Device handbook

SMART GRID BOX

Operating instructions SMART GRID BOX (2024-08)

GMC INSTRUMENTS

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Legal information

Warning notices

In this document warning notices are used, which you have to observe to ensure personal safety and to prevent damage to property. Depending on the degree of danger the following symbols are used:

If the warning notice is not followed death or severe personal injury **will** result.

If the warning notice is not followed damage to property or severe personal injury **may** result.

If the warning notice is not followed the device **may** be damaged or **may** not fulfill the expected functionality.

Qualified personnel

The product described in this document may be handled by personnel only, which is qualified for the respective task. Qualified personnel have the training and experience to identify risks and potential hazards when working with the product. Qualified personnel are also able to understand and follow the given safety and warning notices.

Intended use

The product described in this document may be used only for the application specified. The maximum electrical supply data and ambient conditions specified in the technical data section must be adhered. For the perfect and safe operation of the device proper transport and storage as well as professional assembly, installation, handling and maintenance are required.

Disclaimer of liability

The content of this document has been reviewed to ensure correctness. Nevertheless, it may contain errors or inconsistencies and we cannot guarantee completeness and correctness. This is especially true for different language versions of this document. This document is regularly reviewed and updated. Necessary corrections will be included in subsequent version and are available via our webpage http://www.camillebauer.com.

Feedback

If you detect errors in this document or if there is necessary information missing, please inform us via e-mail to: customer-support@camillebauer.com

Contents

1 Purpose of this document

This document describes the universal power quality analysis device SMART GRID BOX. It is intended to be used by:

- Installation personnel and commissioning engineers
- Service and maintenance personnel
- Planners

Scope

This handbook is valid for all hardware versions of the SMART GRID BOX. Some of the functions described in this document are available only, if the necessary optional components are included in the device. Further information about the used base units is provided via the documents shown in annex B.

Required knowledge

A general knowledge in the field of electrical engineering is required. For assembly and installation of the device knowledge of applicable national safety regulations and installation standard is required.

2 Device overview

By means of the measurement solution SMART GRID BOX the operational aspects of the distribution of electrical energy in low voltage systems can be monitored and, if applicable, controlled.

- Present system state
- Energy flow
- Quality and availability of supply
- Impact of changes or mitigation measures in the network

The device is available in different variants. The nameplate on the device gives information about the present version.

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SMART GRID BOX
SMARTGRID-BOX-4111 3021 40
Ord: 040/510466/010/001
Man: 24 / 5

UPS: Li-Po Battery 4.5Wh

01. Main Device	4) CENTRAX CU5000
02. Main Device Disp.	1) with TFT
03. Main Device UPS	1) with
04. Current Inputs	1) flex. Probes tight
05. Add. Curr. Meas.	3) Central Unit PME
06. Volt. Quick Conn.	0) without
07. Gateway	2) Teltonika RUT241
08. Antenna	1) integrated
09. Mains Supply	4) Aux L1-N-PE, SPD
10. Ethernet Socket	0) without

SMART GRID BOX with connected Rogowski coils and Quick-Connect voltage taps

3 Safety notes

Device may only be disposed in a professional manner!

The installation and commissioning should only be carried out by trained personnel.

Check the following points before commissioning:

– that the maximum values for all the connections are not exceeded, see "Technical data" section,

– that the connection wires are not damaged, and that they are not live during wiring,

– that the power flow direction and the phase rotation are correct.

The instrument must be taken out of service if safe operation is no longer possible (e.g. visible damage). In this case, all the connections must be switched off. The defective component must be returned to the factory or to an authorized service dealer.

The SMART GRID BOX does not have its own power switch.

The voltage measurement inputs L1, L2 and L3 must originate at circuit breakers or fuses rated 5 Amps or less. You have to provide a method for manually removing power from the device, such as a clearly labeled circuit breaker or a fused disconnect switch in accordance with IEC 60947-2 or IEC 60947-3.

It is forbidden to open the housing of installed devices..

Unauthorized repair or alteration of the unit invalidates the warranty.

4 Electrical connections

Ensure under all circumstances that all leads are free of potential when connecting them or in case of manipulating inside the device!

4.1 General safety notes

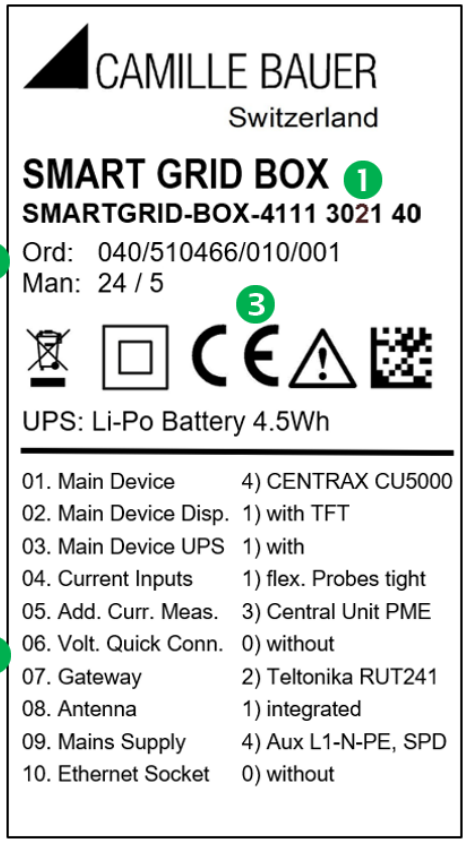
Please observe that the data on the type plate must be adhered to!

The national provisions have to be observed in the installation and material selection of electric lines, e.g. in Germany VDE 0100 “Erection of power installations with nominal voltages up to 1000 V“!

4.2 Nameplate, connection plate

Nameplate

The nameplate on the device provides information about the current variant.



1 Order code

The meaning of the 10-digit order code is explained in plain text under point 4

2 Order number and manufacturing date

Ord: Order number
Man: 24/01 (Manufacturing date YY/MM)

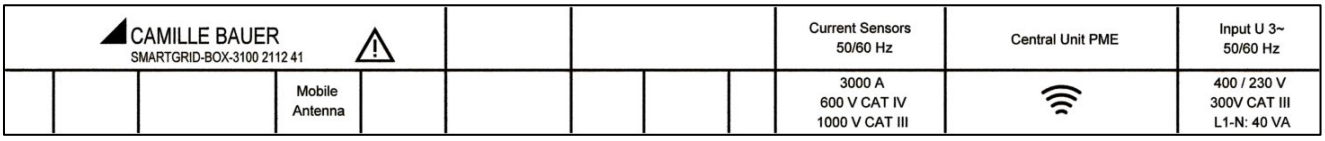
3 Test and conformity marks

Symbol	Meaning
	Device may only be disposed of in a professional manner!
	Double insulation, device of protection class 2
CE	CE conformity mark. The device fulfills the requirements of the applicable EU directives.
	Caution! General hazard point. Read the operating instructions.

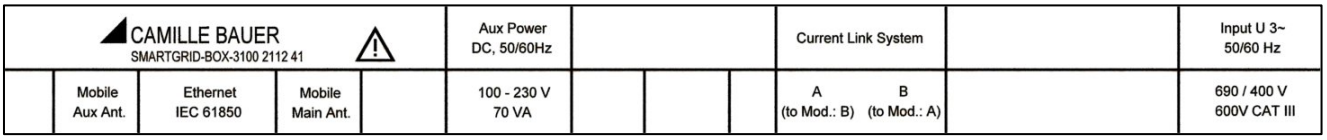
4 Breakdown of order coding

Connection plate

The connection plate on the device shows where the connections for the current device variant are located and which values must be considered when connecting.



Device with option PME



Device with option Current Link

Symbol	Meaning
	Caution! General hazard point. Read the operating instructions.
CAT III	Measurement category CAT III
CAT IV	Measurement category CAT IV

4.3 Power supply of the device

Depending on the variant, the device is either powered via the power supply connection or via the measuring connection terminals L1 and N, which are already pre-wired internally.

- Nominal range: 100 – 230 V AC
- Operating range: 85 – 265 V AC
- OVC III acc. EN 61558

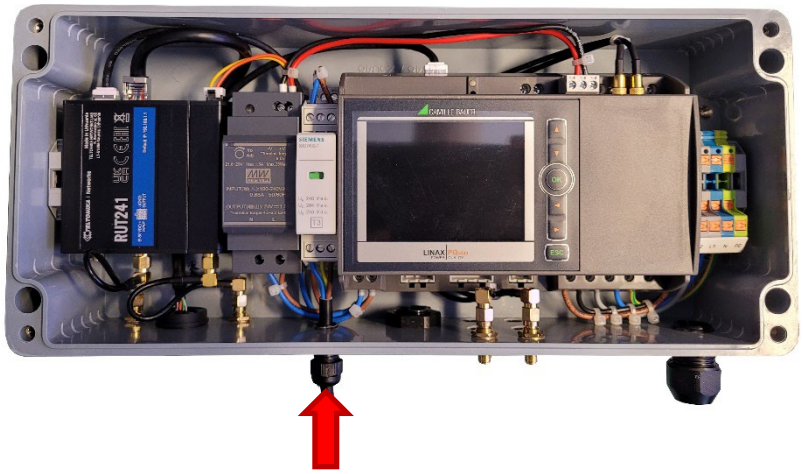
When powered via measuring input L1-N, the following restriction applies

- Voltage measuring input: Measuring range is limited to ≤ 265 V AC (CAT III 300 V)

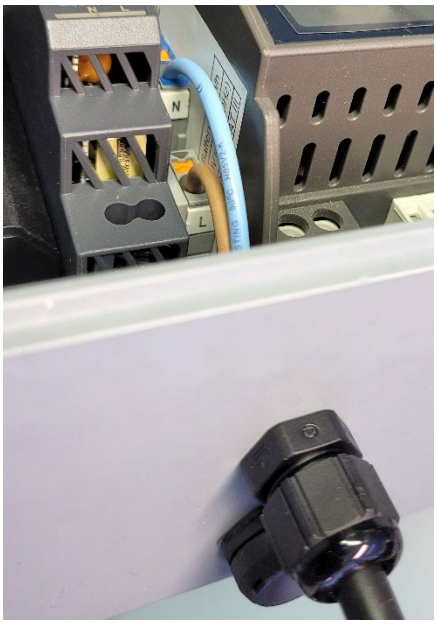
4.3.1 Power supply via measurement input L1-N

Measuring range is limited to ≤ 265 V AC (CAT III 300 V).

4.3.2 Power supply via separate connection



For device variants with separate power supply, the housing must be opened for connection by removing the 4 screws on the top of the housing. The diameter of the supply cable through the cable gland to the input terminals can be 3.5 up to 7 mm.



Device with gateway without surge protective device SPD

`SMARTGRID-BOX-xxxx xx1x 2x`

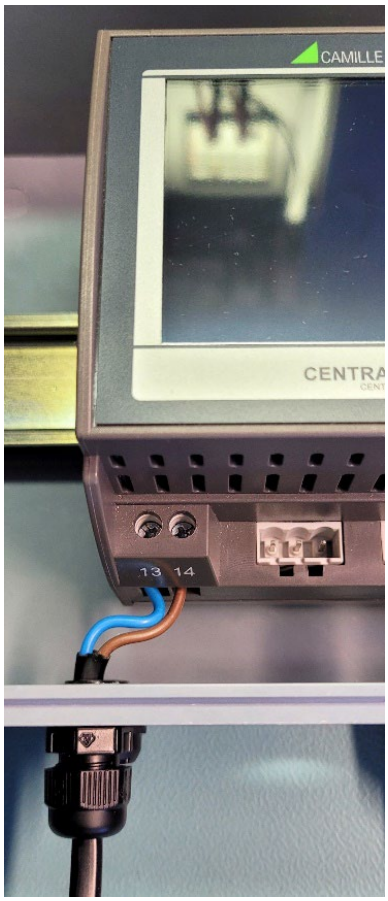
`SMARTGRID-BOX-xxxx xx2x 2x`

OR

Device with base unit PQ5000CL without mobile gateway

`SMARTGRID-BOX-3xxx xx0x 2x`

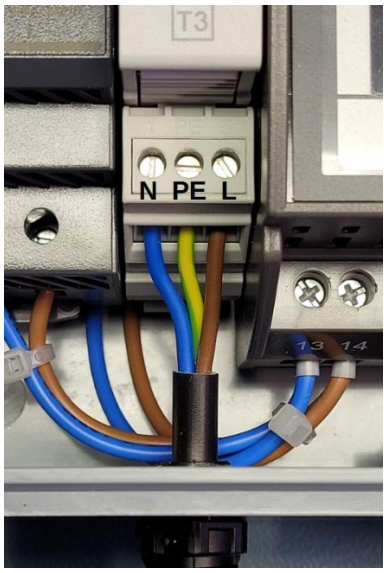
► Connection via 2-pole terminals N and L



Device with base unit DM5000 / PQ5000 / CU5000 without gateway

SMARTGRID-BOX-1xxx xx0x 2x
SMARTGRID-BOX-2xxx xx0x 2x
SMARTGRID-BOX-4xxx xx0x 2x

► Connection directly to base unit, terminals 13 and 14



Device with surge protective device SPD

SMARTGRID-BOX-xxxx xxxx 4x
SMARTGRID-BOX-xxxx xxxx 4x
SMARTGRID-BOX-xxxx xxxx 4x

► Connection directly to SPD terminals: 1 (N), PE, 5 (L)

PE must be connected in any case, otherwise the surge protection will not work.

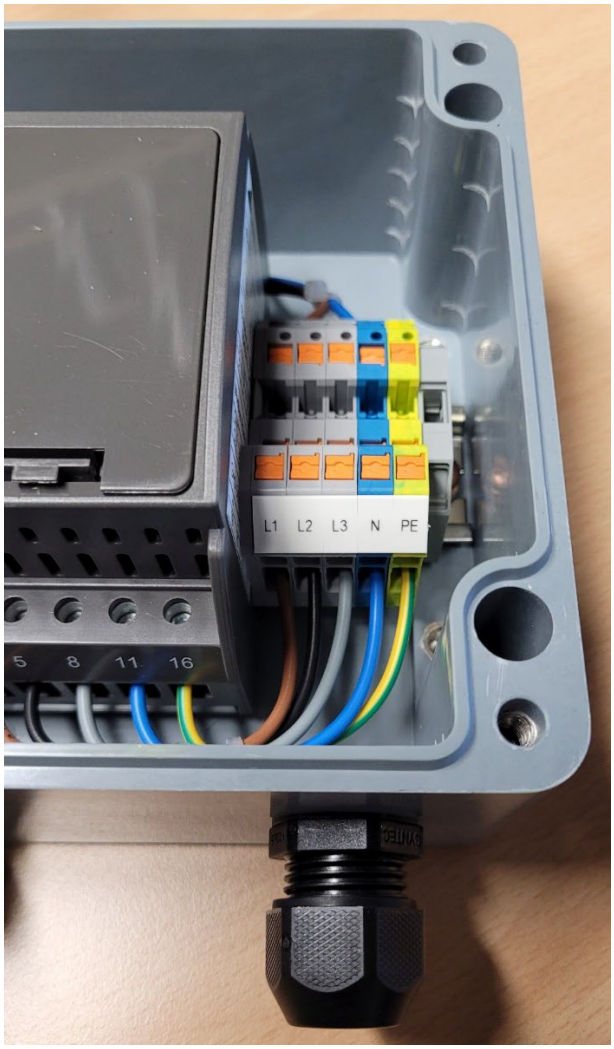
4.4 Voltage connection

Maximum permissible rated voltage 230 VAC to ground resp. 400 V Ph-Ph!

If there is only a PEN conductor present in the installation, i.e. PE and N are not routed separately, the PEN conductor must be connected to PE and N.

4.4.1 Voltage connection to input terminals

To connect the voltages in this device variant, the housing must be opened by removing the 4 screws on the top of the housing.



Connection

The connection is made to the push-in terminals L1, L2, L3, N and PE of the terminal block.

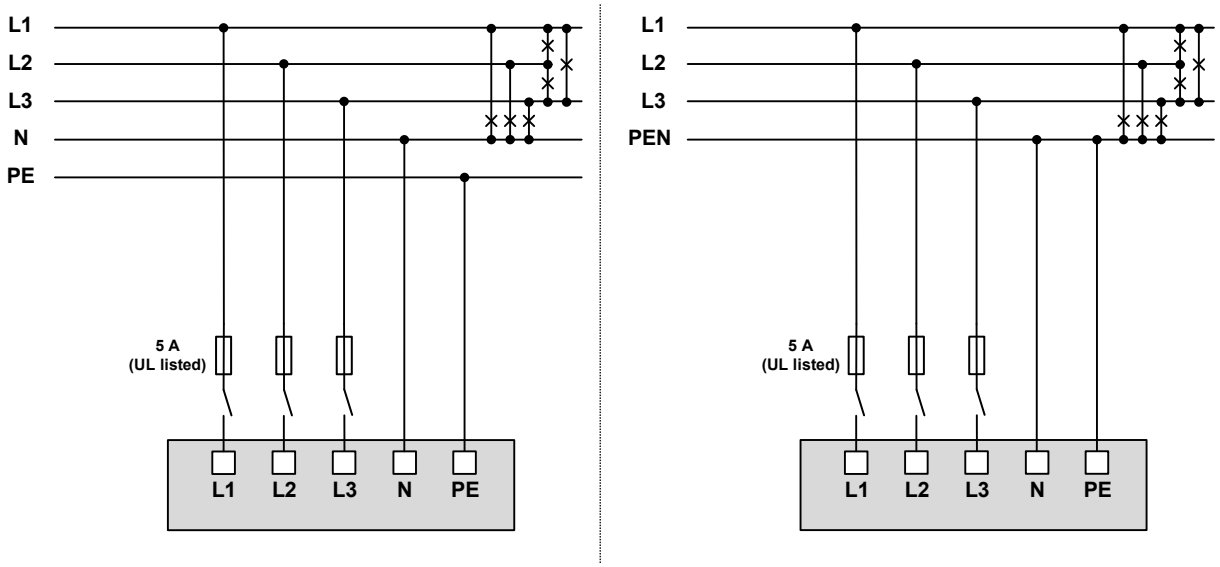
Cross sections 0.2 up to 6.0mm^2 (AWG 24...10)

Cable feedthrough

The diameter of the supply cable through the cable gland to the input terminals can be 8 up to 13 mm.

All **voltage measurement inputs** L1, L2 and L3 must originate at circuit breakers or fuses rated 5 Amps or less. If the device is powered via measurement input, fuses with a value of $I^2ts \geq 7.5\ A^2s$ must be used.

You have to provide a method for manually removing power from the device, such as a clearly labelled circuit breaker or a fused disconnect switch acc. IEC 60947-2 or IEC 60947-3.



4.4.2 Quick Connect voltage connection

For quick voltage connection pre-wired, fused measuring cables are available. The cable length is 3 m each.

SMART GRID BOX with fused voltage connections with 4-mm lamella plugs

Fuse

For security reasons leads for voltage measurement are equipped with the following fuse:

SIBA, type 7009463.3, 6.3 x 32mm, very fast acting
F 3A / 600V / 50kA @ AC 600 V

To replace the fuse the probe can be screwed on.
The fuse should only be replaced by a fuse of the same type..

Do not replace fuse again if failure is repeated. Repeated failure indicates a defective condition that will not clear with replacement of the fuse. Refer condition to a qualified technician.

4.5 Current connection with flexible AC current sensors ACF 3000

	Attention! Refer to Manual
	Double / Reinforced Insulation
	Do not apply around or remove from HAZARDOUS LIVE conductors without additional protective means. “Additional protective means” can be de-energizing the circuit or wearing protective clothing suitable for high voltage work.
	Do not dispose of this product as unsorted municipal waste. Contact a qualified recycler for disposal.
	Complies with the relevant European standards

To avoid electric shock

- Use caution during installation and use of this product. High voltages and currents may be present in circuit under test.
- This product must be used only by qualified personnel practicing applicable safety precautions.
- Do not install this product on live conductors.
- Always de-energize circuit under test before installing flexible measuring head. Always inspect connecting cable and flexible probe for damage before using this product.
- Do not use product if damaged.
- Always connect electronics unit to display device before installing the flexible measuring head.
- Always wear protective clothing and gloves if hazardous live parts are present in the installation where the measurement is carried out.
- If the probe is used in a manner not specified by the manufacturer the protection provided by the equipment may be impaired.

The ACF 3000 is a flexible AC current probe utilizes the Rogowski principle. After appropriate signal conditioning, it can be used with measurement devices to measure currents from very low frequencies up to 20kHz. The flexible and lightweight measuring head allows quick and easy installation in hard to reach areas and with large conductors. It can be used to measure AC current up to 3000A.

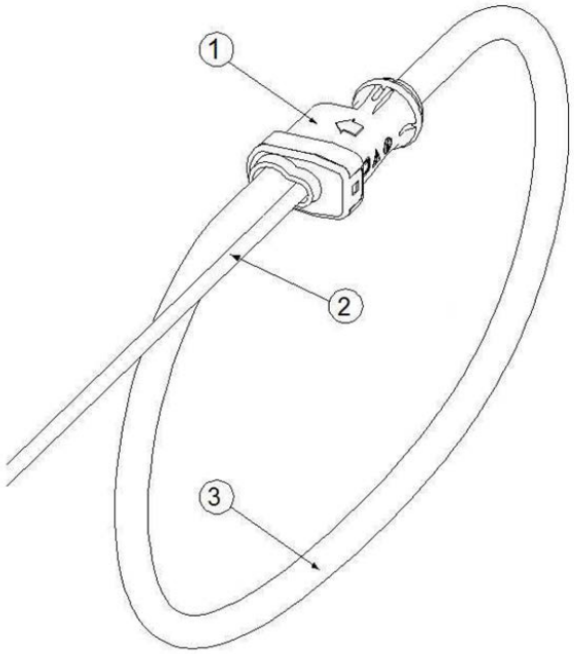
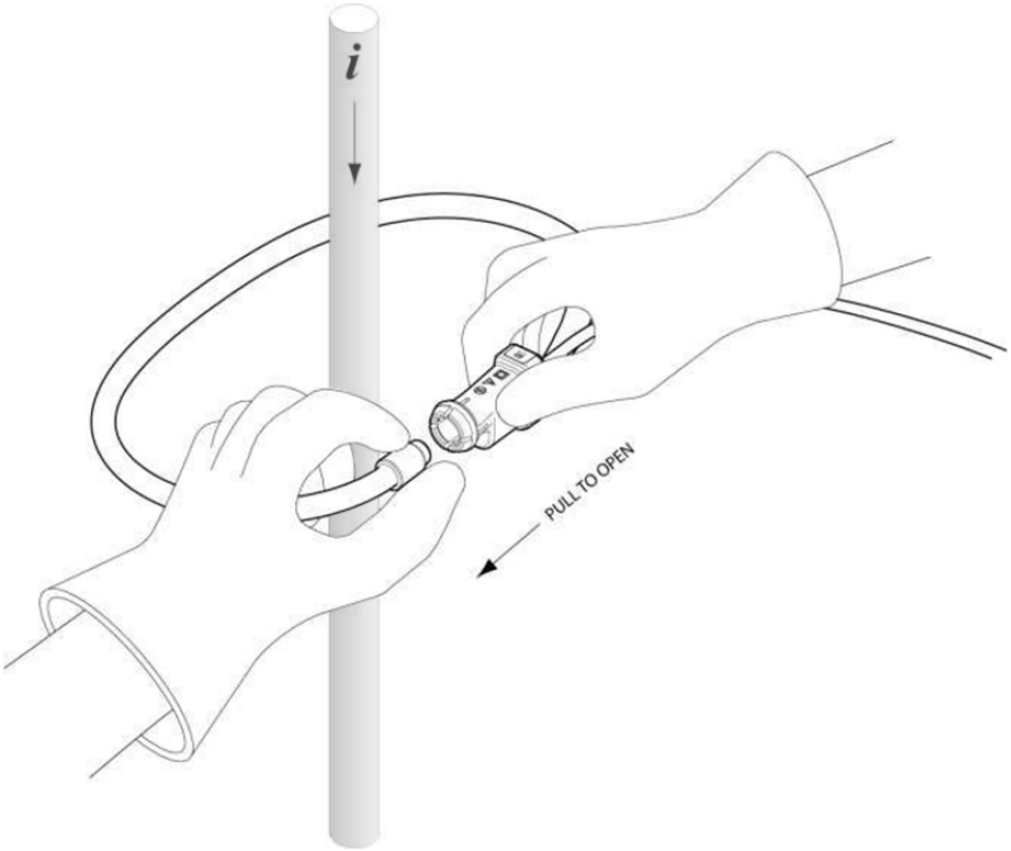


Fig. 1

1. Probe Coupling
2. Probe Output Cable
3. Flexible Current Probe

⚠	**Read safety section of instructions before operating this product.**
⚠	**Ensure conductor to be tested is de-energized** Connect the output of the probe to the input of a measurement device.
⚠	**The flexible current probe is not for use on conductors with a potential of over 1000V.** Wrap the flexible probe around the conductor to be tested, close coupling. Energize the circuit under test. Locate the coupling away from nearby conductors.
⚠	**Always use appropriate equipment for personal protection. Do not use the flexible current probe to measure bare conductors unless wearing protective clothing suitable for high voltage work.**

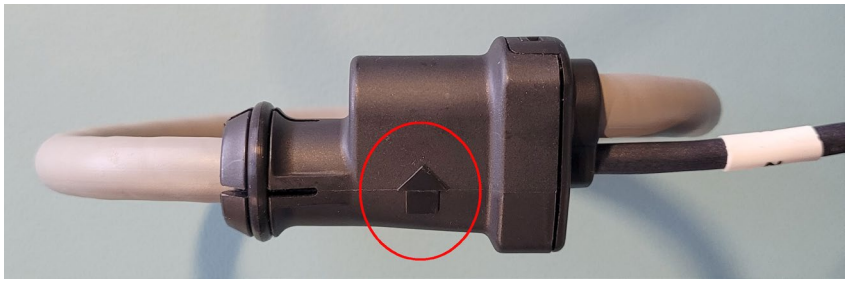


Do not use ACF 3000 if damaged

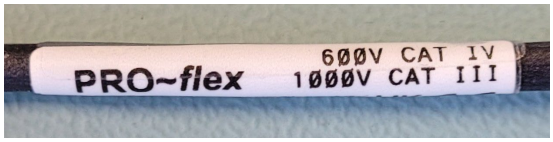
- Always inspect connecting cable and flexible probe for damage before use.
- To avoid electric shock, keep the ACF clean and free of surface contamination.
- Use Isopropyl alcohol to clean the probe.
- Make sure the flexible probe and the connecting cable are dry before further use.

Current connection L1, L2, L3, N

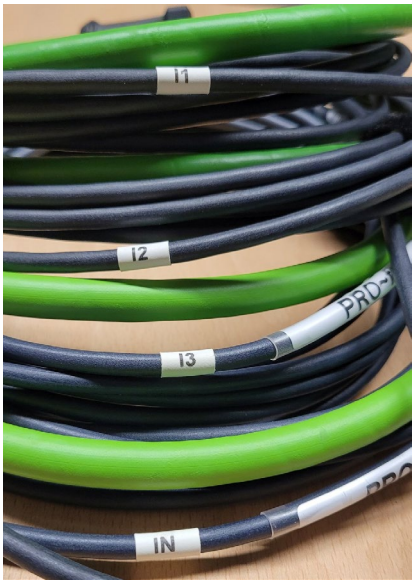
The flexible Rogowski coils are placed directly around the respective conductors. The current direction, which is indicated by an arrow on the measuring head, must be observed

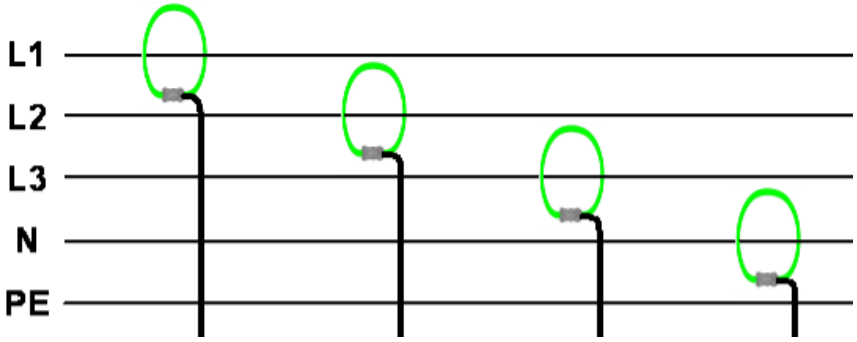


The measurement category of the current sensor is marked on the connection cables.



The current sensors are marked with: **L1 - L2 - L3 - N** resp. **I1 - I2 - I3 – N**

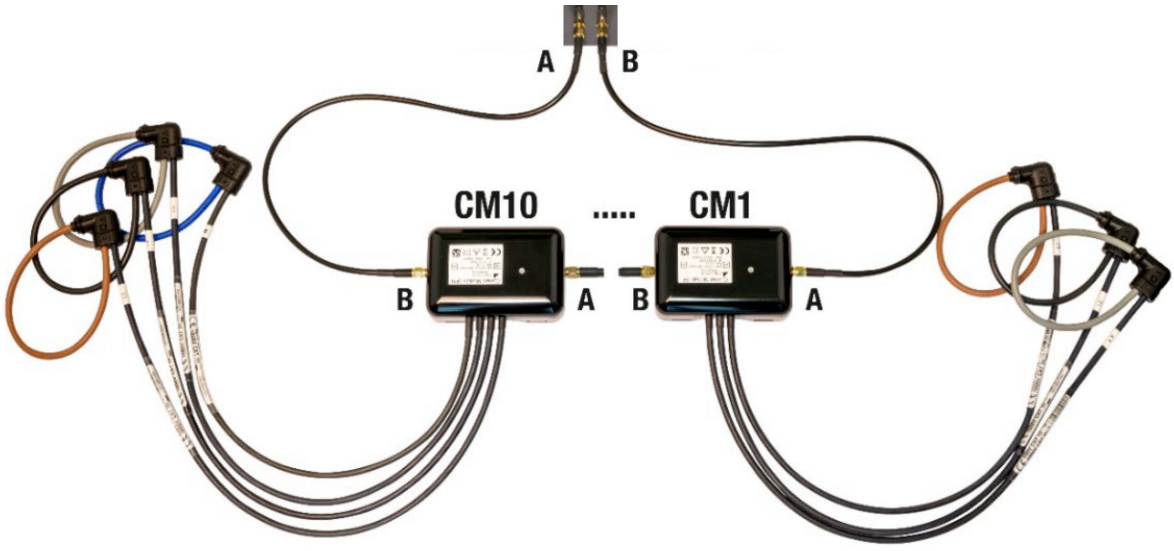




4.6 Connection Current Link System

For the device variant with base unit PQ5000CL Current Modules 3P and / or 3PN with a maximum of 32 current channels have to be arranged in a ring structure for measuring up to 10 feeders. The connection of the individual elements of the ring is done using SMA connection cables.

⚠	The SMA connection cables must not be kinked during assembly, as the conductors could be damaged. The bending radius should be not smaller than 50mm. The fastening of the SMA cables to the corresponding connectors should be done with a torque wrench with a maximum torque of 1 Nm.



4.7 Connection of PME radio modules

The option PME central unit in the base unit serves monitoring load flows in distribution systems or to consumers using up to 33 PME radio sensors. Synchronously with the voltage of the base unit, radio modules with 3 or 4 current channels each record all data required for the analysis of the energy flows and send them wirelessly to the base unit.

The radio modules require a power supply (batteries or USB-C).

During commissioning, each sensor module has to be linked to the base unit, to be able to assign the measured data uniquely to a measurement point. For that, information given on the nameplate of the modules must be available. It can therefore make sense to link the radio modules to the base unit before mounting them in the plant.

Commissioning of the radio modules is shown in annex A.

Modules must not be used with an open housing cover.

4.8 Installing and Fixing CL or PME modules

Rogowski coils

The Rogowski coils of the modules are different in color and also marked:

- L1 – Brown
- L2 – Black
- L3 – Gray
- N – Blue (available for 4-wire versions only)

The Rogowski coils are placed directly around the respective conductors. The current direction, which is indicated by an arrow on the measuring head, must be observed.

The junction box of the CL or PME modules can be fixed directly on a cable using cable ties. Do not mount the junction box on bare conductors!

The connecting cables of the CL modules must be fixed so that they cannot enter dangerously active areas.

5 Commissioning

Before commissioning you have to check if the connection data of the device match the data of the plant (see nameplate and connection plate).

If so, you can start to put the device into operation by switching on either the measurement inputs L1 and N or the external power supply.

5.1 Gateway Teltonika RUT241

The optional Mobile-Gateway RUT241 provides access to device data via the mobile communication network.

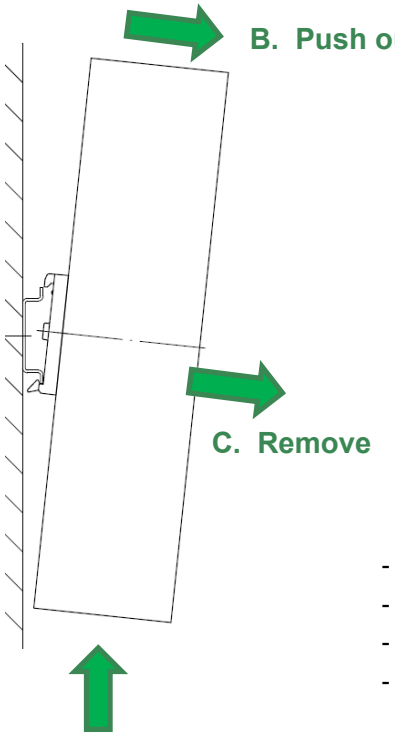
- Type: Teltonika RUT241, LTE CAT4 Industrial Cellular Router
- Instructions available via: https://wiki.teltonika-networks.com/view/RUT241
- Default IP address for configuration: 192.168.1.1

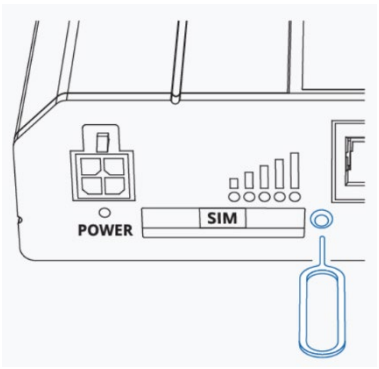
SIM card

The router is delivered without SIM card. To insert a SIM card, you have to open the housing by removing the 4 screws on the top of the housing.

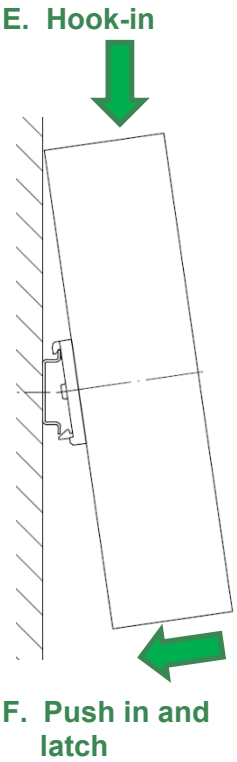
Ensure that all leads already connected to the device are free of potential before opening the housing!

The router is mounted on the left side panel. To insert the SIM card, follow the 6 steps shown below.





- Push the SIM holder button with the SIM needle
- Pull out the SIM holder
- Insert your SIM card into the SIM holder
- Slide the SIM holder back into the router



5.2 Operating LED of the base unit

The operating LED shows the present device state.

Procedure	LED display
Booting of device	• Flashes green (1 Hz) • If successful: Change to static green display
Firmware update	• Change to update mode: Static red • During update: Flashes red (1 Hz) • If successful or cancelled: Booting of device
Factory reset or reset of communication settings	• During reset: Flashes red (1 Hz) • Then (for a factory reset): Booting of device

5.3 Access to base unit via Ethernet connection socket

For the device variant without mobile gateway or with gateway RUT241 the Ethernet interface of the base unit can directly be accessed via the Ethernet connector of the SMART GRID BOX. Via the address **192.168.1.101** the website of the device can be reached, either for device parameterization or to access measurement data.

If the user resets the RUT241 gateway to factory settings for operational reasons, its interfaces must be reconfigured so that the device's website can be accessed again via the Ethernet connector. This is described in annex C.

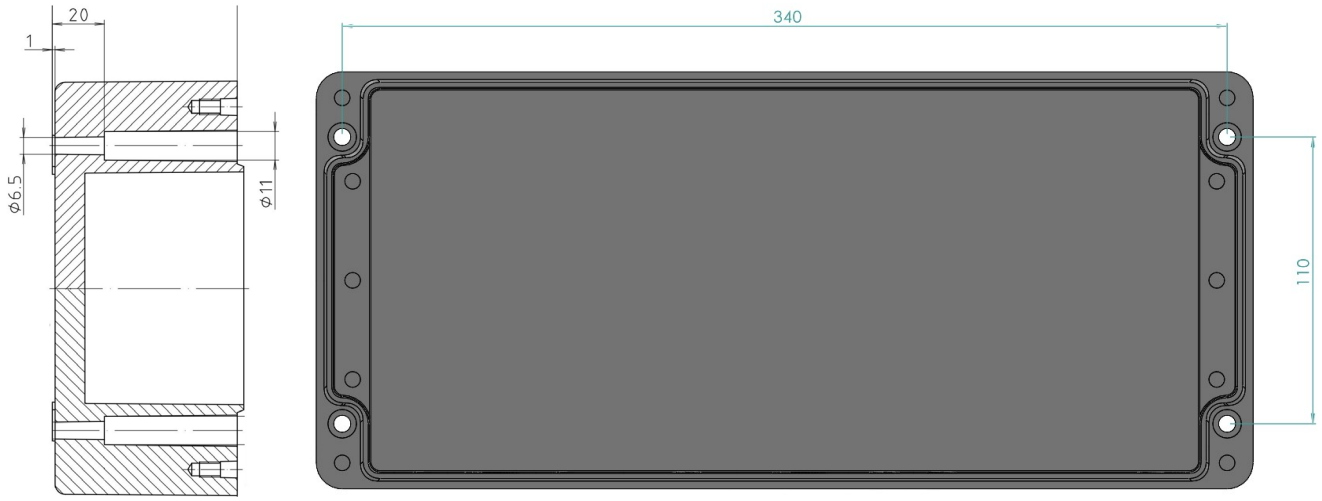
Parameterizing the device functions of the base unit

A full parameterization of all functions of the device is possible directly via web browser. This assumes that user has the required access rights.

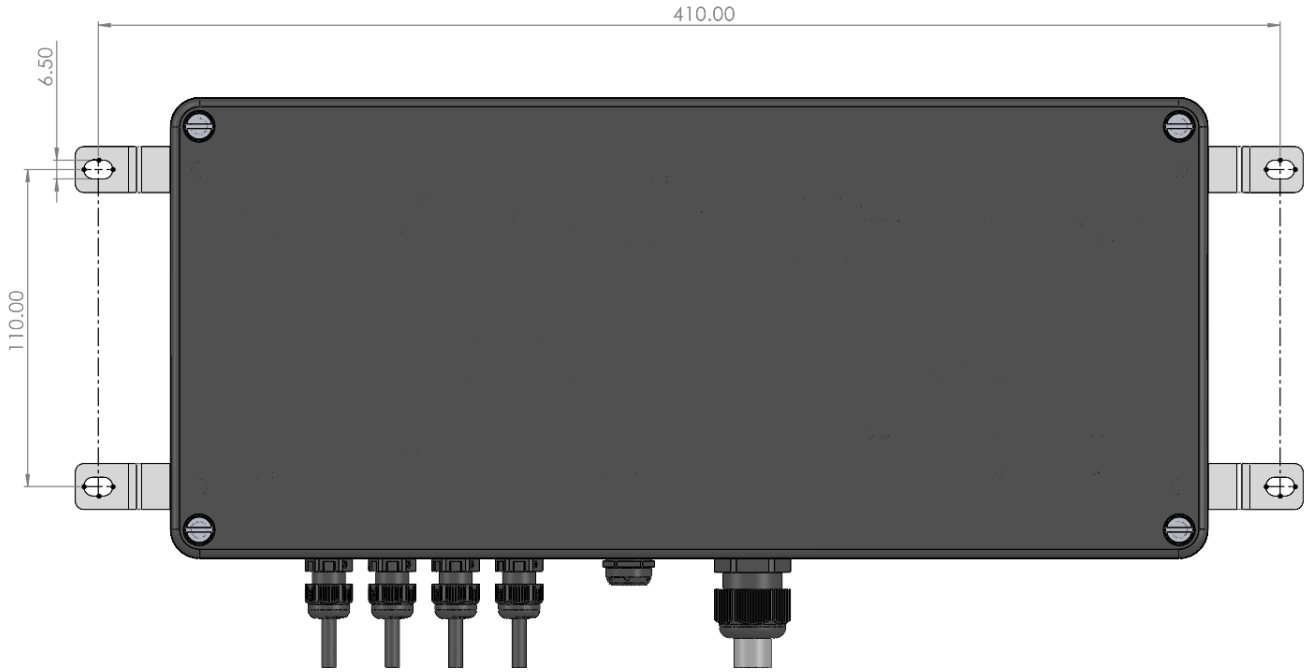
For security reasons, the security features “Users and Permissions” (RBAC) and “Web security” (HTTPS) may be activated. In this case, before the device webpage can be displayed using https, you have to install a root certificate, which is provided via our homepage. Once the certificate is downloaded to the local computer the certificate can be installed manually. Just double-click on the file, and install the certificate as a trusted root certification authority.

6 Wall mounting

Direct mounting with 4 M6 screws (accessible when housing is opened)



Installation with wall brackets (set of 4 pieces: BOPLA WL (BOPLA order no.: 21004300))



7 Technical data

Voltage measuring inputs

The characteristics of the voltage inputs are the same for all base units. However, the measuring range is limited when using an internal auxiliary power supply.

Characteristic	SMARTGRID-BOX-xxxx xxxx 1x /3x	SMARTGRID-BOX-xxxx xxxx 2x /4x
Rated voltage	100…230 V_{LN} 173...400 V_{LL}	57,7…400 V_{LN} 100...693 V_{LL}
Meas. range max.	265 V_{LN}, 460 V_{LL} (sinusoidal)	520 V_{LN}, 900 V_{LL} (sinusoidal)
Measurement category	300V CAT III	600V CAT III
Overload capacity	continuous: 265 V_{LN}, 460 V_{LL}	continuous: 520 V_{LN}, 900 V_{LL} 10 x 1 s, interval 10s: 800 V_{LN}, 1386 V_{LL}
Uncertainty	± 0,1%	
Consumption	≤ U^2 / 1.54 MΩ per phase	
Impedance	1.54 MΩ per phase	

Current measuring inputs

Base unit CU5000 / DM5000 / PQ5000

Range: 0…3000A (max. 3800 A)

See operating instructions of Rogowski coil ACF3000 for further information

Current Module 3P / 3PN

Nominal current

- Range 1: 400 A (typ.), 1000 A (max.)
- Range 2: 8 kA (typ.), 20 kA (max.)

Measurement category: 600V CAT IV

Uncertainty: ± 0,5% (with centered conductors and no external field)

Angle error: ± 1,0°

Design: 3 or 4 Rogowski coils

Measurement uncertainty

Reference conditions: Acc. IEC/EN 60688, ambient 15…30°C, sinusoidal input signals, Rogowski current measurement with centered conductors and no external field

Quantity	**PQ5000CL**	**CU5000 / DM5000 / PQ5000**
Voltage	± 0,1 %	± 0,1%
Current	± 0,5 %	± 0,1%
Power	± 2,0 % (typical)	± 0,2%
Power factor	± 1,0°	± 0,2°
Frequency	± 0,01 Hz	± 0,01 Hz
Active energy	Class 3 (typical)	Class 0.2S, EN 62053-22
Reactive energy	Class 3 (typical)	Class 0.5S, EN 62053-24

Systems: 4-wire, unbalanced

Nominal frequency: 42...50...58Hz or 50.5...60...69.5Hz (CU5000 / DM5000 / PQ5000 only)

Sampling rate: 18 kHz (U), 54 kHz (I for PQ5000CL)

Internal data memory: 16 GB

Option PME

Current module CTR75-1000A

Number of channels	3 or 4
Max. number of modules	25...33 (≤100 currents per PME central unit)
Frequency range	10 Hz up to 100 kHz
Max. rated current I_N	1000 A [1)]
Max. measurable current	1.2 x I_N
Starting current	2 A (fundamental component)

[1)] The measurement range will be automatically set based on the rated value selected for the associated measurement system

Sampling rate	6 kHz
Polling interval	configurable 1…20 s, default 1 s
Transmission power	configurable -12…8dBm, default 0 dBm
Range	10 m at transmission power 0 dBm

Power supply

Sources	4 x batteries 1,5 V AA / FR6 /L91 or USB-C (5 V DC)
	Energizer Ultimate Lithium AA (not in scope of supply)
Battery life time	appr. 10 years, at transmission power 0 dBm

Measurement uncertainty

Reference conditions: Ambient 23°C±1K, sinusoidal input signals, Rogowski current measurement with centered conductors and no external field

Note: If the conductor is not centered, the additional error can be up to ±2.5% of the measured value

Current	±0,5 % (IEC 60688)
Active / reactive energy	Class 3.0 typical (IEC 62053)

Radio communication

Frequency	2,4 GHz
Security	Advanced Encryption Standard AES-128
Number of PME systems	Up to 5 at the same location

Mechanical attributes of the sensors

Leiterdurchmesser	≤75 mm
Sensorkabel	Ø 6 mm

Power supply

Consumption:	≤ 40VA
- **Via Meas. input L1-N**	SMARTGRID-BOX-xxxx xxxx 1 / 3
- **Separate connection**	SMARTGRID-BOX-xxxx xxxx 2 / 4
Nominal voltage:	100…230V AC 50/60Hz / DC ±15%

Ambient conditions, general information

Operating temperature:	• Device without UPS: –10 up to 15 up to 30 up to + 55°C
	• Device with UPS: 0 up to 15 up to 30 up to + 35°C

(if used outside this operating temperature range, it is not ensured that the UPS battery pack is recharged).

Storage temperature:	Base device: -25 up to +70°C;
	Battery pack UPS: -20…60°C (<1 month); -20°…45°C (< 3 months);
	-20…30°C (< 1 year)
Temperature influence:	0.5 x measurement uncertainty per 10 K
Long term drift:	0.5 x measurement uncertainty per year
Usage group:	II (acc. EN 60 688)
Relative humidity:	< 95% no condensation
Altitude:	≤ 2000 m max.

Mechanical attributes

Weight: approx. 3.5kg (without connections cables and sensors, depending on device variant)
Dimensions L x W x H: 360 x 160 x 91 mm

Safety

Protection class: II (protective insulation, voltage inputs via protective impedance)
Pollution degree: 2
Protection: IP65 (closed housing)

The device uses the principle of protective impedance for the voltage inputs to ensure protection against electric shock. All circuits of the device are tested during final inspection.

Prior to performing high voltage or isolation tests involving the voltage inputs, all output connections of the device, especially analog outputs, digital and relay outputs as well as Modbus and Ethernet interface, must be removed. A possible high-voltage test between input and output circuits must be limited to 500V DC, otherwise electronic components can be damaged.

If the device contains a surge protective device (SMARTGRID-BOX-xxxx xxxx 3x /4x), pull out the plug of the SPD or disconnect the SPD before measuring the insulation resistance.

Further technical data can be found in the documents in annex B, depending on the base unit used.

8 Applied regulations, standards and directives

IEC/EN 62053-22	Static meters for AC active energy (classes 0,1S, 0,2S and 0,5S)
IEC/EN 62053-24	Static meters for reactive energy at fundamental frequency (classes 0,5S, 1S, 1, 2 and 3)
IEC/EN 61010-1	Safety regulations for electrical measuring, control and laboratory equipment
IEC/EN 61000-4-30 Ed.3	Power quality measurement methods
IEC/EN 61000-4-7	General guide on harmonics and interharmonics measurements
IEC/EN 61000-4-15	Flickermeter - Functional and design specifications
IEEE 1159.3	Recommended Practice for the Transfer of Power Quality Data
IEC 62586-1 Ed.2	Power quality measurement in power supply systems – Power quality instruments (PQI)
IEC 62586-2 Ed.2	Power quality measurement in power supply systems – Functional tests and uncertainty requirements
EN50160	Voltage characteristics of electricity supplied by public distribution systems
IEC/EN 60688	Electrical measuring transducers for converting AC electrical variables into analog or digital signals
DIN 40110	AC quantities
IEC/EN 60068-2-1/	Ambient tests
-2/-3/-6/-27:	-1 Cold, -2 Dry heat, -3 Damp heat, -6 Vibration, -27 Shock
IEC/EN 60529	Protection type by case
IEC/EN 61000-6-4	Electromagnetic compatibility (EMC): Emission standard for industrial environments
IEC/EN 61000-6-5	Electromagnetic compatibility (EMC): Immunity for equipment used in power station and substation environment
UL94	Tests for flammability of plastic materials for parts in devices and appliances
2011/65/EU (RoHS)	EU directive on the restriction of the use of certain hazardous substances

Warning
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

This device complies with part 15 of the FCC:

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This Class A digital apparatus complies with Canadian ICES-003.

This product may contain a gateway Teltonika RUT241 according to RED Directive 2014/53/EU
EU declaration of conformity see: https://wiki.teltonika-networks.com/view/RUT241_CE/RED/

This product may contain a gateway Teltonika TRB140 according to RED Directive 2014/53/EU
EU declaration of conformity see: https://wiki.teltonika-networks.com/view/TRB140_CE/RED/

Annex

A Commissioning of PME radio modules

A.1 Linking the PME radio modules to the base unit

For an explicit assignment of the measurement data, the radio modules need to be linked individually to the base unit during commissioning. Doing so, you have to:

1. Supply power to the base unit, that the device website becomes available.
2. Provide power for the radio modules (batteries or USB-C)
   Hint: Linking is possible even if the module is not powered
3. Add the radio module to the base unit via QR-Code or manual entry of the Install Code
4. Assign the module to a PME measurement system
5. Assign a name to the measurement system
6. Parametrize the measurement system for the task (system, nominal current, amplification factor(s))
7. Assign the name of the measurement system to the radio module, if desired

Repeat steps 2 to 7 until all radio modules are linked to the base unit.

***Hint**: These steps will be executed immediately, without having the changed configuration to be stored in the device.*

A.1.1 Power supply

The radio module CTR75-1000A needs to be powered. This is possible via either batteries or via USB-C (5 VDC).

Inserting / replacing batteries

> *The batteries must not be inserted / replaced during operation, the radio module must be removed from the system.*

1. Loosen the screws (4x Torx Plus® 10IP) on the bottom of the housing
2. Remove the housing cover. ATTENTION: This cover muster later be reassembled on the same housing bottom.

   > *Make sure that you are free of static electricity, so that the electronic is not damaged by static discharge.*

3. Insert batteries in the battery holder or replace the existing batteries. Pay attention to the specified polarity. Always change all batteries at once.

   > *Only use **Energizer Ultimate Lithium AA (1,5 V AA / FR6 / L91) batteries**. If other batteries are used, operational reliability and service life could be reduced.*

4. Electronics and housing cover (with the information given on the nameplate) form a unit. The same cover must be placed on the electronics again. Then fix the screws again (maximum torque 1.0 Nm).

The charge status of the batteries can be queried via the service menu **PME current module state**. If the charge level is ≤10 %, all batteries in the corresponding module should be replaced.

Name	ID	Firmware version	Sensor type		Last seen	RSSI (⌀)	Link Quality
NCS3	E7-4973E8DD	1.0	CTR75-1000A, 3CH	76 %	0 s	-54 dBm (-58 dBm)	100%
UT3	E7-4973E8DE	1.0	CTR75-1000A, 3CH	68 %	0 s	-63 dBm (-56 dBm)	100%

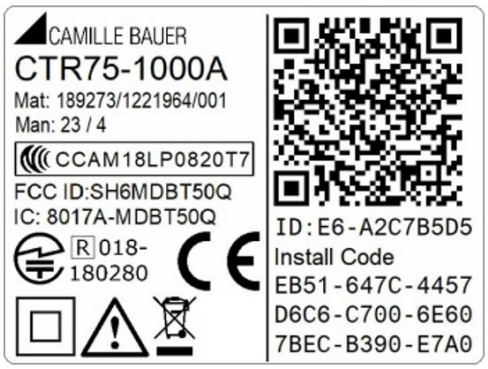
Powering the module via USB-C (5 VDC)

As an alternative to battery power, the module can also be supplied via the side USB-C connector. If possible, use a supply with galvanic isolation.

> ⚠ *The cable for powering via USB-C must not be routed over bare live conductors.*

As soon as the module is powered the LED flashes either red or green.

A.1.2 Add a radio module to the base unit

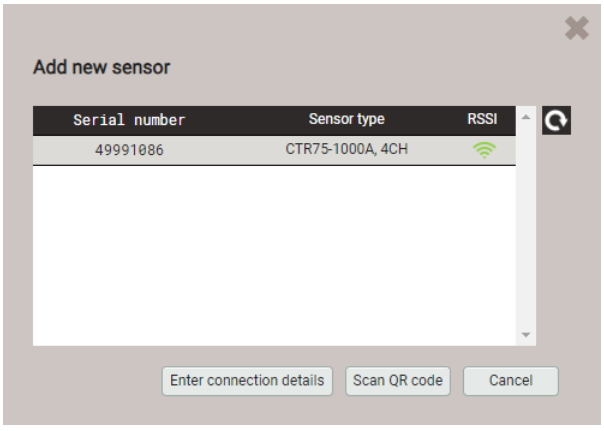


On the right side of the nameplate of the radio module are three pieces of information, which are required for installation:

- **ID**: Identification number of the module, consisting of the module type (E6 or E7) and a unique sequential number (here A2C7B5D5)
- **Install Code**: 32-digit number that is required when linking the module to the base unit and ensures that communication is encrypted.
- **QR-Code**: Scannable version of the Install Code, for a faster installation procedure.

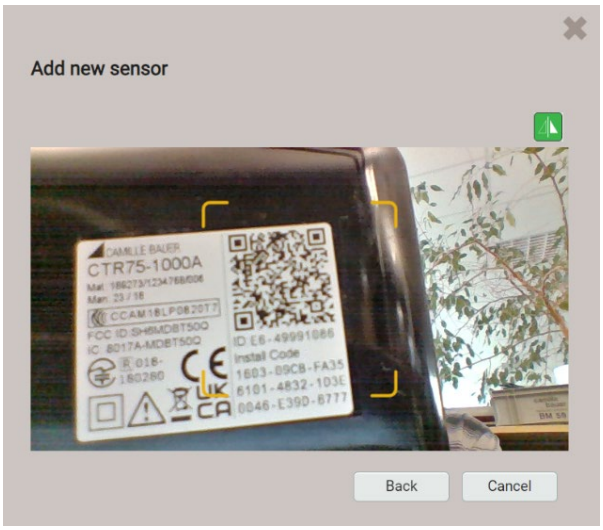
a) Adding a current module to a base unit is done via its website. Select *Add new sensor* in the settings menu of the *PME current modules*. All modules reachable via radio and not assigned to a base unit will be displayed.

***Hint**: Each module can be linked to only one base unit.*



b) If the website is displayed on a device with camera (smart phone, tablet, notebook) or a webcam is connected to the PC, select «Scan QR code», scan the code and proceed to step d).

Please note the information on using the camera in [appendix C](#).

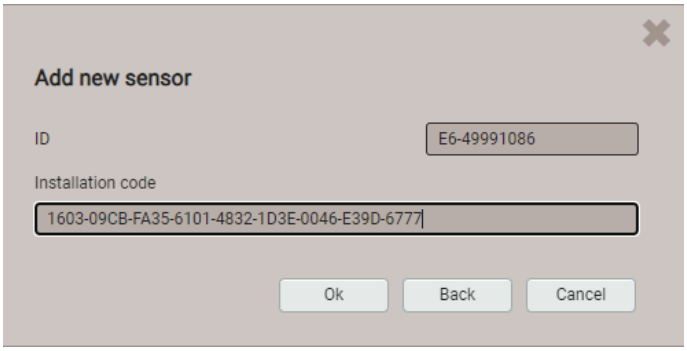


c) If there is no camera available, select

- «Enter connection details» and enter **ID and Install Code**

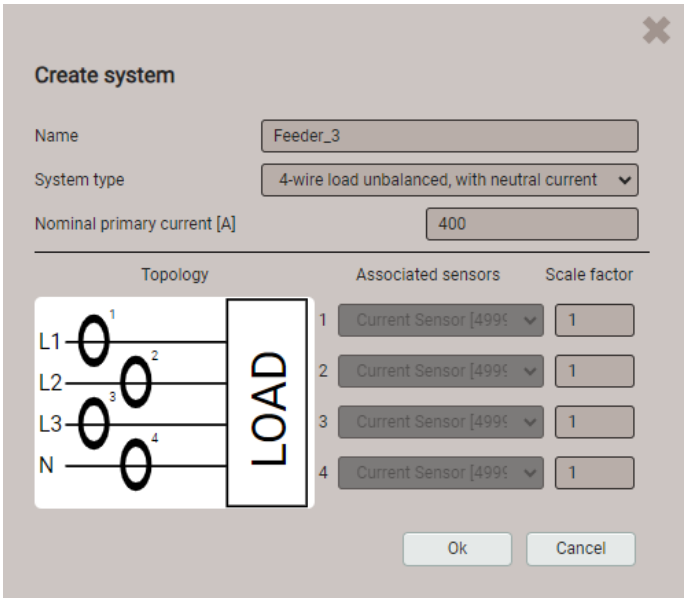
OR

- A device from the list of the not assigned devices and enter the **Install Code**

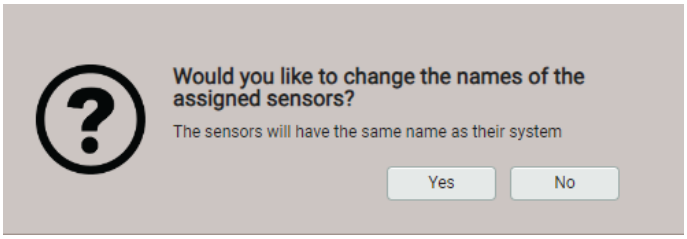


d) The new module must then be assigned to a measurement system. A name can be assigned to the measuring system, the type of connection can be defined and the nominal current can be set. If one or multiple of the sensors only measure a part of the respective total current, this can be corrected with a scale factor, for example by a factor of 2 if only one of 2 parallel conductors is measured.

A negative amplification factor reverses the current direction, e.g. if a sensor is incorrectly connected.



e) In the last step the name of the measurement system can also be assigned to the module. This makes it easier to see the module usage within the sensor overview.



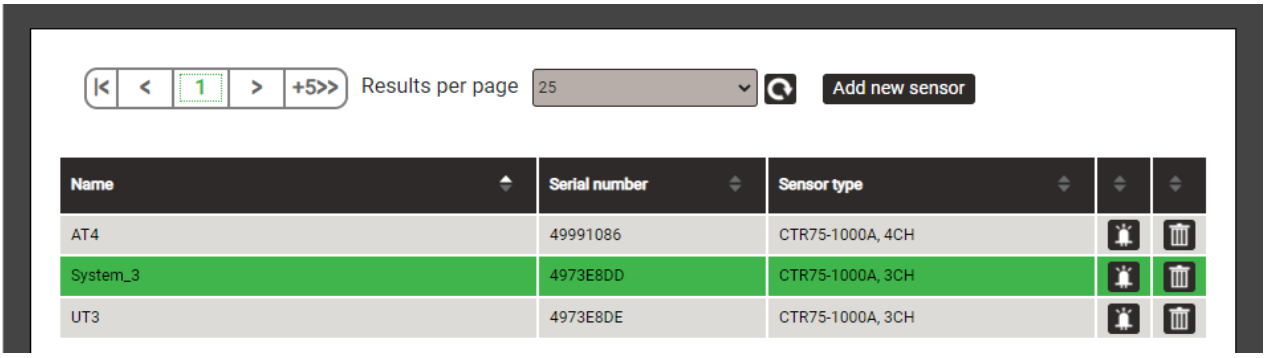
A.1.3 Modifying module settings

The radio modules use default settings, e.g. a transmission power of 0 dBm (1 mW) or a polling interval of 1 s. If radio modules are mounted at a greater distance from the base unit, it may be necessary to increase the transmission power to ensure reliable radio reception. This then increases the power demand and can reduce the life cycle of the batteries. By extending the polling interval on the other hand the battery load can be reduced.

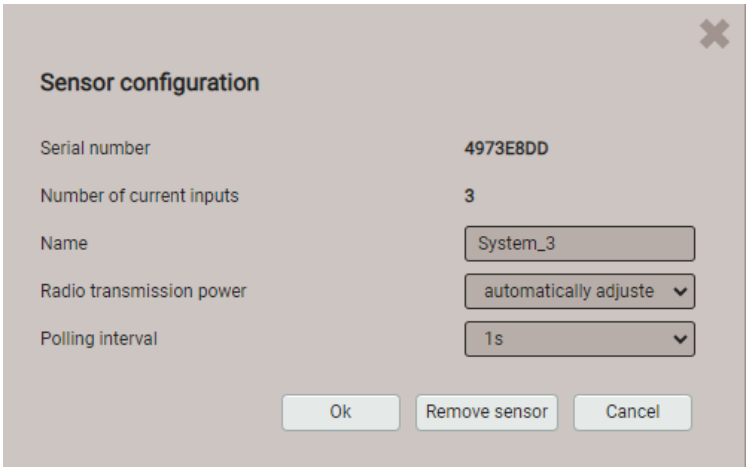
In order to change the settings of individual modules, a module can be selected in the configuration menu of the PME current modules. In this menu you can also:

Activate an LED flashing mode to identify the selected module

Remove modules



In the sensor configuration the desired modifications can then be made:



A.1.4 State overview of the modules

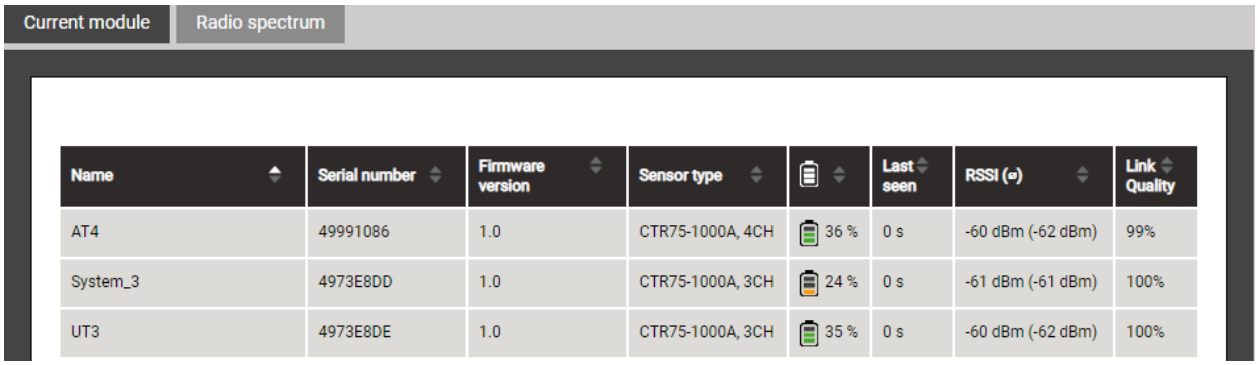
The state LED provides information about the current operating state of the respective module

Color	State	Meaning
-	dark	**No power**
red	Flashing every 5 s	Radio module **with power**, no measurement system assigned yet, not synchronized
green	Flashes every 1 s or 10 s [1)]	Radio module in **measurement mode**, synchronized to base unit
orange	Flashes every 1 s for 5 s	**Module identification** via Web-GUI

[1)] *60 s after synchronization the flashing frequency changes to a 10 s cycle*

Detailed information about the **state of the PME current modules** can be visualized via the service menu:

- Name, Serial number, Firmware version and type of the respective module
- Battery state of charge [%]
- Time since last successful communication
- RSSI reception level [dBm] of the last message, average level over the last 5 min in parentheses
- Link Quality: Percentage of successful queries in the last 5 minutes

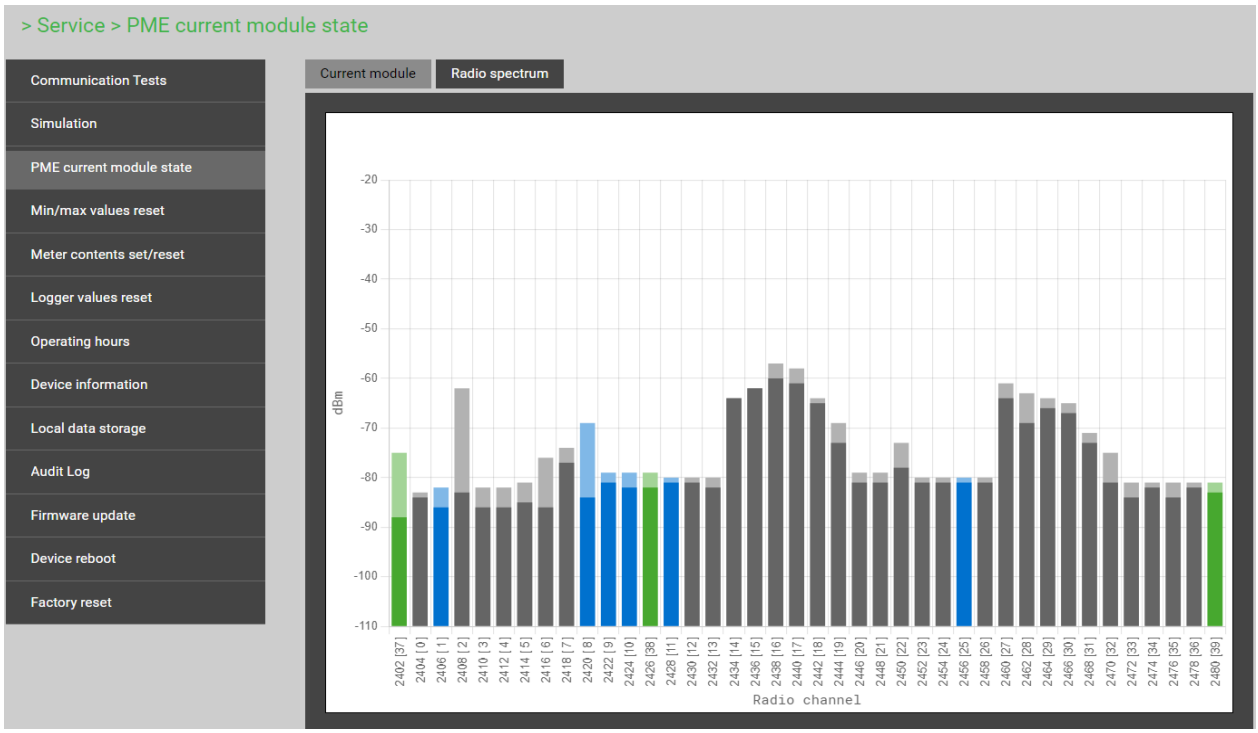


Name	Serial number	Firmware version	Sensor type		Last seen	RSSI (⌀)	Link Quality
AT4	49991086	1.0	CTR75-1000A, 4CH	36 %	0 s	-60 dBm (-62 dBm)	99%
System_3	4973E8DD	1.0	CTR75-1000A, 3CH	24 %	0 s	-61 dBm (-61 dBm)	100%
UT3	4973E8DE	1.0	CTR75-1000A, 3CH	35 %	0 s	-60 dBm (-62 dBm)	100%

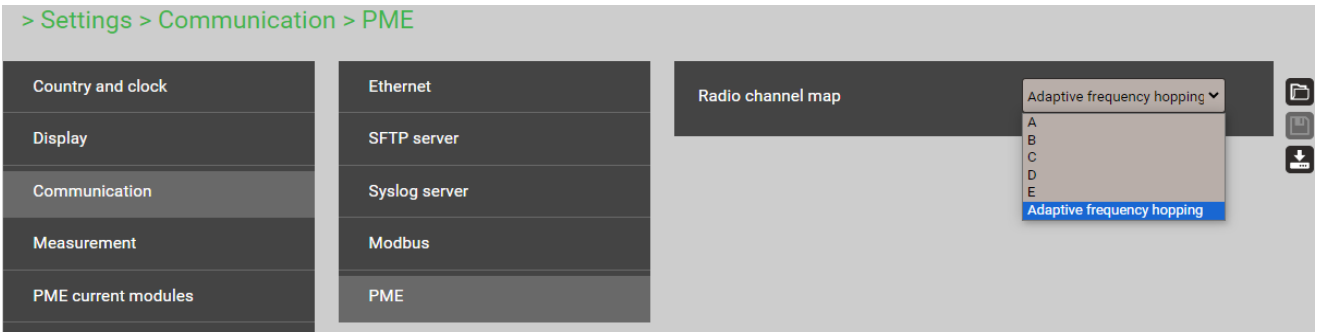
A.2 Radio channel selection

Via display of the radio spectrum the data channels used for the communication of the base unit with the radio modules may be visualized.

- Used data channels
- Synchronization channels
- Unused channels



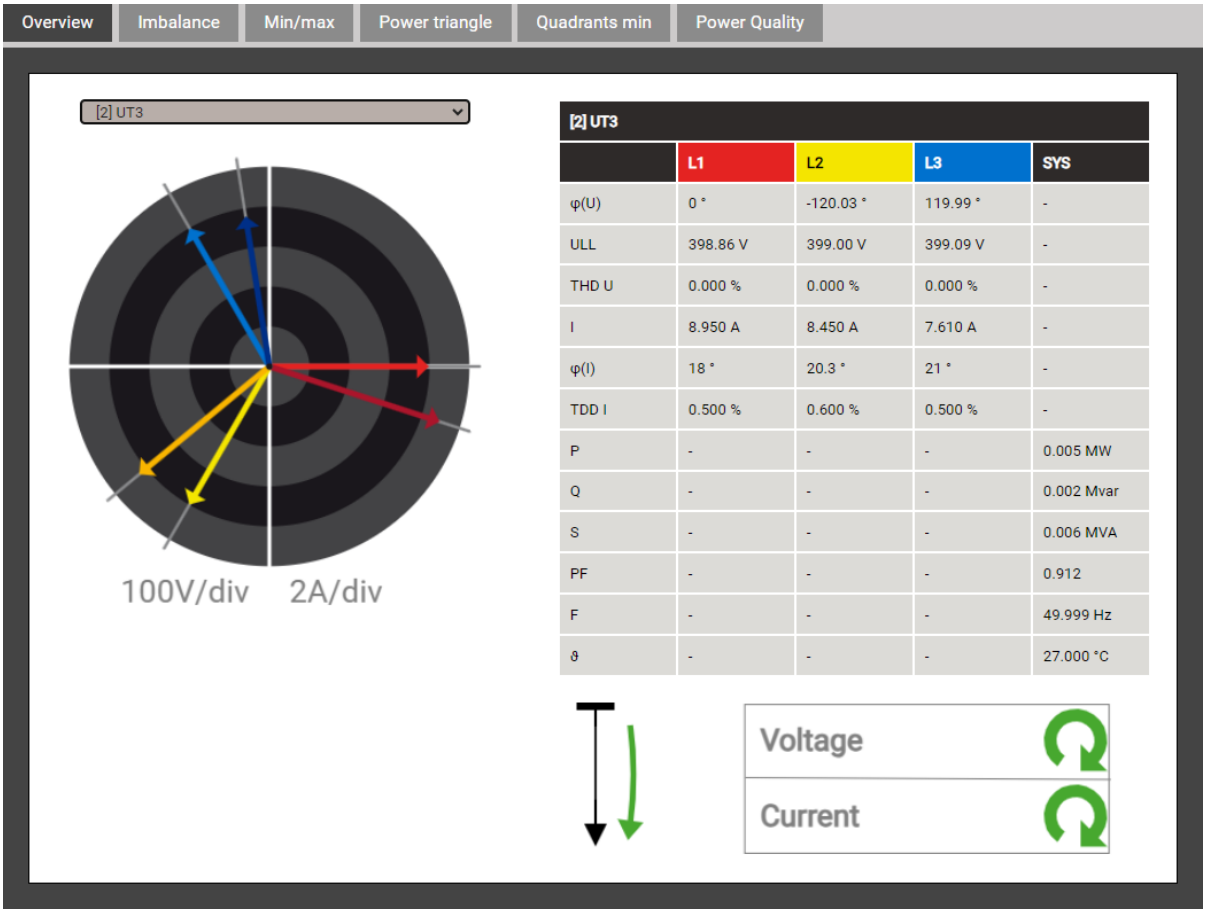
If the Link Quality is lower than expected, you can try to improve the quality by selecting other data channels. This selection can be changed in the communication settings of the base unit.



- A: Radio channels 0, 4, 8, 12, 16, 20, 24, 28, 32
- B: Radio channels 1, 5, 9, 13, 17, 21, 25, 29, 33
- C: Radio channels 2, 6, 10, 14, 18, 22, 26, 30, 34
- D: Radio channels 3, 7, 11, 15, 19, 23, 27, 31, 35
- E: Radio channels 0, 6, 11, 13, 19, 20, 26, 33, 36
- Adaptives frequency hopping (default setting): The device automatically searches the channels with the best transmission quality

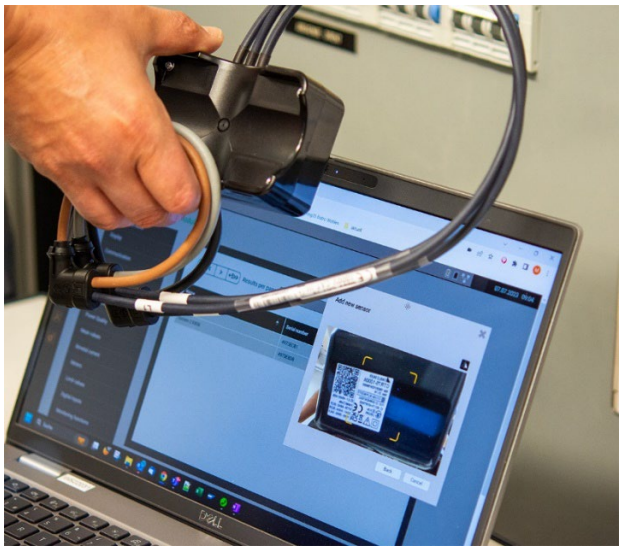
A.3 Installation check for devices with option PME

Phasor diagram and the visualization of sense of rotation and energy direction are displayed in the same image in the instantaneous values menu of the WEB interface. This information can be displayed not only for the basic device, but also for each individual PME measuring system. The system to be displayed can be selected in the top left drop-down menu.



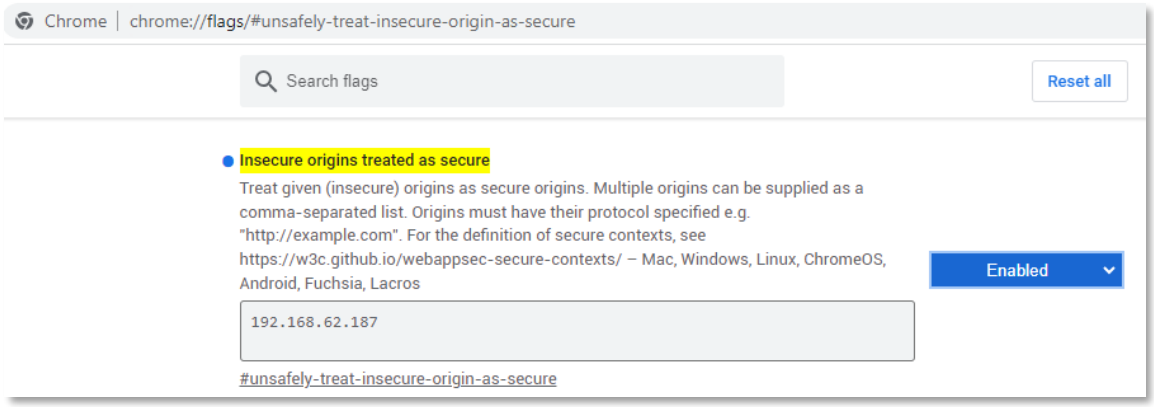
Instantaneous values display of a PME measurement system

A.4 Using a camera



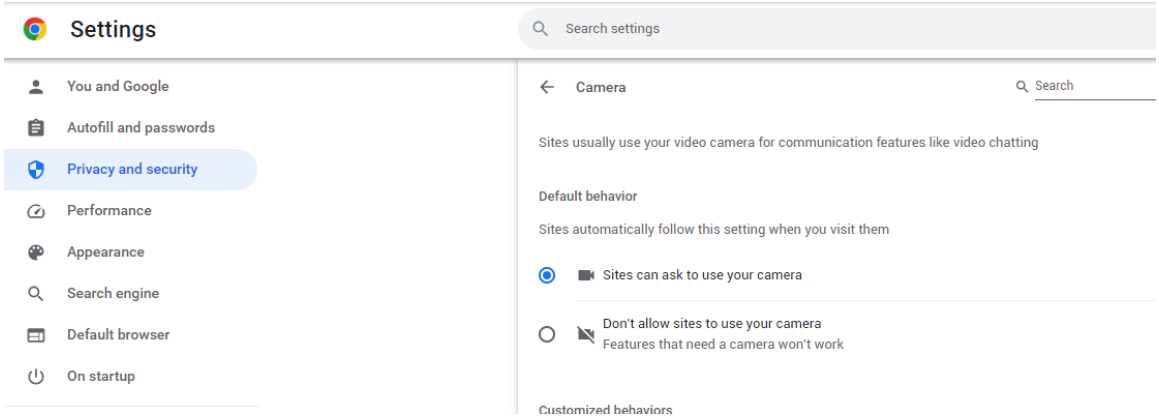
In order to be able to use the camera to scan the QR code on a website, the following points must be observed:

- The website must use secure HTTPS communication. Note: Enabling web security using HTTPS is described in the device manual for the basic device.
  OR
- Alternatively, the (insecure) website of the device can be defined as a secure source

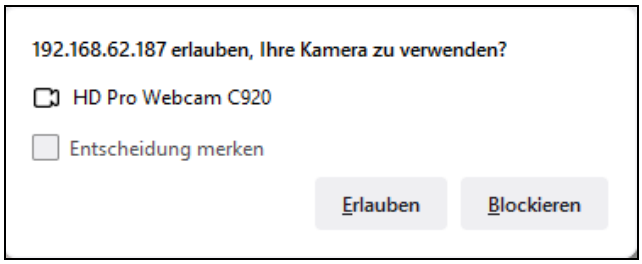


Flag settings in Chrome browser

- The use of the camera by websites must be activated in the browser settings in the privacy and security section

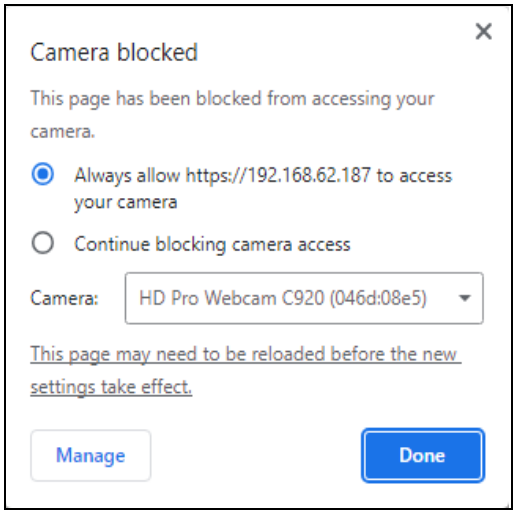


- Depending on the browser, a permission may be required before activating the camera.



Browser: Firefox

- Permission to use the camera via a website can be revoked at any time. If several cameras are connected, the camera to be used can be selected



Browser: Chrome

B Further documents

B.1 Base unit SINEAX DM5000

Further documents are available via https://camillebauer.com/en/product/sineax-dm5000/:

- Device handbook SINEAX DM5000
- Security instructions SINEAX DM5000/CENTRAX CU5000/LINAX PQ5000
- Modbus interface DM5000
- Camille Bauer certificate for encrypted HTTPS communication

B.2 Base unit LINAX PQ5000

Further documents are available via https://camillebauer.com/en/product/linax-pq5000/:

- Device handbook LINAX PQx000
- Operating instructions Rogowski ACF 3000
- Security instructions SINEAX DM5000/CENTRAX CU5000/LINAX PQ5000
- Modbus interface LINAX PQx000
- Modbus interface option PME central unit
- Camille Bauer certificate for encrypted HTTPS communication

B.3 Base unit LINAX PQ5000 Current Link

Further documents are available via https://camillebauer.com/en/product/linax-pq5000cl/:

- Device handbook LINAX PQ5000CL
- Security instructions PQ5000CL
- Security instructions Current Module
- Modbus interface LINAX PQ5000CL
- IEC61850 interface LINAX PQ5000CL
- Camille Bauer certificate for encrypted HTTPS communication

B.4 Base unit CENTRAX CU5000

Further documents are available via https://camillebauer.com/en/product/centrax-cu5000/:

- Device handbook CENTRAX CUx000
- Operating instructions Rogowski ACF 3000
- Security instructions SINEAX DM5000/CENTRAX CU5000/LINAX PQ5000
- Modbus interface CENTRAX CUx000
- Modbus interface option PME central unit
- Camille Bauer certificate for encrypted HTTPS communication

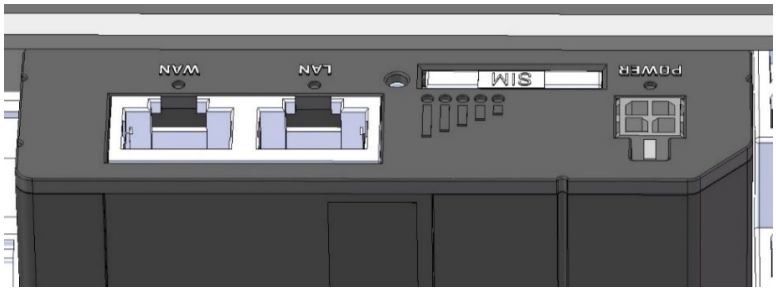
C Configuration of RUT241 after reset

If the Teltonika RUT241 gateway is reset by the user for operational reasons, the gateway's connections must be reconfigured so that access to the base unit's website is possible again.

Configuring the LAN sockets on the Teltonika RUT241 gateway

1) Connect the Smart Grid Box to the computer via the Ethernet connection socket.

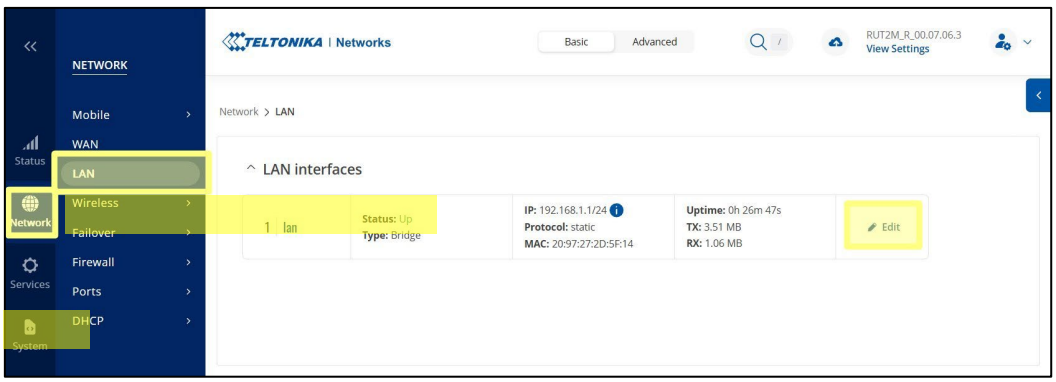
***Hint**: Ex-works the LAN socket of the RUT241 inside the device is connected to the Ethernet socket of the Smart Grid Box and the WAN socket of the RUT241 is connected to the base unit. Please verify if point 2) is not working.*



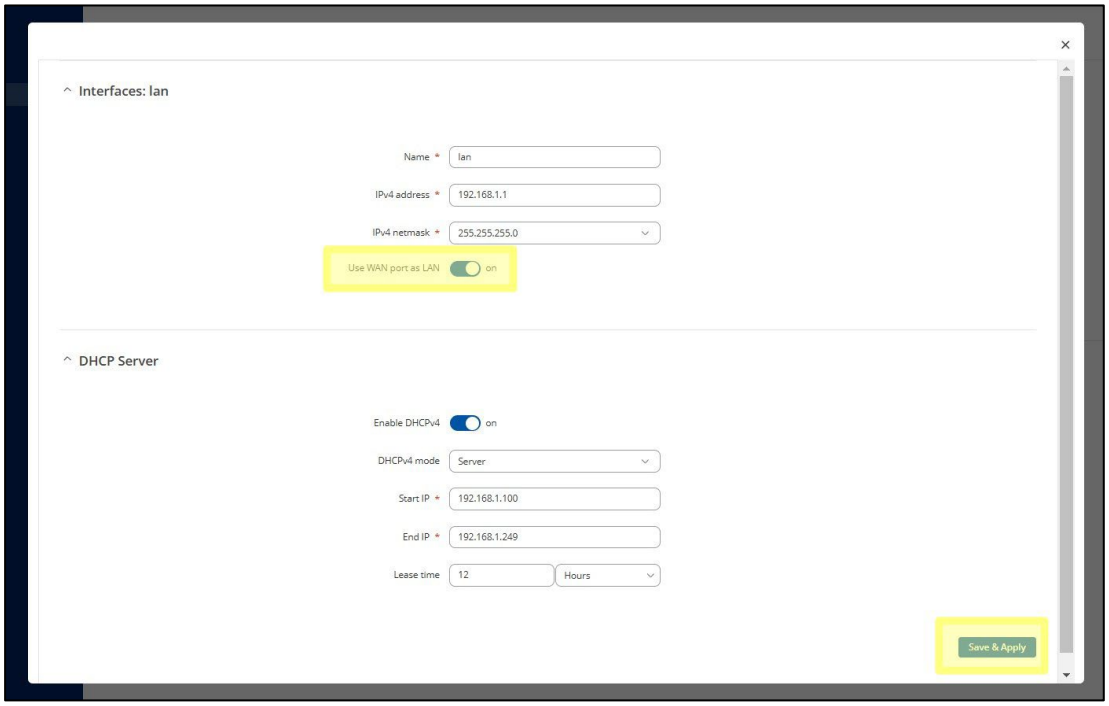
2) Navigate to the RUT241 gateway website (http://192.168.1.1) and log in with USERNAME and PASSWORD

   The default settings of USERNAME and PASSWORD are printed on the backside of the gateway and on the label on the upper side of the gateway.

3) After entering, navigate to Network>LAN>Edit



4) Set «Use WAN port as LAN" to "on" and save it using "Save & Apply"



5) Now both RJ45 ports of the gateway are configured as LAN ports.

D Gateway Bentonet (Teltonika TRB140)

The 6-digit number code for commissioning in the Bentonet system is given on a label on the gateway.