440 V DC 0 ... 550 V	AC 0 ... 760 V DC 0 ... 1100 V

Frequency range:	DC or 40 ... 1000 Hz	
Max. line capacitance:	5 µF	
Internal resistance (AC / DC):	> 240 kΩ	
Measuring voltage:	Approx. ± 90 V	
Max. mesured current (R_E = 0):	< 0.40 mA	
Response inaccuracy:	± 15 % ± 1.5 kΩ	IEC 61557-8
Response value hysteresis:	Approx. + 25 %; min. + 1 kΩ	
On delay		
At C_E = 1µF, response value ≤ 100 kΩ, R_E of ∞ to 0.5 * response value:	≤ 1 s	
At C_E = 1µF, response value > 100 kΩ, R_E of ∞ to 0.5 * response value:	< 2 s	
Measuring time:		
At C_E = 1 … 5 µF	< 5 s	
Min. operate time:	> 0.2 s	
Response value		
Adjustable via Modbus		
Pre-warning "R_{pA}":	In the range of 1 ... 500 kΩ in 1 kΩ steps	
Alarm "R_A":	In the range of 1 ... 500 kΩ in 1 kΩ steps	
Response value broken wire detection L(+)/L(-):	> Approx. 500 kΩ	
Response value broken wire detection PE1/PE2:	> Approx. 0.5 kΩ	
Max. wire length between insulation monitor and coupling device:	< 0.5 m	

Technical Data

Auxiliary voltage input A1(+)/A2

Nom. Voltage	Voltage range	Frequency range
AC/DC 24 ... 60 V	AC 19 ... 68 V	45 … 400 Hz; DC 48 % W*)
	DC 19 ... 96 V	W*) ≤ 5 %
AC/DC 100 ... 230 V	AC 70 ... 276 V	45 … 400 Hz; DC 48 % W*)
	DC 80 ... 300 V	W*) ≤ 5 %

*) W = Permitted residual ripple of auxiliary supply

Nominal consumption:	
DC 12 V, 24 V, 48 V:	Max. 3 W
AC 230 V:	Max. 3.5 VA

Control input X1/X2 for external combined Test-/Reset-Taste

Current flow:	Approx. 3 mA
No-load operation voltage X1 to X2:	Approx. 12 V
Permissible wire length:	< 50 m
Activat. time t for test signal:	1.5 s < t < 10 s
Activat. time t for reset signal:	t < 1.5 s
Activation time t for stop of the measuring function:	t > 10 s

Outputs

Indicator contact:	2 x 1 changeover contact for Alarm (K1) and Pre-Alarm (K2) energized or de-energized on trip (programmable)	
Thermal current I_{th}:	Max. 4 A (see also temperature range operation)	
Switching capacity		
To AC 15:		
NO contact:	5 A / AC 230 V	IEC/EN 60947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60947-5-1
To DC 13:	2 A / DC 24 V	IEC/EN 60947-5-1
Electrical life		
At 5 A, AC 230 V:	1 x 10^5 switching cycles	
Short circuit strength		
Max. fuse rating:	4 A gG / gL	IEC/EN 60947-5-1
Mechanical life:	50 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Auxiliary voltage AC/DC 24 ... 60 V:	- 40 ... + 60 °C - 40 ... + 70 °C (Device mounted with min. 1 cm distance to adjacent devices **or** device with max. 2 x 0.5 A contact current)	
Auxiliary voltage AC/DC 100 ... 230 V:	- 40 ... + 60 °C - 40 ... + 70 °C (Device mounted with min. 1 cm distance to adjacent devices **and** device with max. 2 x 0.5 A contact current)	
Storage:	- 40 ... + 70 °C	
Altitude:	≤ 2000 m	IEC 60664-1

Technical Data

Clearance and creepage distances		
Rated insulation voltage:	300 V	
Overvoltage category:	III	
Rated impuls voltage / pollution degree:		IEC 60664-1
Measuring circuit L(+)/L(-) to auxiliary voltage A1(+)/A2 and indicator relay contacts K1, K2:	4 kV / 2	
Auxiliary voltage A1(+)/A2 to indicator relay contacts K1, K2:	4 kV / 2	
Indicator relay contact K1 to indicator relay contacts K2:	4 kV / 2	
Bus A, B to measuring circuit L(+)/L(-) and auxiliary voltage A1(+)/A2 and indicator relay contacts K1, K2:	6 kV / 2	
Insulation test voltage		
Routine test:	AC 2,5 kV; 1 s AC 4 kV; 1 s	
EMC		IEC/EN 61326-2-4
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 voltage		
Between		
wires for power supply:	1 kV	IEC/EN 61000-4-5
Between wire and ground:	2 kV	IEC/EN 61000-4-5
HF-wire guided:	20 V	IEC/EN 61000-4-6
Interference suppression:	Limit value classe B	EN 55011
Degree of protection		
Housing:	IP 30	IEC/EN 60529
Terminals:	IP 20	IEC/EN 60529
Housing:	Thermpolastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, Frequency 10 ... 55 Hz, IEC/EN 60068-2-6 frequency 2 ... 13.2 Hz, 13.2 ... 100 Hz, acceleration ± 0.7 gn IEC/EN 60068-2-6	
Shock resistance:	10 gn / 11 ms, 3 pulses IEC/EN 60068-2-27	
Climate resistance:	40 / 070 / 04	IEC/EN 60068-1
Terminal designation:	EN 50005	
Wire connection		DIN 46228-1/-2/-3/-4
Cross section:	0.5 ... 4 mm² (AWG 20 - 10) solid or 0.5 ... 4 mm² (AWG 20 - 10) stranded wire without ferrules 0.5 ... 2.5 mm² (AWG 20 - 10) stranded wire with ferrules	
Stripping length:	6.5 mm	
Wire fixing:	Cross-head screw / M3 box terminals	
Wire connection Bus		
pluggable cage-clamp terminal:	0,14 ... 0,5 mm² solid or 0,14 ... 0,25 mm² stranded ferruled	
Insulation of wires or sleeve length:	7 mm	
Fixing torque:	0.5 Nm	
Mounting:	DIN rail	IEC/EN 60715
Mounting position:	Vertical (air flow trough ventilation slots must be ensured)	
Weight:	Approx. 205 g	

Dimensions

Width x height x depth:	52.2 x 90 x 71 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61373
Ambient temperature:	OT1, OT2 compliant	
Protective coating of the PCB:	No	

Standard Types

RN 5897.12/321	AC/DC 24 … 60 V
Article number:	0069399
• Auxiliary voltage:	AC/DC 24 … 60 V
RN 5897.12/321	AC/DC 100 … 230 V
Article number:	0069400
• Auxiliary voltage:	AC/DC 100 … 230 V
• Outputs:	1 changeover contact for pre-warning 1 changeover contact for alarm
• Setting range pre-warning:	1 kΩ … 500 kΩ
• Setting range alarm:	1 kΩ … 500 kΩ
• With connection facility of a coupling device RL 5898 or RP 5898	
• Max. line capacitance:	5 µF
• Energized or de-energized on trip	
• Selection of type of network	
• Width:	52.5 mm

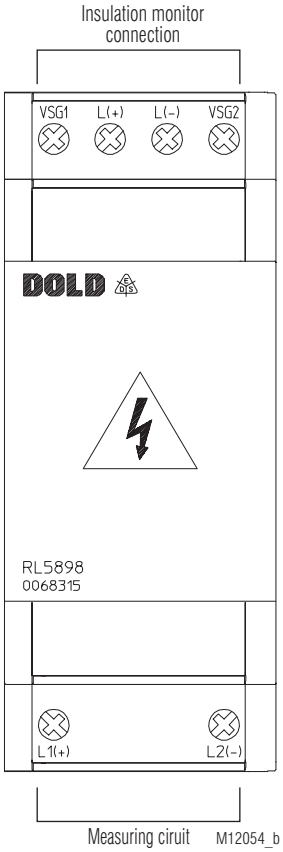
Ordering Example for variants

RN 5897 .12 /_ _ _ AC/DC 24 … 60 V 1 kΩ ... 500 kΩ 1 kΩ ... 500 kΩ

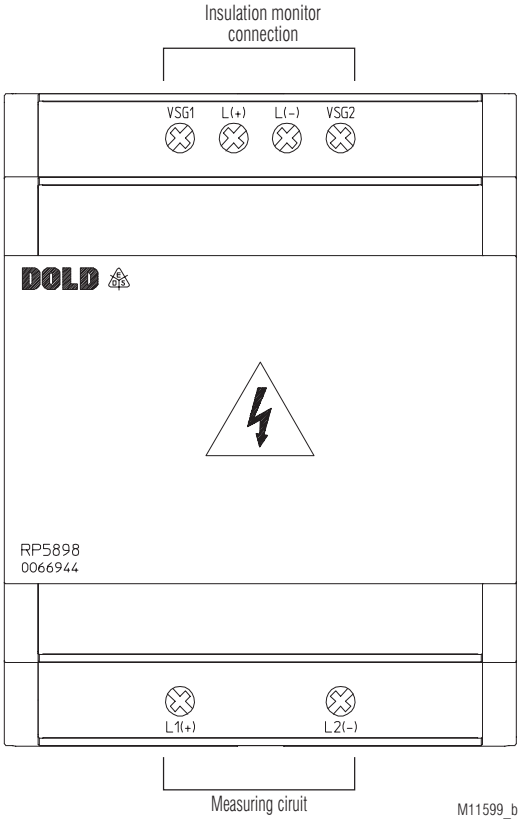
- Setting range Pre-warning
- Setting range alarm
- Auxiliary voltage
- Variant, if required
- Contacts
- Type

Accessories

RL 5898/61
Article number: 0068315
- Coupling device for RN 5897.12/320
- Extension of nominal voltage range U_N to DC 500 V, AC 400 V
- Weight: Approx. 60 g
- Dimensions
  - Width x height x depth: 35 x 90 x 71 mm

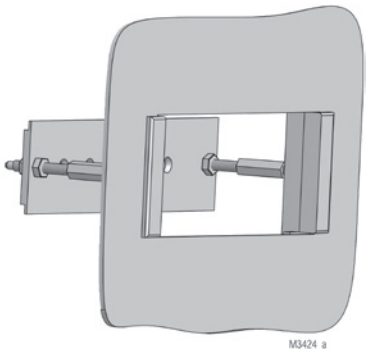


RP 5898/61
Article number: 0066944
- Coupling device for RN 5897.12/320
- Extension of nominal voltage range U_N to DC 1000 V, AC 690 V
- Weight: Approx. 110 g
- Dimensions
  - Width x height x depth: 70 x 90 x 71 mm



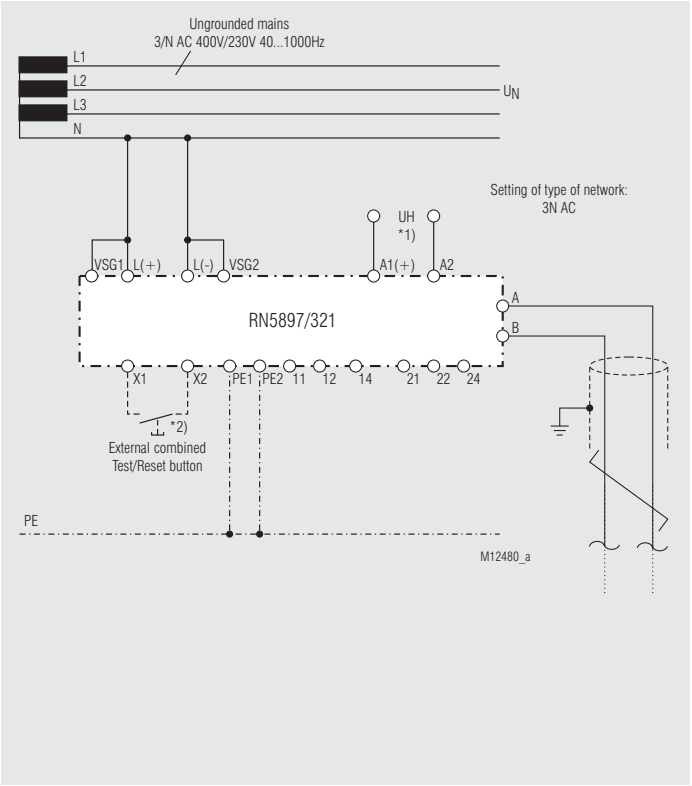
Accessories

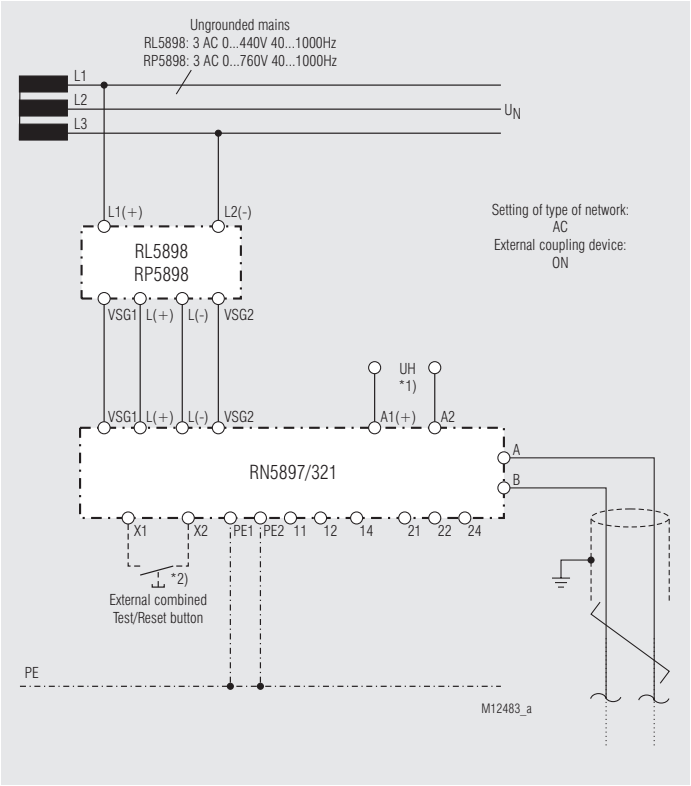
Flush mounting kit
Order reference: KU 4087-150/0056598



For universal use with:
- R-series devices of 17.5 to 105 mm width
- Easy mounting

Connection Examples

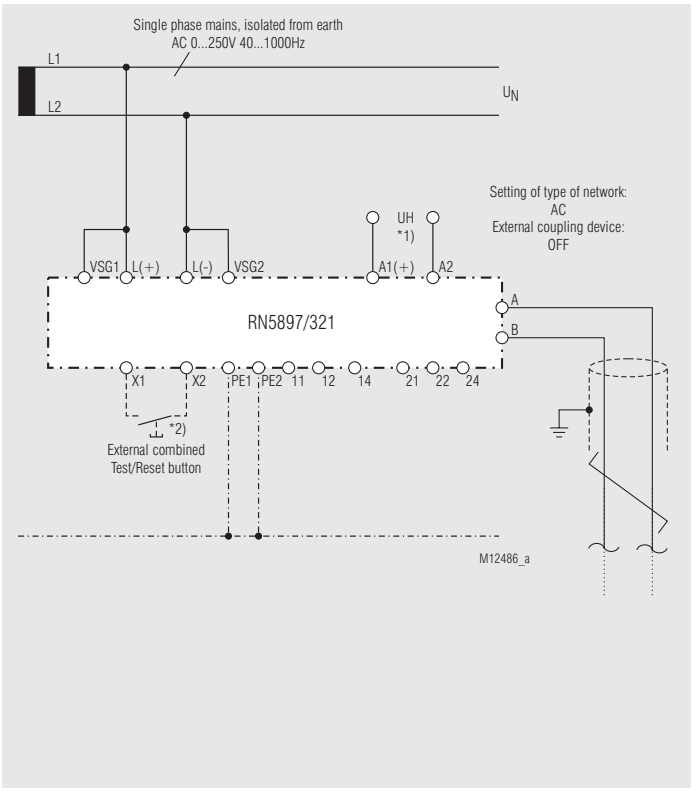


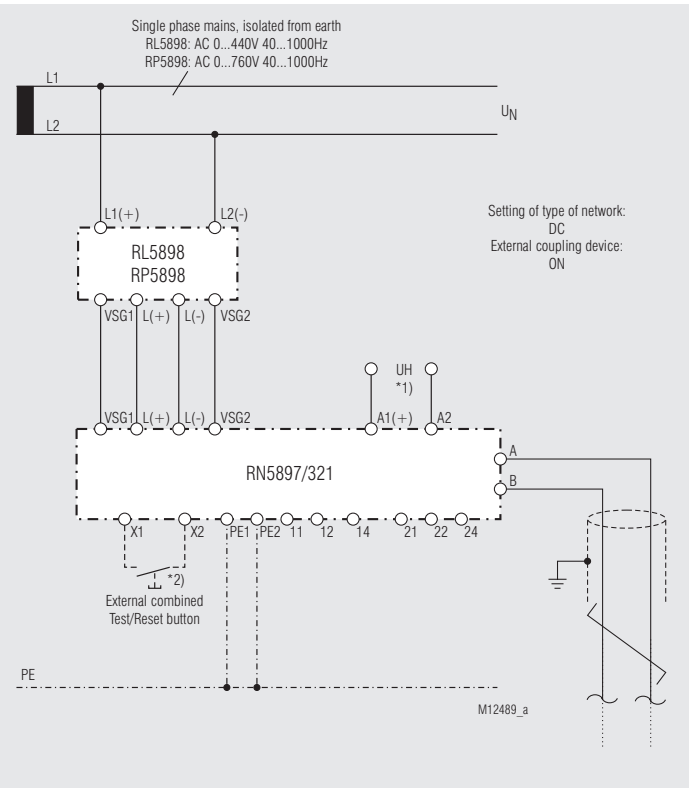


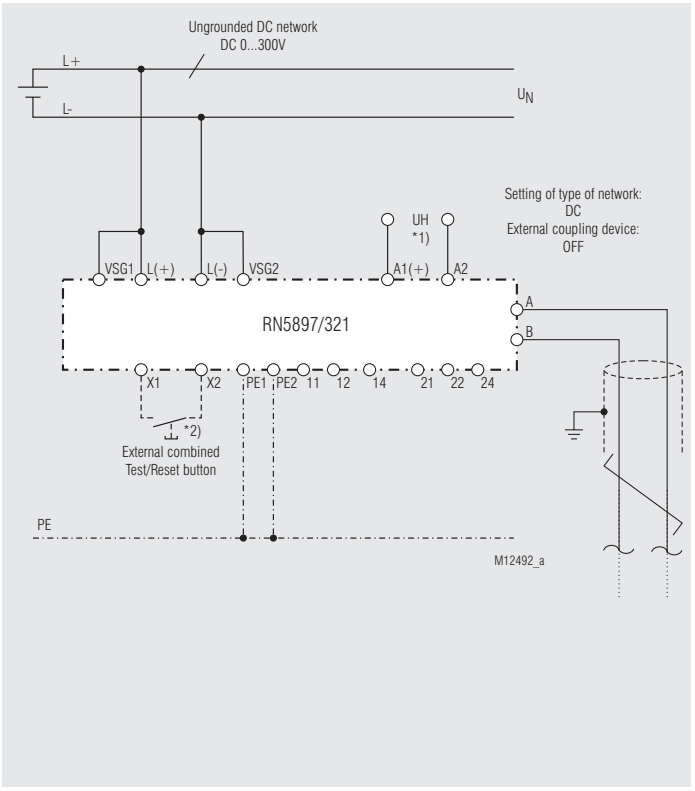
*1) Auxiliary voltage U_H (A1(+)/A2) can also be sourced from the monitored voltage system.
The voltage range of the auxiliary supply has to be taken into account.

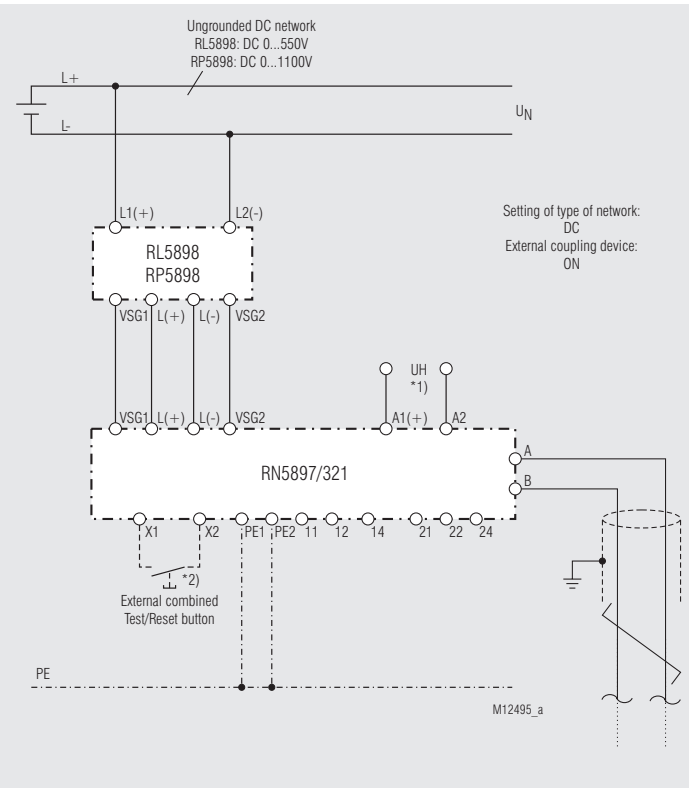
*2) Control input X1/X2 for external combined Test-/Reset-button with Stop of the measuring function:
- Control 1.5 s < t < 10 s: Test function
- Control < 1.5 s: Reset function
- Control > 10 s: Stop of measuring function

Connection Examples









*1) Auxiliary voltage U_H (A1(+)/A2) can also be sourced from the monitored voltage system.
The voltage range of the auxiliary supply has to be taken into account.

*2) Control input X1/X2 for external combined Test-/Reset-button with Stop of the measuring function:
- Control 1.5 s < t < 10 s: Test function
- Control < 1.5 s: Reset function
- Control > 10 s: Stop of measuring function

Bus Interface

Protocol	Modbus Seriell RTU
Adress	1 to 99
Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
Data bit	8
Stop bit	2
Parity	None

More information about the interface, wiring rules, device identification and communication monitoring can be found in the Modbus user manual.

Function-Codes

At RN 5897/321 the following function codes are implemented:

Function-Code	Name
0x01	Read Coils
0x03	Read Holding Register
0x04	Read Input Register
0x05	Write Single Coil
0x06	Write Single Register
0x10	Write Multiple Register

Device configuration

Device configuration data (parameters and setting values from register 42001, as well as the "factory setting" command) are directly stored in the EEPROM in non-volatile memory when writing via Modbus. As the write cycles of an EEPROM are limited, the write operation with these registers or this command must not be cyclic.

Parameter Table

Coils

Register-Adress	Protocol-Adress	Name	Value range	Initial value	Description	Data type	Access rights
1	0	Reset	0x0000 0xFF00	0x0000	No Function Error acknowledgem. device error (relay 2)	BIT	Write / read
2	1	Device reset	0x0000 0xFF00	0x0000	No Function Device restart	BIT	Write / read
3	2	Reserved	0x0000 0xFF00	0x0000	-	BIT	-
4	3	Factory setting	0x0000 0xFF00	0x0000	No Function Factory setting of the parameters	BIT	Write / read
5	4	Device selftesting	0x0000 0xFF00	0x0000	No Function Selftesting	BIT	Write / read
6	5	Fault memory Indicator relay K1 + K2	0x0000 0xFF00	0x0000	No Function Fault memory acknowledgement Indicator relay K1 and K2	BIT	Write / read
7	6	Reserved	0x0000 0xFF00	0x0000	-	BIT	-
8	7	Advanced Test	0x0000 0xFF00	0x0000	No Function Advanced Test	BIT	Write / read
9	8	Measuring function stopped	0x0000 0xFF00	0x0000	Continue measuring function Interrupt measuring function	BIT	Write / read

Parameter Table

Input Registers

Register-Adress	Protocol-Adress	Name	Value range	Description	Data type	Access rights
30001	0	Device failure	0 … 12	0: No failure 1: Broken wire detection L(+)/L(-) 2: Broken wire detection PE1/PE2 3: Internal failure detected in test mode 4: Reserved 9: Communication fault Modbus 10: Checksum failure EEPROM 11: Internal communication fault 12: Internal error 4	UINT16	Read
30002	1	State of device	0 … 5	0: Device initialize 1: Device is ready and in measuring mode 2: Device in error mode 3: Device in selftesting 4: Device in advanced test 5: Measuring function stopped	UINT16	Read
30003	2	Device flags	0 … 3	Bit 0: Indicator relay K2 energized Bit 1: Indicator relay K1 energized	UINT16	Read

Register-Adress	Protocol-Adress	Name	Value range	Description	Data type	Access rights
32001	2000	Insulating resistance	0 … 20000, 65535	in 1/10 kΩ	UINT16	Read
32002	2001	Asymmetrical insulating resistance	1,2,4	Bit 0: Resistance is asymmetrical Bit 1: Asymmetrical against L+ Bit 2: Asymmetrical against L-	UINT16	Read
32003	2002	Measured mains voltage	0 … 300 without VSG 0 … 1000 with VSG	in V	UINT16	Read
32004	2003	Stored min. insulating resistance	0 … 20000, 65535	in 1/10 kΩ	UINT16	Read

Parameter Table

Holding Registers

Register-Adress	Protocol-Adress	Name	Value range	Initial value	Description	Data type	Access rights
40001	0	Control word 1	0 … 65535	0	Bit 0 = Reset Bit 1 = Device reset Bit 2 = Reserved Bit 3 = Factory settings Bit 4 = Device selftesting Bit 5 = Fault memory acknowledgement indicator relay K1 and K2 Bit 6 = Reserved Bit 7 = Advanced test Bit 8 = Measuring function stopped	UINT16	Write / read
40002	1	Timeout release	0 … 1	0	Bit 0 = Enable	UINT16	Write / Read
40003	2	Timeout	100 …10000 0 …10000	1000	Timeout Value in ms (write) Timeout Value in ms (read)	UINT16	Write / Read

Register-Adress	Protocol-Adress	Name	Value range	Initial value	Description	Data type	Access rights
42001	2000	Broken wire detect in measuring circuit	1,2,4	1	Bit 0 = On Bit 1 = Off Bit 2 = Only during the device selftesting	UINT16	Write /Read
42002	2001	Storing insulation fault message indicator relay K1+ K2	0 … 1	0	0 = Off 1 = On	UINT16	Write /Read
42003	2002	Switching mode of output relays indicator relay K1+ K2	0 … 1	0	0 = De-energized on trip 1 = Energized on trip	UINT16	Write /Read
42004	2003	Power supply type	1,2,4	1	Bit 0 = AC mains Bit 1 = DC mains Bit 2 = 3N AC mains	UINT16	Write /Read
42005	2004	Reserved	-	1		UINT16	Write /Read
42006	2005	Response value indicator relay K1	1 … 500	500	Response value indicator relay K1 in kΩ	UINT16	Write /Read
42007	2006	Response value indicator relay K2	1 … 500	500	Response value indicator relay K2 in kΩ	UINT16	Write /Read
42008	2007	Coupling device	1,2	1	Bit 0 = Off Bit 1 = RL 5898 or RP 5898	UINT16	Write /Read