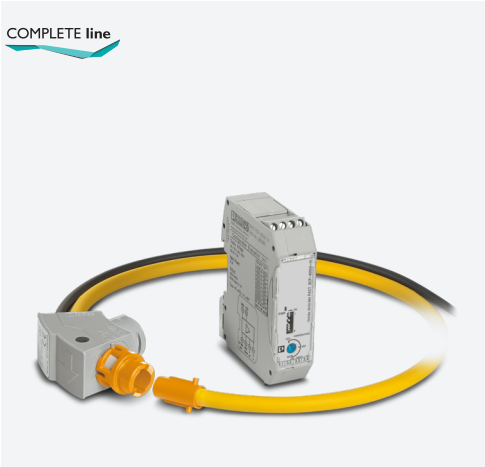
PACT RCP-4000A-1A-Dxxx

Configurable current transformer for retrofitting



Data sheet
106312_en_05

 2024-05-28

1 Description

The Rogowski coil is used to measure AC current and is primarily intended for subsequent installation in existing plants - either on power rails or power cables.

Subsequent installation around the conductor is possible because you can separate out the measuring line of the Rogowski coil.

The device consists of two components.

The output signal of the Rogowski coil is directed to a measuring transducer that issues an AC current of max. 1 A with phase fidelity on the output.

With the measuring transducer, you can choose between eight current measurement ranges from 100 A AC to 4000 A AC. You can define the current measurement ranges using DIP switches.

There are two clamping devices that you can use to affix the Rogowski coil to busbars of differing strengths.

You can use the measuring transducer in conjunction with the energy meters in the EMpro product range.

Features

- Fast installation
- Short shutdown times
- Eight current measuring ranges
- Flexible measuring coil lengths of 300 mm, 450 mm, 600 mm
- Large bandwidth of 40 Hz ... 20,000 Hz
- 100 mV output signal per 1,000 A AC
- Rated insulation voltage: 1000 V AC (rms CAT III), 600 V AC (rms CAT IV)
- Acquisition of harmonics and transients
- Measurement of brief current pulses
- Magnetic saturation not possible due to the air-core coil

Make sure you always use the latest documentation.
It can be downloaded from the product at phoenixcontact.com/products.

This document is valid for the products listed in the “Ordering data” chapter.

2 Table of contents

3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Set consisting of a 1 A measuring transducer and a Rogowski coil with signal line. Length of Rogowski coil: 300 mm, diameter: 95 mm. Length of signal line: 3 m. The Rogowski coil measures the AC current of busbars and power lines.	PACT RCP-4000A-1A-D95	2904921	1
Set consisting of one 1 A measuring transducer and one Rogowski coil with signal line. Length of Rogowski coil: 450 mm, diameter: 140 mm. Length of signal line: 3 m. The Rogowski coil measures the AC current of busbars and power lines.	PACT RCP-4000A-1A-D140	2904922	1
Set consisting of a 1 A measuring transducer and a Rogowski coil with signal line. Length of Rogowski coil: 600 mm, diameter: 190 mm. Length of signal line: 3 m. The Rogowski coil measures the AC current of busbars and power lines.	PACT RCP-4000A-1A-D190	2904923	1
Set consisting of a 1 A measuring transducer and a Rogowski coil with signal line. Length of Rogowski coil: 300 mm, diameter: 95 mm. Length of signal line: 5 m. The Rogowski coil measures the AC current of busbars and power lines.	PACT RCP-4000A-1A-D95-5M	2910325	1
Set consisting of a 1 A measuring transducer and a Rogowski coil with signal line. Length of Rogowski coil: 300 mm, diameter: 95 mm. Length of signal line: 10 m. The Rogowski coil measures the AC current of busbars and power lines.	PACT RCP-4000A-1A-D95-10M	2910326	1
Set consisting of one 1 A measuring transducer and one Rogowski coil with signal line. Length of Rogowski coil: 450 mm, diameter: 140 mm. Length of signal line: 10 m. The Rogowski coil measures the AC current of busbars and power lines.	PACT RCP-4000A-1A-D140-10M	1033483	1
Set consisting of a 1 A measuring transducer and a Rogowski coil with signal line. Length of Rogowski coil: 600 mm, diameter: 190 mm. Length of signal line: 10 m. The Rogowski coil measures the AC current of busbars and power lines.	PACT RCP-4000A-1A-D190-10M	2910327	1

Accessories	Type	Item no.	Pcs./Pkt.
The optional holding device ensures the Rogowski coil is securely seated on busbars with a thickness of 10 … 15 mm. During installation, the coil housing is pushed onto the flange of the holding device and snaps in automatically.	PACT RCP-CLAMP	2904895	1
The optional holding device ensures the Rogowski coil is securely seated on busbars that are 5 … 10 mm thick. During installation, the coil housing is pushed onto the flange of the holding device and snaps in automatically.	PACT RCP-CLAMP-5-10	2907888	1

4 Technical data

Input Measuring coil	
Frequency measuring range	40 Hz ... 20000 Hz
Position error	<± 0.1 % (typical)
Linearity error	< 0.1 %
Signal output Measuring coil	
Output signal (at 50 Hz)	100 mV (no load, at 1,000 A)
Output voltage (in no-load operation)	V_{OUT} = M * dI/dt
Output voltage (sinusoidal, in no-load operation)	100 mV (V_{OUT} = 2 * π * M * f * I (M = 0.318 µH; example: At 50 Hz; I = 1,000 A))
General data, measuring coil	
Length Measuring coil	300 mm , 450 mm , 600 mm
Internal resistance (Measuring coil)	175 Ω , 263 Ω , 350 Ω
Diameter Measuring coil	8.3 mm ±0.2 mm
Diameter Measuring coil when installed	95 mm
Length Signal line	3 m , 5 m , 10 m
Conductor structure signal line	2x 0.22 mm (Signal (tinned)) 1x 0.22 mm (Shielding (tinned))
Max. measurement current	100 kA (50 Hz)
Temperature coefficients	≤ 0.0235 %/K (-20 °C ... 0 °C) ≤ 0.009 %/K (0 °C ... 20 °C) ≤ 0.0075 %/K (20 °C ... 70 °C)
Coil material	Elastollan
Housing material	PC
Insulation	double insulation
Electrical isolation	Reinforced insulation in accordance with IEC 61010-1
Pollution degree	2
Overvoltage category	III (1000 V, to neutral conductor) IV (600 V, to neutral conductor)
Degree of protection	IP67 (not assessed by UL)
Rated insulation voltage	1000 V AC (rms CAT III) 600 V AC (rms CAT IV)
Test voltage	10.45 kV DC (60 s)
Basic accuracy	<± 0.2 %
Ambient temperature range Operation	-30 °C ... 80 °C
Ambient temperature range Storage/transport	-40 °C ... 80 °C

Input data Measuring transducers	
Primary rated current I_{pn}	0 A AC ... 100 A AC 0 A AC ... 250 A AC 0 A AC ... 400 A AC 0 A AC ... 630 A AC 0 A AC ... 1000 A AC 0 A AC ... 1500 A AC 0 A AC ... 2000 A AC 0 A AC ... 4000 A AC
Configurable/programmable	Via DIP switches
Phase angle	< 1 °

Signal input Measuring transducers	
Input signal (at 50 Hz)	100 mV (1000 A)
Curve type	Sine
Input impedance	27 kΩ (smallest measuring range)

Signal output Measuring transducer	
Load	0 Ω ... 1.25 Ω
Max. distances for copper cables at $P_{N\ max}$	16 m (0.75 mm² (AWG 20)) 32 m (1.5 mm² (AWG 16)) 55 m (2.5 mm² (AWG 14))
Max. current consumption	190 mA

Miscellaneous data for measuring transducer	
Nominal supply voltage	24 V DC -20 % ... +25 %
Nominal supply voltage range	19.2 V DC ... 30 V DC
Protective circuit	Surge protection (33 V suppressor diode)
Power consumption	4 W
Linearity error	< 0.5 % (From the range end value)
Maximum transmission error	≤ 0.5 % (From the range end value)
Frequency range	45 Hz ... 65 Hz
Max. detectable harmonics	< 2 kHz
Current consumption	< 190 mA (at 19.2 V)
Housing material	Polyamide
Degree of protection	IP20
Test voltage, input/output/supply	1.5 kV AC (Supply/input and output: 50 Hz, 1 min)
Electrical isolation	Reinforced insulation in accordance with IEC 61010-1
Dimensions W/H/D	22.5 mm / 85 mm / 70.4 mm
Ambient temperature range Operation	-20 °C ... 70 °C
Ambient temperature range Storage/transport	-25 °C ... 85 °C
Altitude	< 2000 m
Humidity non-condensing	5 % ... 95 %

System data (coil and measuring transducer)	
Temperature coefficients	0.005 %/K (+10 °C ... +70 °C, both components have the same ambient temperature)
Temperature coefficients	0.07 %/K (-20 °C ... +10 °C, both components have the same ambient temperature)
Typical measuring error	< 1 %
Approvals/conformities	
Standards/regulations Measuring coil	IEC 61010-1 IEC 61010-2-032
CE CE-compliant	
UKCA UKCA-compliant	
CMIM CMIM-compliant	
UL, USA/Canada Measuring coil	UL 61010 Recognized
UL, USA/Canada Measuring transducer	UL 508 Listed
Conformance with EMC directive	
Noise emission	EN 61000-6-4
Noise immunity	EN 61000-6-3

5 Safety regulations and installation notes

- Only qualified specialists staff may install, set up and operate the device. Observe the national safety rules and regulations for the prevention of accidents.
- Installation, operation, and maintenance may only be carried out by qualified electricians. Follow the installation instructions as described.
- When installing and operating the device, observe the applicable regulations and safety directives (including national safety directives), as well as the generally recognized technical regulations.
- Observe the safety information, conditions, and limits of use specified in the product documentation. Comply with them.
- The products are built according to the latest safety requirements. However, dangerous situations or damage to the products or other property can arise from misuse of this device.
- The device fulfills the requirements of the EMC directives and harmonized European standards. Any modifications to the systems can influence the EMC behavior.
- The installer of the system is responsible for the safety of the system in which the device is installed.
- When working on the device, observe the national safety and accident prevention regulations.
- Disregarding these safety regulations may result in death, serious personal injury or damage to equipment.
- The device must not be opened or modified. Do not repair the device yourself, replace it with an equivalent device. Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from violation.
- Connecting and disconnecting the measurement circuit to/from the measuring transducer is only allowed when the conductor is switched off.
- Before working on the device, disconnect the power.
- Keep the product documentation in a safe place.
- Only use accessories that meet the specifications of the device manufacturer (e.g. combination of measuring coil and measuring transducer).

The device contains valuable recyclable materials, which should be utilized.

Dispose of the device separately from other waste, i.e., via an appropriate collection site.

The following symbols are located on the device:

Warning! Read through the operating manual carefully.

Protected with double insulation or reinforced insulation

Do not apply around or remove from hazardous live conductors without additional protective means.

WARNING: Danger to life by electric shock!

The device is only to be used as described here. Phoenix Contact accepts no liability if the device is used for anything other than its designated use. Any use other than the designated use may lead to malfunction or irreversible damage of the device.

The IP20 degree of protection (IEC 60529/ EN 60529) of the device is intended for use in a clean and dry environment. Install the module in a housing with at least IP54 degree of protection in accordance with EN 60529. The stated limits concerning mechanical or thermal loads on the module must not be exceeded.

Cover termination area after installation in order to avoid accidental contact with live parts (e. g., installation in control cabinet).

6 Function description

The Rogowski coil is used to measure alternating currents.

6.1 Structure

The conductor is configured as a toroidal core coil.

A toroidal core coil does not have a magnetic core, which is why it is referred to as an air coil.

The air coil has a low inductive resistance, enabling fast current pulses to be detected.

The air coil offers the following advantages.

- No magnetic saturation
- High linearity, even at high currents
- Good response to rapid current changes
- Protected against electromagnetic interference
- The current can rise up to the short-circuit current without damaging the coil.

6.2 Method of operation

The measuring coil is not a closed ring, it can be released and opened at the housing lock.

A voltage is induced in the Rogowski coil which is proportional to the current level.

The output signal of the Rogowski coil is 100 mV AC per 1,000 A AC.

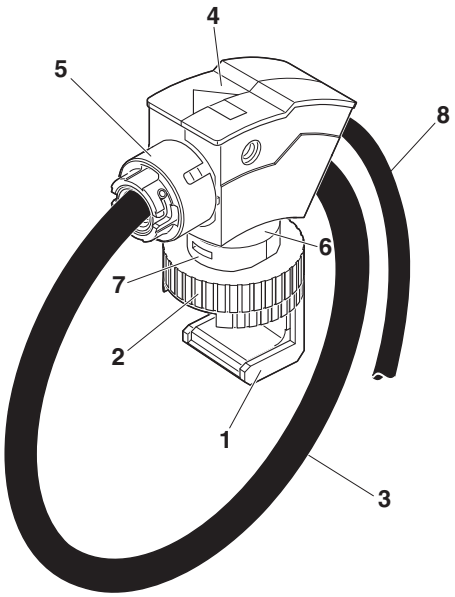
The output signal (mV) is converted using a measuring transducer and output as an alternating current on the output side.

The maximum value is 1 A AC.

7 Operating and indication elements

7.1 Rogowski coil

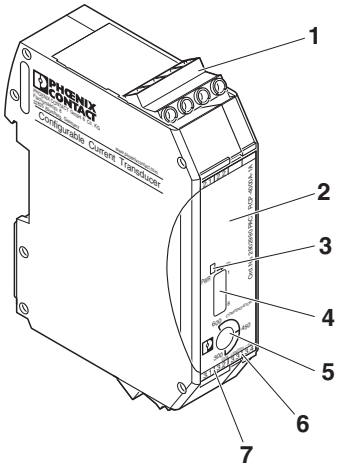
Bild 1 Rogowski coil



1 Holder
2 Thumbwheel of holding device
3 Measuring coil
4 Housing
5 Bayonet locking
6 Flange of coil housing
7 Guide ribs of holding device (inside)
8 Signal line

7.2 Measuring transducers

Bild 2 Measuring transducer



1 Supply voltage (2.1: +24 V, 2.2: GND1)
2 Transparent cover
3 Green “PWR” LED, power supply
4 DIP switches S1 ... S8
5 Potentiometer
6 Output: 1 A (3.3: 1 A out, 3.4: 1 A in)
7 mV input signal (3.1: Coil Input (mV), 3.2 (GND2))

8 Installation

- Provide a switch/circuit breaker close to the device, which is labeled as the disconnecting device for this device.
- Provide for a overcurrent protection device (I ≤ 4 A) in the installation.
- Select a current measuring range by DIP switch before switching on the measuring transducer. If you operate the measuring transducer for a long time without setting a current measuring range, the device may be damaged.
- Avoid installing it in the immediate vicinity of devices that function on the basis of high-frequency AC signals, since these can influence the measurement results.
- Observe the maximum distance between the measuring transducer and a downstream device. For detailed information, please refer to the technical data under “Max. distances for copper cables at $P_{N\ max.}$”. The values specified there refer to the maximum distance taking into account the contact resistances of the terminal points, measuring devices, etc. This value is a total of approximately 0.5 Ω.
- Install the measuring transducers with a clearance of approximately 10 mm to each other. In order to achieve this clearance, we recommend the use of the end bracket for DIN rails: CLIPFIX 35 (Item No.: 3022 218).
- Connect only Phoenix Contact Rogowski coils PACT RCP-... to the measuring transducer, since these coils have the necessary insulation.
- Connect the measuring transducer only to SELV and PELV circuits.
- Make sure that no supply voltage is applied to the measuring transducer before connecting the measuring circuit.
- Make sure that GND1 and GND2 are not connected together, not even via ground potential (PE).
- Connect GND1 and the bare shield cable of the Rogowski coil to ground potential (PE). Connect only the white cable to GND2.
- If you use several devices in a measuring setup, do not make the connections of GND2 to ground potential (PE) together or individually and do not connect the mV inputs of the devices.
- After connecting the signal output, check the voltage drop with a constant output signal and make sure that the maximum load is not exceeded.
- During maintenance work, disconnect the device from all effective power sources.
- Before configuring settings using DIP switch, make sure the device has been de-energized.
- If the device is not used as described in the documentation, the intended protection can be negatively affected.

CAUTION: Damage due to incorrect connection

Open operation of the current output damages the measuring transducer. Before startup, make sure that either a device with a specific load is connected to terminals 3.3 and 3.4 or that the terminal blocks are short-circuited with a bridge.

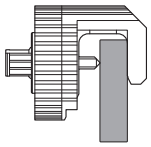
Before startup, make sure that the device is fully and correctly connected.

When energy is measured in a three-phase network, you must install the measuring coils around the current-carrying conductors so that the arrows on the housing point in the same direction. Otherwise, the total power calculation will not be correct (e.g. P1+P2-P3).

8.1 Installation on the power rail

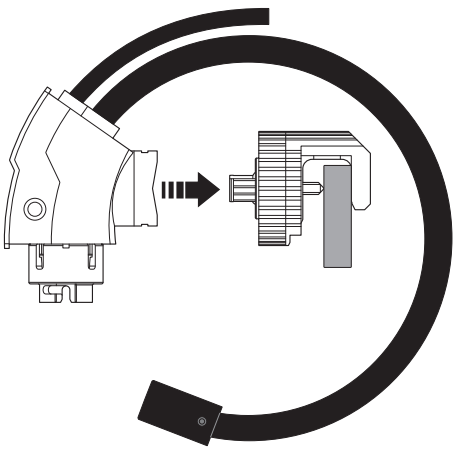
- Place the power rail holder onto the top edge of the power rail, making sure that it is straight.

Bild 3 Power rail bracket



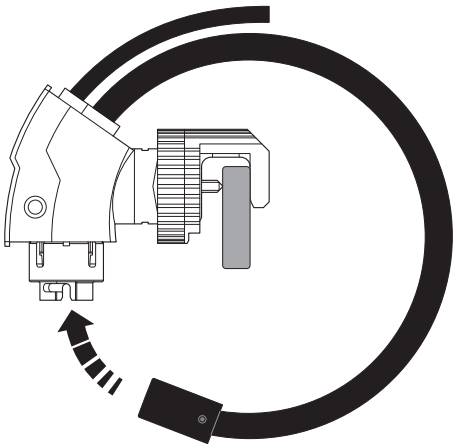
- Turn the thumbwheel to the right (hand-tight) and make sure that the holder is firmly attached to the power rail.
- Turn the bayonet locking of the Rogowski coil to the left (to release the measuring line).
- Pull the coil line out of the housing.
- Route the coil line around the power rail.
- Push the flange of the coil housing onto the two guide ribs of the thumbwheel until the limit stop is reached.

Bild 4 Mount housing



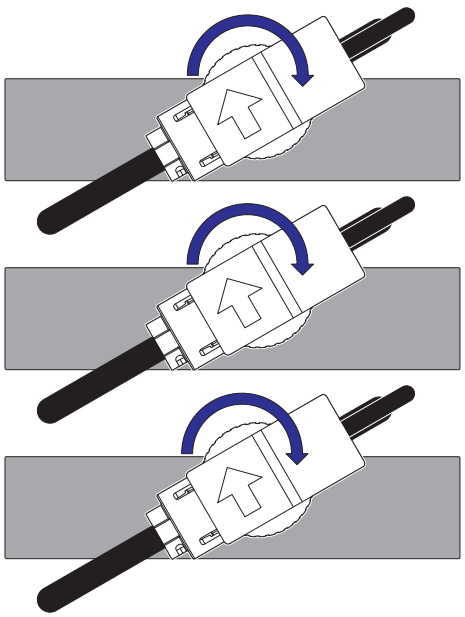
- Push the coil line into the housing.

Bild 5 Mount coil line



- Turn the bayonet locking to the right until you hear the measuring coil click into place.
- Make sure that the measuring coil does not touch the power rail to be measured or any neighboring power rail, since the maximum permitted temperature of the signal line is +80 °C.
- If necessary, turn the housing to the right in 15° steps (only turn it to the right or else the thumbwheel might become loose).

Bild 6 Turn the housing



- Connect the signal line of the Rogowski coil to the input terminals of the measuring transducer.
  Blue signal line: Terminal point 3.1
  White line: Terminal point 3.2
  Bare shield cable: Ground potential (PE)

Bild 7 Connect signal line

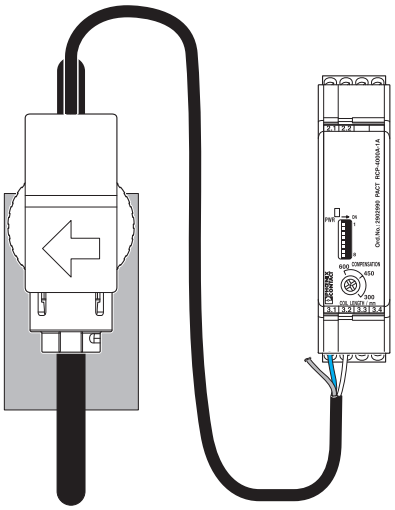
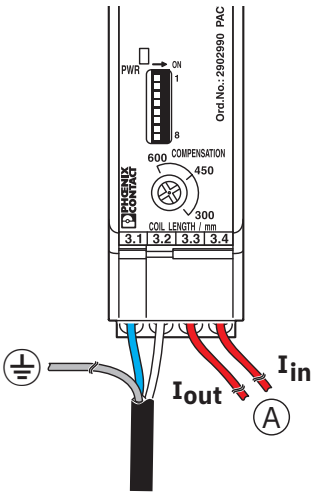


Bild 8 Connect signal line

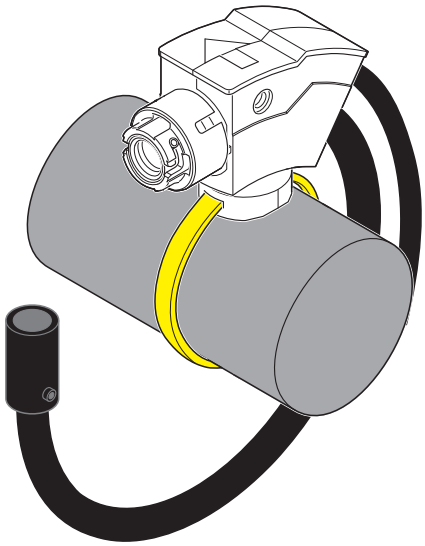


- Connect the output current from terminal point 3.3 (1A out) to terminal point S1 of the energy measuring device and terminal point 3.4 (1A in) to terminal point S2.
- Make sure that the signal line does not touch any of the power rails, since the maximum permitted temperature of the signal line is +80 °C.

8.2 Installation on a round conductor

- Turn the bayonet locking of the Rogowski coil to the left (to release the measuring line).
- Pull the coil line out of the housing.
- Route the coil line around the current line.
- Push the coil line into the housing.
- Turn the bayonet locking to the right until you hear the measuring coil click into place.
- Place the coil housing on the current line with the flange at a right angle.
- Guide a cable binder around the round conductor and pull it through the recess in the flange.

Bild 9 Circular conductor



8.3 Power supply

Supply the measuring transducer with 24 V DC.

24 V DC: Terminal point 2.1

GND 1: Terminal point 2.2

9 Current measuring ranges

For measuring current, you must put the DIP switches of the measuring range selected in the "ON" position.

Measuring range	DIP switch
100 A	8
250 A	7
400 A	6
630 A	5
1000 A	4
1500 A	3
2000 A	2
4000 A	1

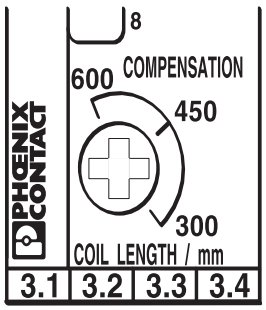
10 Measuring coil length compensation

There are three measuring coils with different lengths that you can choose for current measurements in accordance with the dimensions of the current-carrying conductor.

The different lengths of the measuring coil have an effect for which you can compensate using a potentiometer on the front of the measuring transducer.

For optimum operations, set the value of the used coil length on the potentiometer.

Bild 10 Potentiometer



11 Recommendations for the use of coil lengths and power rails

Power rail [mm x mm]	Diameter/coil length [mm]	1 power rail per phase	2 power rails per phase	3 power rails per phase
30 x 10	95/300	X	X	-
40 x 10	95/300	X	X	-
40 x 10	140/450	-	-	X
50 x 10	95/300	X	-	-
50 x 10	140/450	-	X	X
60 x 10	95/300	X	-	-
60 x 10	140/450	-	X	X
80 x 10	140/450	X	X	X
100 x 10	140/450	X	X	-
100 x 10	190/600	-	-	X
120 x 10	140/450	X	-	-
120 x 10	190/600	-	X	X
160 x 10	190/600	X	X	X

12 Service and maintenance

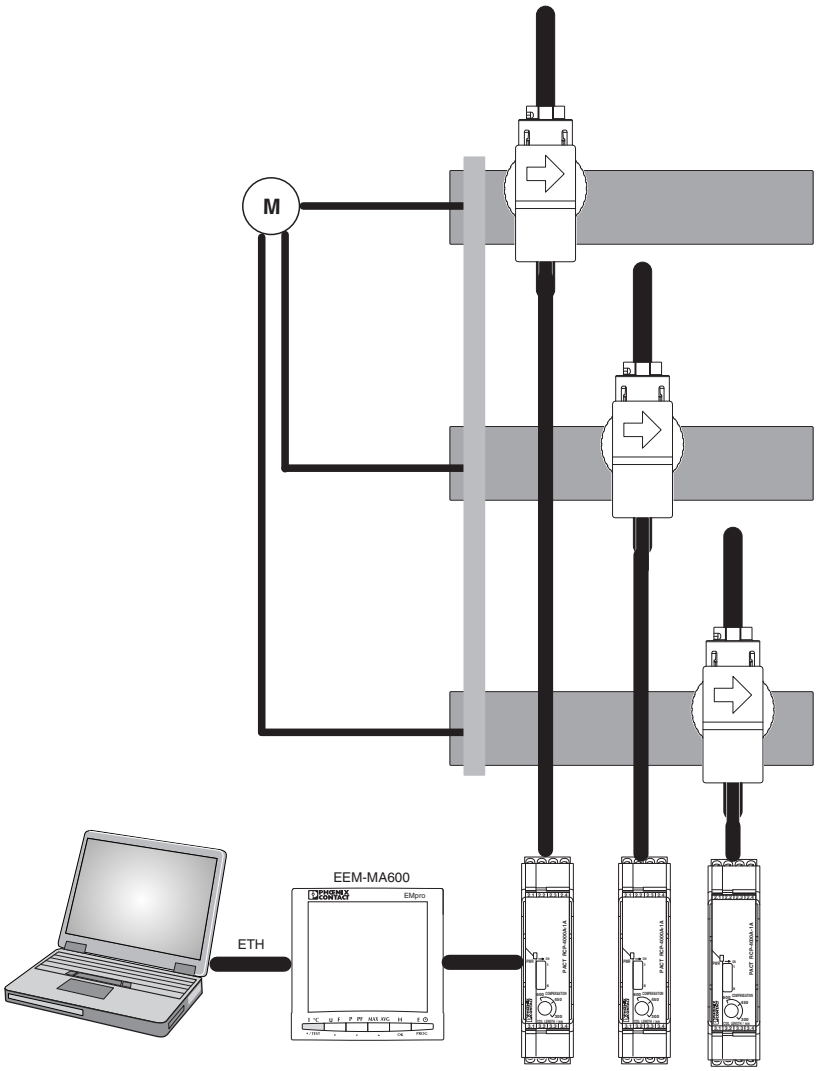
- Keep the device clean and free of contamination.
- Clean the device with water or a neutral cleaning agent using a soft, moist cloth. Avoid corrosive chemical products, solvents, and aggressive cleaning agents.
- Ensure that the device is dry before further use.
- Do not use the device in dirty or dusty locations.

13 Application examples

13.1 Energy measurement with measuring transducer

You can connect the 1 A alternating current of the measuring transducer directly to an energy measuring device from the EMpro product family.

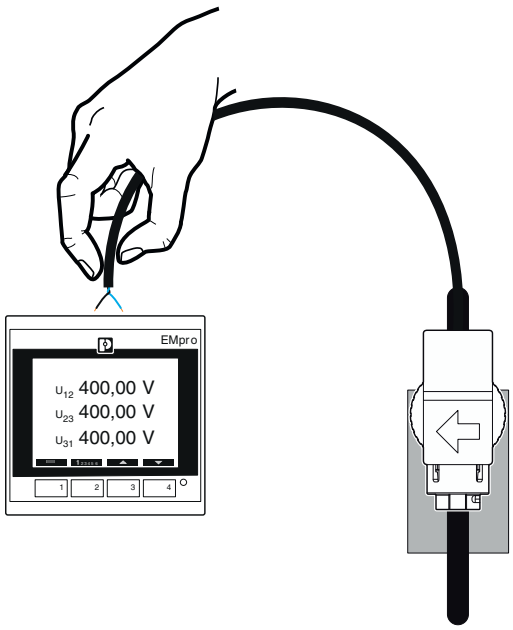
Bild 11 Example application



13.2 Energy measurement without measuring transducer

You can connect the AC mV signal of the Rogowski coil directly to an energy measuring device from the EMpro product family.

Bild 12 Energy measurement without measuring transducer



The following Rogowski coils are available.

Order designation	Item No.
PACT RCP-D95	2904890
PACT RCP-D140	2904891
PACT RCP-D190	2904892
PACT RCP-D95-5M	2910322
PACT RCP-D95-10M	2910323
PACT RCP-D190-10M	2910324
PACT RCP-D140-10M	1033482

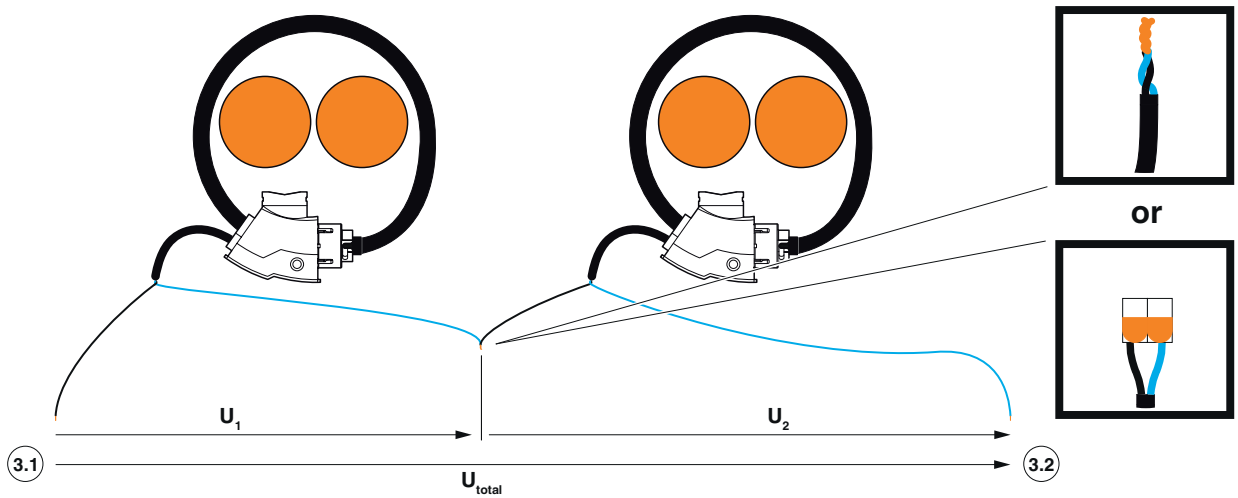
13.3 Energy measurement in series connection

If several electrical conductors belong to one phase, one Rogowski coil may be too short to enclose all conductors.

In this case, you can connect the signal lines (mV) of two Rogowski coils in series.

The total voltage represents the total current (100 mV AC equates to 1,000 A AC).

Bild 13 Series connection



13.4 Energy measurement in outdoor applications

The following UV-resistant items are available for use in outdoor applications.

Order designation	Item No.
PACT RCP-4000A-1A-D190-3M-UV	1033485
PACT RCP-4000A-1A-D140-3M-UV	1058044