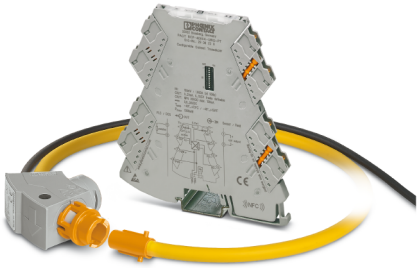
COMPLETE line

PACT RCP-4000A-UIRO-xx-Dxxx

Configurable current transformer for retrofitting



Data sheet
106844_en_03

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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.

With the freely-adjustable measuring transducer, you can choose between eight current measurement ranges from 100 A AC to 4000 A AC. You can specify the current measurement ranges using DIP switches or software.

Signals between 0 mA ... 21 mA and 0 V ... 10.5 V are possible on the output side.

It is possible to measure current without disconnecting the conductors using integrated test disconnect terminals.

The device offers the "fault-monitoring" function, which detects both module or power supply failures and errors in the module's signal input.

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

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
- Rated insulation voltage: 1000 V AC (rms CAT III), 600 V AC (rms CAT IV)

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

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

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3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Set consisting of a 4-way signal conditioner with screw connection technology and a Rogowski coil 300 mm in length/95 mm in diameter for AC current measurement on busbars and power lines. The signal conditioner outputs 8 different standard signals on the output side and has one switching output.	PACT RCP-4000A-UIRO-D95	2906231	1
Set consisting of a 4-way signal conditioner with screw connection technology and a Rogowski coil 450 mm in length/140 mm in diameter for AC current measurement on busbars and power lines. The signal conditioner outputs 8 different standard signals on the output side and has one switching output.	PACT RCP-4000A-UIRO-D140	2906232	1
Set consisting of a 4-way signal conditioner with screw connection technology and a Rogowski coil 600 mm in length/190 mm in diameter for AC current measurement on busbars and power lines. The signal conditioner outputs 8 different standard signals on the output side and has one switching output.	PACT RCP-4000A-UIRO-D190	2906233	1
Set consisting of a 4-way signal conditioner with push-in connection technology and a Rogowski coil 300 mm in length/95 mm in diameter for AC current measurement on busbars and power lines. The signal conditioner outputs 8 different standard signals on the output side and has one switching output.	PACT RCP-4000A-UIRO-PT-D95	2906234	1
Set consisting of a 4-way signal conditioner with push-in connection technology and a Rogowski coil 450 mm in length/140 mm in diameter for AC current measurement on busbars and power lines. The signal conditioner outputs 8 different standard signals on the output side and has one switching output.	PACT RCP-4000A-UIRO-PT-D140	2906235	1
Set consisting of a 4-way signal conditioner with push-in connection technology and a Rogowski coil 600 mm in length/190 mm in diameter for AC current measurement on busbars and power lines. The signal conditioner outputs 8 different standard signals on the output side and has one switching output.	PACT RCP-4000A-UIRO-PT-D190	2906236	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 , 3 m , 3 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	II
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 / 1 min.)
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
Signal input Measuring transducers	
Input signal (at 50 Hz)	100 mV (1000 A)
Curve type	Sine
Input impedance	> 100 kΩ
Signal output Measuring transducer	
Output signal	0 mA ... 20 mA (via DIP switch) 4 mA ... 20 mA (via DIP switch) 0 mA ... 10 mA (via DIP switch) 2 mA ... 10 mA (via DIP switch) 0 mA ... 21 mA (can be set via software) 0 V ... 10 V (via DIP switch) 2 V ... 10 V (via DIP switch) 0 V ... 5 V (via DIP switch) 1 V ... 5 V (via DIP switch) 0 V ... 10.5 V (can be set via software)
Maximum output signal	24.6 mA ≈ 12.3 V
Load/output load	≤ 600 Ω (20 mA) ≥ 10 kΩ
Ripple	< 20 mV_{PP}

Miscellaneous data for measuring transducer	
Nominal supply voltage	24 V DC
Nominal supply voltage range	9.6 V DC ... 30 V DC
Supply voltage range	9.6 V DC ... 30 V DC
Protective circuit	Surge protection (33 V suppressor diode)
Typical current consumption	32 mA (at 24 V DC) 64 mA (at 12 V DC)
Power consumption	≤ 1 W (at I_{OUT} = 20 mA, 9.6 V DC, 600 Ω load)
Maximum transmission error	≤ 0.5 % (From the range end value)
Temperature coefficients	≤ 0.015 %/K
Frequency range	16 Hz ... 1000 Hz
Step response (0–99%)	110 ms
Housing material	PBT
Degree of protection	IP20
Test voltage, input/output/supply	3 kV (50 Hz, 1 min.)
Electrical isolation	Reinforced insulation in accordance with IEC 61010-1
Dimensions W/H/D	6.2 mm / 110.5 mm / 120.5 mm
Ambient temperature range Operation	-40 °C ... 70 °C
Ambient temperature range Storage/transport	-40 °C ... 85 °C
Altitude	< 2000 m
Humidity non-condensing	5 % ... 95 %
System data (coil and measuring transducer)	
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 When being exposed to interference, there may be minimal deviations.	EN 61000-6-2

5 Safety regulations and installation notes

- 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.
- While the devices are in operation, contact-dangerous voltages may be present on the control elements. For this reason parameterization, conductor connection, and opening of the module lid are allowed only when devices are in a de-energized state unless the connected circuits are exclusively SELV or PELV circuits.
- 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.
- The IP20 degree of protection (IEC/EN 60529) specifies that the device is intended for use in a clean and dry environment. Do not subject the device to mechanical and/or thermal stress that exceeds the specified limits.
- The device complies with the EMC regulations for industrial areas (EMC class A). When using the device in residential areas, it may cause radio interference.
- If the device is not used as described in the documentation, the intended protection can be negatively affected.
- To protect the device against mechanical or electrical damage, install it in suitable housing with an appropriate degree of protection according to IEC/EN 60529.
- 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 ($I \leq 4$ A) in the installation.
- Thanks to its housing, the device has basic insulation to the neighboring devices, for 150 Veff. If several devices are installed next to each other, this has to be taken into account, and additional insulation has to be installed if necessary!
- The voltages present at the input, output and supply are extra-low voltages (ELV). Depending on the application, dangerous voltage (> 30 V) against ground could occur. For this event, safe electrical isolation from the other connections has been implemented.
- The device must be stopped if it is damaged, has been subjected to an impermissible load, stored incorrectly, or if it malfunctions.
- Only use copper conductors providing the permitted temperature range (60 °C / 75 °C) as connecting cables.
- Disregarding these safety regulations may result in death, serious personal injury or damage to equipment.
- Only use accessories that meet the specifications of the device manufacturer (e.g. combination of measuring coil and measuring transducer).
- Connect only Phoenix Contact Rogowski coils PACT RCP-... to the measuring transducer, since these coils have the necessary insulation.
- 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.
- 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.



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.

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.

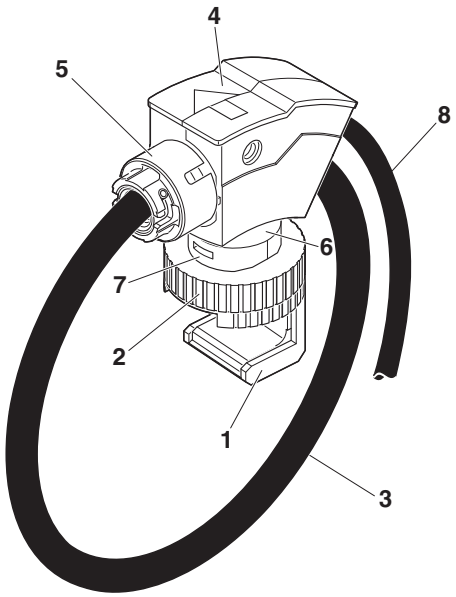
The output signal of the Rogowski coil is 100 mV AC per 1,000 A AC.

The output signal (mV) is converted using a measuring transducer and output in the form of eight different standard signals on the output side.

7 Operating and indication elements

7.1 Rogowski coil

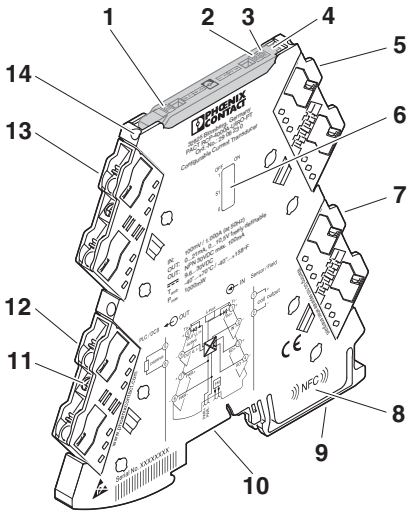
Figure 1 Rogowski coil



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

Figure 2 Measuring transducer



1 DO switch contact yellow LED
2 Error indicator "ERR" red LED
3 Green “PWR” LED, power supply
4 Cover with labeling option
5 mV input signal
6 DIP switch S1
7 Output: Switch contact
8 NFC coil
9 Universal snap-on foot for EN DIN rails
10 Connection for DIN rail connector
11 Spindle screw
12 Supply voltage
13 Output: Standard and normalized signals
14 Current measuring socket

8 Measuring coil installation

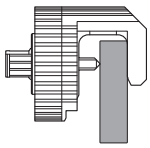
CAUTION: Risk of injury

Connecting and disconnecting the measurement circuit to/from the measuring transducer is only allowed when the conductor is switched off.

8.1 Installation on the power rail

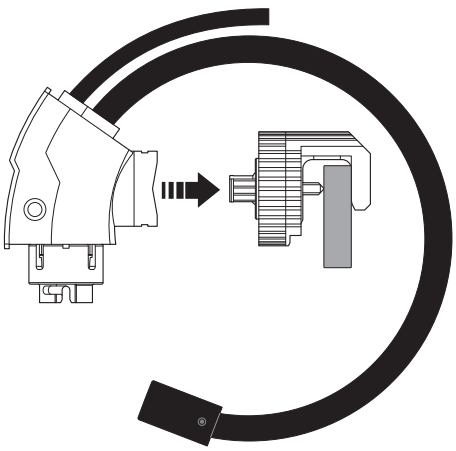
- Place the power rail holder onto the top edge of the power rail, making sure that it is straight.

Figure 3 Power rail bracket



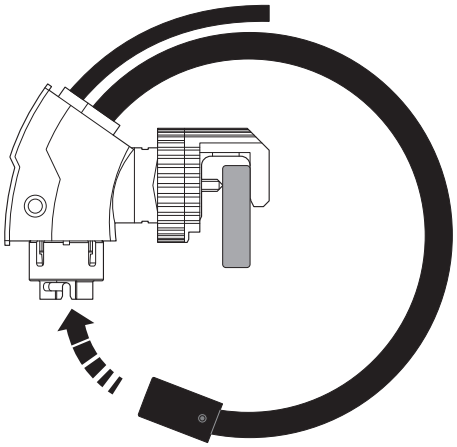
- Turn the thumbwheel to the right (hand-tight) and make sure that the holder is firmly attached to the power rail.
- Turn the bayonet locking of the Rogowski coil to the left (to release the measuring line).
- Pull the coil line out of the housing.
- Route the coil line around the power rail.
- Push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

Figure 4 Mount housing



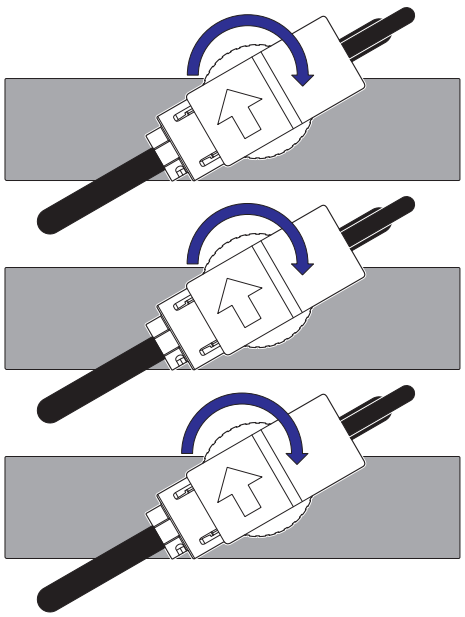
- Push the coil line into the housing.

Figure 5 Mount coil line



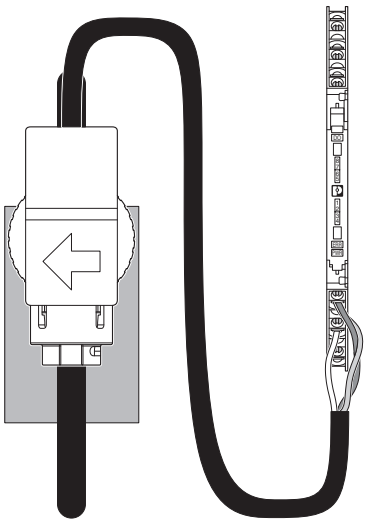
- Turn the bayonet locking to the right until you hear the measuring coil click into place.
- Make sure that the measuring coil does not touch the power rail to be measured or any neighboring power rail, since the maximum permitted temperature of the signal line is +80 °C.
- If necessary, turn the housing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

Figure 6 Turn the housing



- Connect the signal line of the Rogowski coil to the input terminals of the measuring transducer.
  Blue signal line and naked shielded cable: terminal point 1
  White line: terminal point 2

Figure 7 Connect signal line

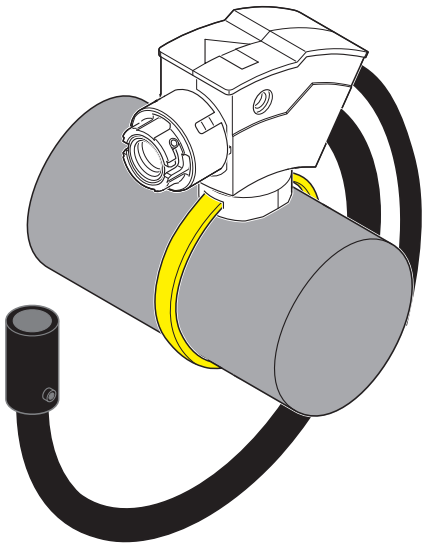


- Make sure that the signal line does not touch any of the power rails, since the maximum permitted temperature of the signal line is +80 °C.

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.

Figure 8 Circular conductor



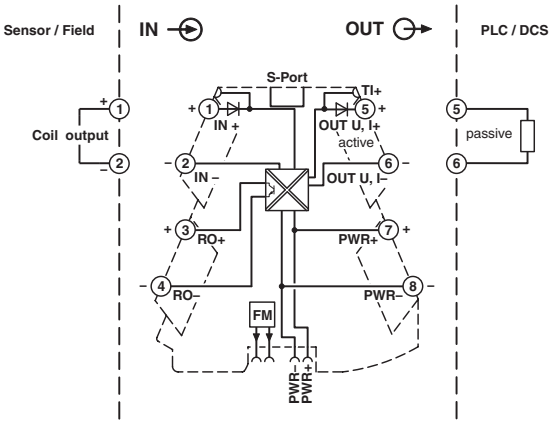
9 Measuring transducer installation

9.1 Connection notes

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and IEC 61340-5-1.

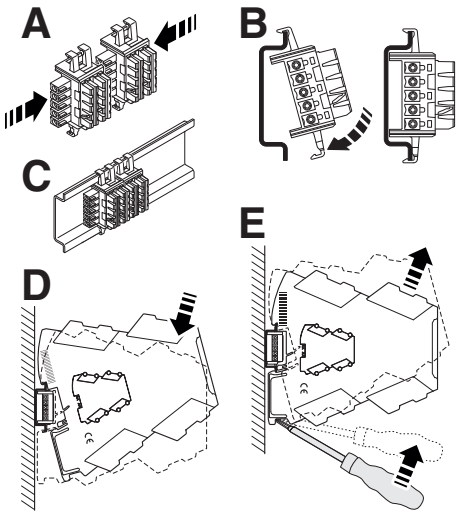
9.2 Block diagram

Figure 9 Block diagram



9.3 Mounting

Figure 10 Mounting and removing



– Mount the module on a 35 mm DIN rail according to EN 60715.
– When using the DIN rail connector, first place it into the DIN rail (see A – C). It is used to bridge the power supply. It is also absolutely vital that you snap the module and the DIN rail connector into position in the correct direction: the snap-on foot should be at the bottom and the connector on the left.

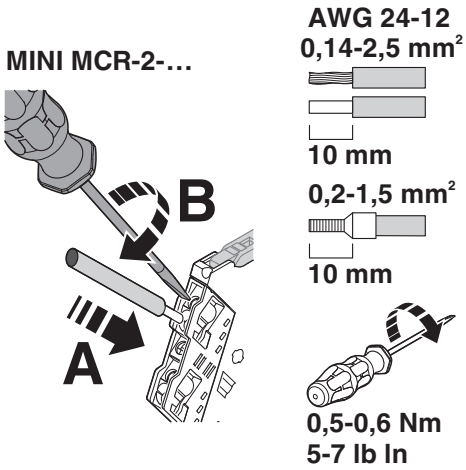
9.4 FASTCON Pro plugs

The device has FASTCON Pro plug-in connection terminal blocks with an integrated test disconnect terminal block, which you can plug or unplug directly and without tools.

The spindle screw will turn by itself when the FASTCON Pro plugs are connected. There is no need for you to fix the spindle screw in place as well.

Screw connection:

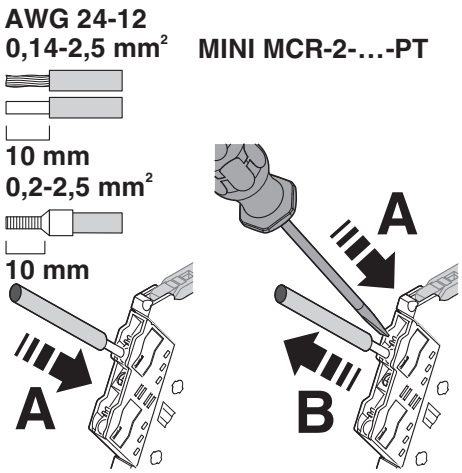
Figure 11 Screw connection



- Strip the wire by approximately 10 mm and crimp ferrules to the end of the wire.
- Insert the wire into the corresponding connection terminal block.
- Use a screwdriver to tighten the screw in the opening above the connection terminal block.

Push-in connection:

Figure 12 Push-in connection



If you want to use conductors with ferrule:

- Strip the wire by approximately 10 mm and crimp ferrules to the end of the wire.
- Insert the wire into the corresponding connection terminal block.
- Push in the pushbutton with a screwdriver to release.

If you want to use conductors without ferrule:

- Push the pushbutton in with a screwdriver.
- Insert the wire into the corresponding connection terminal block.
- Push in the pushbutton with a screwdriver to release.

9.5 Power supply

NOTE

Never connect the supply voltage directly to the DIN rail connector. Drawing power from individual devices is not permitted!.

Where the total current consumption of the aligned modules does not exceed 400 mA, the power can be supplied directly at the connection terminal blocks of the module.

We recommend connecting a 630 mA fuse (normal-blow or slow-blow) upstream.

10 Diagnostics and status indicators

Name	Color/status	Description
PWR	Green	Supply voltage
	Lit	Supply voltage present
ERR	Red	Fault display or simulation mode
	Flashing fast (2.8 Hz)	Sensor fault or invalid DIP switch configuration
	Flashing slowly (1.4 Hz)	Simulation mode
	Lit	Internal device error
DO	Yellow	Switch contact
	Lit	Switch contact activated

11 Configuration

The device is supplied with the following standard configuration:

Mean-value generation off; current measuring range: 0 ... 100 A; length of the measuring coil: 300 mm; signal output: 4 ... 20 mA; no output limitation; error evaluation as per NE43 (downscale); fault monitoring contact reacts for all faults; configurable via software.

Depending on the dimensions of the power rail, you can choose between three different measuring coil lengths: 300 mm, 450 mm, or 600 mm.

If you have activated mean-value generation via DIP switch S1, location 1, the output value is averaged over the 10 most recent measurement values.

11.1 Configuration via DIP switches

At delivery, all DIP switches are in the "OFF" position.

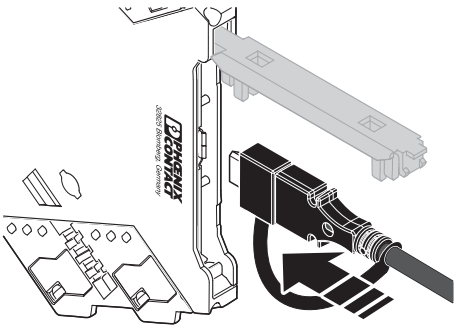
Configure the DIP switches according to the planned application using the configuration tables.

		DIP S1									
		1	2	3	4	5	6	7	8	9	0
Default											
DIP switch configuration off		-	-	-	-	-	-	-	-	-	
DIP switch configuration on		-	-	-	-	-	-	-	-	-	ON
Mean-value generation	1 value		-	-	-	-	-	-	-	-	ON
Mean-value generation	10 values	ON	-	-	-	-	-	-	-	-	ON
Input signal	0 ... 100 A	-				-	-	-	-	-	ON
	0 ... 250 A	-	ON			-	-	-	-	-	ON
	0 ... 400 A	-		ON		-	-	-	-	-	ON
	0 ... 630 A	-	ON	ON		-	-	-	-	-	ON
	0 ... 1000 A	-			ON	-	-	-	-	-	ON
	0 ... 1500 A	-	ON		ON	-	-	-	-	-	ON
	0 ... 2000 A	-		ON	ON	-	-	-	-	-	ON
	0 ... 4000 A	-	ON	ON	ON	-	-	-	-	-	ON
Coil length	300 mm	-	-	-	-			-	-	-	ON
	450 mm	-	-	-	-		ON	-	-	-	ON
	600 mm	-	-	-	-	ON		-	-	-	ON
Output signal	0 mA ... 20 mA	-	-	-	-	-	-				ON
	4 ... 20 mA	-	-	-	-	-	-	ON			ON
	0 ... 10 mA	-	-	-	-	-	-		ON		ON
	2 ... 10 mA	-	-	-	-	-	-	ON	ON		ON
	0 ... 10 V	-	-	-	-	-	-			ON	ON
	2 ... 10 V	-	-	-	-	-	-	ON		ON	ON
	0 ... 5 V	-	-	-	-	-	-		ON	ON	ON
	1 ... 5 V	-	-	-	-	-	-	ON	ON	ON	ON

11.2 Configuration via software

Use the IFS-USB-PROG-ADAPTER (Item No. 2811271), TWN4 MIFARE NFC USB ADAPTER (Item No. 2909681) or IFS-BT-PROG-ADAPTER (Item No. 2905872) programming adapter to connect the device and PC.

Figure 13 Programming connection



In addition to DIP switch settings, software configuration offers enhanced setting options and a monitoring function for maintenance purposes.

The following free software solutions are available for you to download from the Internet.

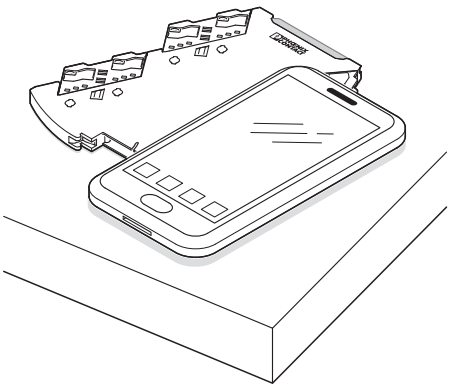
– ANALOG-CONF standard software
– FDT/DTM solutions: FDT frame application and DTM packages

11.3 Configuration via MINI Analog Pro app

In addition to DIP switch settings, app configuration offers enhanced setting options.

Using the MINI Analog Pro Smartphone app via the NFC interface of your Smartphone you can configure the module without an additional programming adapter or cables.

Figure 14 Configuration



12 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 coils cause an effect for which you can compensate with DIP switch S1, location 5/6.

For optimum operation, set the value of the coil length used via the DIP switch.

13 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

14 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.

15 Application example

The output signals of the measuring transducers (e.g., 4 ... 20 mA) are transmitted to a controller for further processing.

