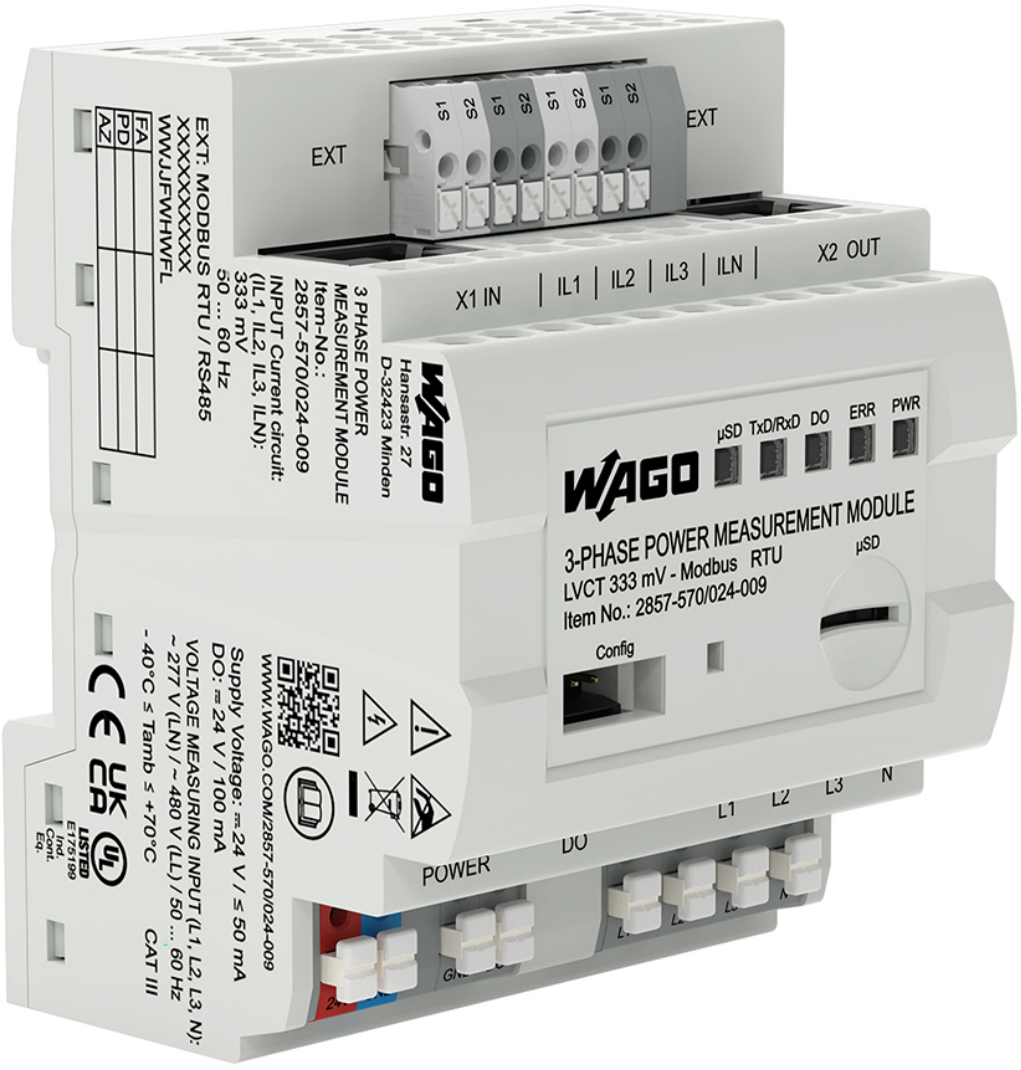
TECHDOCS

WAGO Signal Conditioner

3-Phase Power Measurement, 333 mV LVCT

2857-570/024-0009



Product manual
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Every conceivable measure has been taken to ensure the accuracy and completeness of this documentation. However, as errors can never be fully excluded, we always appreciate any information or suggestions for improving the documentation.

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Table of Contents

1 Provisions

This document applies to the following product:

2857-570/000-009 (3-Phase Power Measurement Module; 333 mV Low Voltage Current Transformer (LVCT))

Produktdetailseite	www.wago.com/2857-570/000-009

The product must only be installed and operated in accordance with the operating instructions. Knowledge of the operating instructions is required for proper use. You can find all documents and information on the detailed product page.

1.1 Intended Use

The product allows measurement of the electrical data of a 3-phase supply network.

The product is an open type device and is designed for installation in an additional enclosure.
- The product is designed for use in dry indoor rooms.
- Operation of the products in industrial area is permitted.
- The product meets the EMC requirements for the residential, office and commercial area as well as small business, if the product used complies with the required emissions of interference (emission limits).
- Operation of the product in other application areas is only permitted when corresponding approvals and labeling are present.

Improper Use

Improper use of the product is not permitted.

Improper use occurs in particular in the following cases:
- Non-observance of the intended use
- Use without protective measures in an environment in which moisture, salt water, salt spray mist, dust, corrosive fumes, gases, direct sunlight or ionizing radiation can occur
- Implementation of a Known Misuse
- Use of the product in areas with special risk that require continuous fault-free operation and in which failure of or operation of the product can result in an imminent risk to life, limb or health or cause serious damage to property or the environment (such as the operation of nuclear power plants, weapons systems, aircraft and motor vehicles)

Warranty and Liability

The provisions of the latest WAGO General Terms and Conditions of Deliveries and Services (GTC) apply as well as the Software License Terms for Standard Software (SW-License) applicable to software products und software embedded in WAGO hardware products, both available at: www.wago.com.

In particular, the warranty is void when:
- The product is improperly used.
- The defect is based on (customer-)specific specifications (hardware and software configurations).

- Modifications of the hardware or software by the user or third parties were made that are not described in this documentation and are at least responsible for the occurrence of the defect.

Individual agreements always take precedence.

Obligations of the installer/operator

Installers and operators bear responsibility for the safety of an installation or a system assembled with the product.

The installer/operator is responsible for the proper installation and the safety of the system. It must comply with the laws, standards, guidelines, local regulations, the state and the rules of technology applicable at the time of installation and must observe the guidelines and instructions described in the operating instructions. The installation requirements of the approvals must also be met.

In the event of non-compliance, operation of product within the scope of the approval is not permitted.

1.2 Typographical Conventions

Number Notation

100	Decimals: Normal notation
0x64	Hexadecimals: C-notation
'100'	Binary: In single quotation marks
'0110.0100'	Nibbles separated by a period

Text Markups

italic	Names of paths or files
bold	Menu items, entry or selection fields, emphasis
`Code`	Excerpts from program code
>	Selection of a menu point from a menu
"Value"	Value entries
[F5]	Identification of buttons or keys

Links

	Link to a topic in a document
	Link to a separate document
	Link to a website
	Link to an email address
Glossary	Link to a glossary entry

Sequence of Action

✓ This symbol identifies a precondition.

1. Action step

2. Action step

   ⇨ This symbol identifies an intermediate result.

➡ This symbol identifies the result of an action.

- Individual action step

Lists

- Lists, first level
  – Lists, second level

Figures

Figures in this documentation are for better understanding and may differ from the actual product design.

Warning Messages

⚠ DANGER

Type and source of hazard

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

- Action step to reduce risk

⚠ WARNING

Type and source of hazard

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

- Action step to reduce risk

⚠ CAUTION

Type and source of hazard

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

- Action step to reduce risk

NOTICE

Type and source of malfunction (property damage only)

Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

- Action step to reduce risk

Information Notices

Note

Information

Indicates information, clarifications, recommendations, referrals, etc.

1.3 Legal Information

Intellectual property

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Third-party products are always mentioned without any reference to patent rights. WAGO GmbH & Co. KG, or the manufacturer of third-party products, retains all rights regarding patent, utility model or design registration.

Third-party trademarks are referred to in the product documentation. The "®" and "™" symbols are omitted hereinafter. The trademarks are listed in the Appendix: **Protected Rights [▸ 106]**.

Subject to Change

The instructions, guidelines, standards, etc., in this manual correspond to state of the art at the time the documentation was created and are not subject to updating service. The installer and operator bear sole responsibility to ensure they are complied with in their currently applicable form. WAGO GmbH & Co. KG retains the right to carry out technical changes and improvements of the products and the data, specifications and illustrations of this manual. All claims for change or improvement of products that have already been delivered – excepting change or improvement performed under guarantee agreement – are excluded.

Licenses

The product contains open-source software. The requisite license information is saved in the product. This information is also available under **www.wago.com**.

2 Safety

This section presents hazards that could occur if the product is used. Builders and operators must take all hazards into account when analyzing the risk of their installed systems. Measures to reduce the risk of hazards that are foreseeable from the manufacturer's point of view (i.e., without knowledge of the specific system built) are explained in the respective sections of this documentation (e.g., in "Planning").
Builders and operators must implement explained risk reduction measures and also take their own measures depending on the residual risk.

2.1 General Safety Regulations

- This documentation is part of the product. Therefore, retain the documentation during the entire service life of the product. Pass on the documentation to any subsequent user of the product. In addition, ensure that any supplement to this documentation is included, if necessary.
- The product must only be installed and put into operation by qualified electrical specialists per EN 50110-1/-2 and IEC 60364.
- Set up permissions management for authorized persons.
  - Physical access may only be made by authorized persons.
  - Digital access may only be made by authorized persons.
- Comply with the laws, standards, guidelines, local regulations and accepted technology standards and practices applicable at the time of installation.

2.2 Electrical Safety

- Hazardous electrical voltage can cause electric shock or burns! Always disconnect all power supplies from the products before mounting, installing, troubleshooting or performing maintenance.
- Make sure the product does not carry any voltage before starting work.

Power Supply

- For non-hazardous live voltages, use SELV/PELV power supplies in accordance with EN/UL/IEC 61010-1.
- Connecting impermissible current or frequency values may destroy the products.

Grounding/Protection/Fuses

- Establish sufficient grounding. Make sure there is a flawless electrical connection between the DIN-rail and frame / additional enclosure.
- When handling the product, please ensure that environmental factors (personnel, work space and packaging) are properly equalized. Do not touch any conducting parts.
- In systems operated within the scope of UL, only use UL-approved fuses.
- Provide a suitable disconnect mechanism and overcurrent protection on the system side. The disconnect mechanism must be located near the product where it can be operated and be clearly associated with the product. The **OFF** position of the disconnect mechanism must be clearly marked.

Cables

- To minimize interference (e.g., by electromagnetic interference), maintain a spatial separation between control, signal and data lines and the power supply lines.
- Always design the connection cables for the maximum anticipated current load.
- High currents and the inherent head generated by the product can cause additional heat generation at the clamping point. Plan for a correspondingly higher temperature range for the connecting cables, or reduce inherent heat by selecting larger conductor cross-sections.
- Only one conductor may be connected to each connection point (e.g., CAGE CLAMP® connection).

Protection

- When working on the system (e.g., during maintenance), protect the facility part in question from accidental or unauthorized restart.

2.3 Mechanical Safety

- Do not open the product housing.
- Before startup, please check the product for any damage that may have occurred during shipping. Do not put the product into operation in the event of mechanical damage.

2.4 Thermal Safety

- The temperature inside the additional enclosure must not exceed the ambient temperature permitted for the mounted products.

2.5 Indirect Safety

- Do not use any contact spray for cleaning.
- Only use a dry or cloth or a clothed dampened with water to clean the product. Do not use cleaning agents, e.g., abrasive cleaners, alcohols or acetone.
- The products are not resistant to materials having seeping and insulating properties such as aerosols, silicones and triglycerides (found in some hand creams). If these substances occur in the environment of the products, install the products in an additional housing that is also resistant to these substances.
- Replace any defective or damaged devices.
- Only use accessories authorized by WAGO.

3 Properties

3.1 Overview

The product allows measurement of electrical data in a 3-phase supply network. Based on these input signals, the product determines various measured variables, such as voltage and current, reactive, apparent and active power, energy consumption, power factor, phase angle and frequency.

When specific requirements are met, the voltages of the three phases can be directly measured; the currents must be measured via LVCT (for more information, see **Power Measurement [▸ 53]**). On the basis of these input signals, the power measurement module determines the various AC measured quantities, such as voltage and current, reactive, apparent and active power, energy consumption, power factor, phase angle and frequency. Also, harmonic analysis is possible for a selectable phase up to the 41st harmonic.

The product provides the measured values via an RS-485/Modbus RTU serial interface. Thus, the measured values can also be transferred to a higher-level controller (e.g., WAGO EDM 2.0). This enables a comprehensive analysis of the three-phase network. These measured values allow the operator optimized control of the supply to a drive or machine, protecting the system from damage and failure. In addition, a line structure configuration ("Daisy Chain Configuration") can be facilitated via a second RJ-45 interface.

The product can be used in the following network topologies:

- 4-wire three-phase network (4-L)
- 3-wire three-phase network (3-L)
- 2-wire network (2-L)

3.2 View

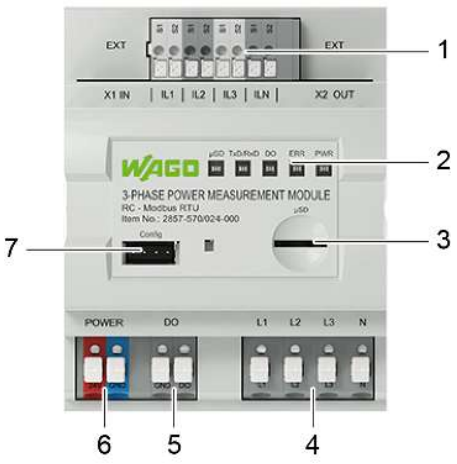


Figure 1: Front View

Pos.	Designation	Details
1	Current measurement inputs for Low Voltage Current Transformer (LVCT) with basic insulation	**Measurement Inputs [▸ 13]**
2	Status and Error LEDs	**Indicators [▸ 17]**
3	Memory card slot "µSD"	Memory Card Slot "µSD" for Micro SD Cards

Pos.	Designation	Details
4	Voltage measurement inputs	Measurement Inputs [▸ 13]
5	Switch output "DO"	Switch Output "DO" and S0 Interface
6	Supply connection "POWER"	Supply Connection "POWER"
7	Configuration interface "Config"	Configuration interface "Config"

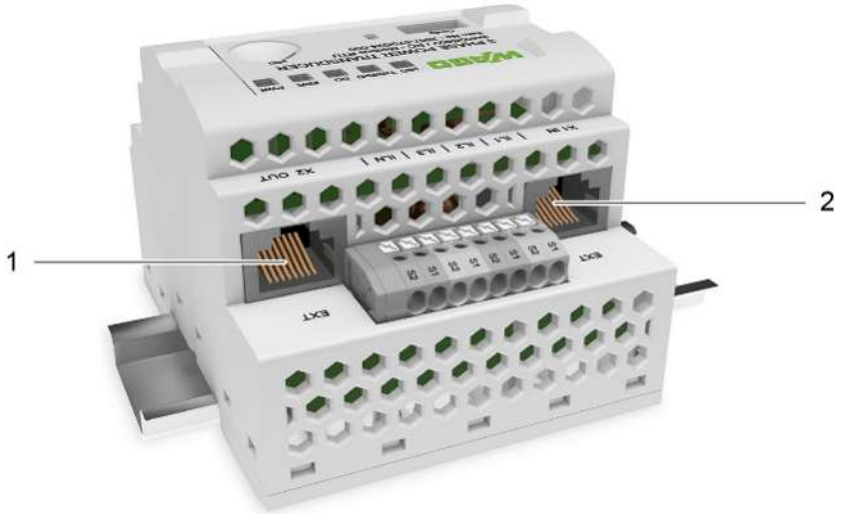


Figure 2: View from above

Pos.	Designation	Details
1	Modbus RTU interface "X2 OUT"	Modbus-RTU interface "X1 IN" and "X2 OUT"
2	Modbus RTU interface "X1 IN"	Modbus-RTU interface "X1 IN" and "X2 OUT"

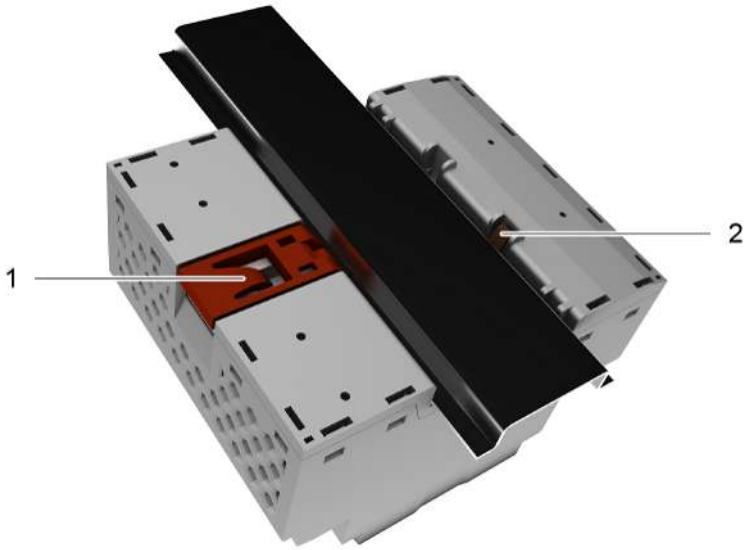


Figure 3: View from below

Pos.	Designation	Details
1	Snap-in mounting foot	Installation and Removal [▸ 63]
2	Spring contact for functional ground	Functional Earth Connection [▸ 16]

See also

- Installation and Removal [▸ 63]

3.3 Connectors

3.3.1 Measurement Inputs

Current measurement inputs

IL1 … ILN – terminals respectively marked with S1 and S2 – are the inputs for current measurement. The Low Voltage Current Transformer (LVCT) with basic insulation are connected here.

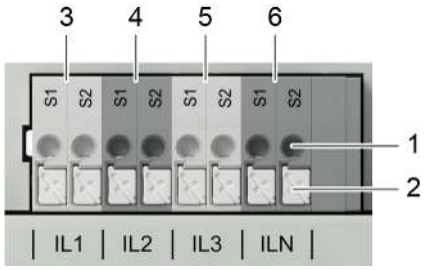


Figure 4: Measurement inputs for current measurement

Pos.	Designation	Connection	Description
1	Test slot for associated CAGE CLAMP® connection		
2	Push-button		Push-button to open the associated Push-in CAGE CLAMP®
3	IL1-S1	LVCT L1	Input for current measurement L1
	IL1-S2		
4	IL2-S1	LVCT L2	Input for current measurement L2
	IL2-S2		
5	IL3-S1	LVCT L3	Input for current measurement L3
	IL3-S2		
6	ILN-S1	LVCT N	Input for current measurement N
	ILN-S2		

Voltage measurement inputs

L1 … N – terminals marked accordingly – are the voltage measurement inputs. Up to four wires of the network to be measured are connected here.

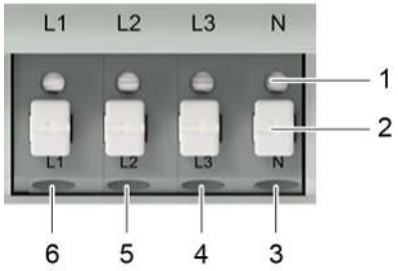


Figure 5: Measurement inputs for voltage measurement

Position	Designation	Connection	Description
1	Test slot for associated CAGE CLAMP® connection		
2	Push-button		Push-button to open the CAGE CLAMP®
3	N	Neutral conductor N	Reference potential for current and voltage
4	L3	Conductor L3	Input for voltage measurement L3
5	L2	Conductor L2	Input for voltage measurement L2
6	L1	Conductor L1	Input for voltage measurement L1

3.3.2 Switch Output "DO" and S0 Interface

With switch output "DO", whether the input signal exceeds or falls below the threshold values can be reported. If it does, the output is set to +24 VDC and delivers a maximum current of up to typ. 1 mA. Then e.g., an LED can be actuated.

More detailed information at:

- "Threshold Over-/Underruns"
- "Energy Value Readout at the S0 Interface"

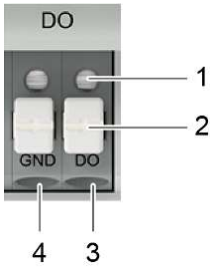


Figure 6: Switch Output "DO" and S0 Interface

Position	Designation	Connection	Description
1	Test slot for associated CAGE CLAMP® connection		
2	Push-button		Push-button to open the CAGE CLAMP®
3	DO	LEDs, relays etc.	Digital output, 24 VDC (switch output) or S0 interface
4	GND	Ground	Digital output, Ground (GND) or S0 interface

Note

Either switch output or S0 interface!

Please note that either "DO" or S0 interface can function as switch output at a time!
Both functions cannot be used simultaneously!

To read out the energy values, switch output "DO" can be configured as an S0 interface with the WAGO Interface Configuration Software. However, the same "DO" and "GND" connections are used.

3.3.3 Modbus-RTU interface "X1 IN" and "X2 OUT"

Table 1: Communication – Modbus RTU

Property	Value
Interface	RS-485 (2-wire) via 2 × RJ-45 connector
Number of subscribers (max.)	32
Addressing	Via interface configuration software

The interfaces correspond to RS-485 are equipped as RJ-45 ports. The shielding is directly connected to FE (functional earth).

Table 2: Pin Assignment Modbus interface "X1 IN" and "X2 OUT"

Pin Assignment Modbus interface "X1 IN" and "X2 OUT"	
Pin contact (X1; X2)	**Assignment**
1	N. C.
2	N. C.
3	N. C.
4	A (Data +)
5	B (Data -)
6	N. C.
7	N. C.
8	Common

To form a line structure, two interfaces are internally bridged. See the figure below:

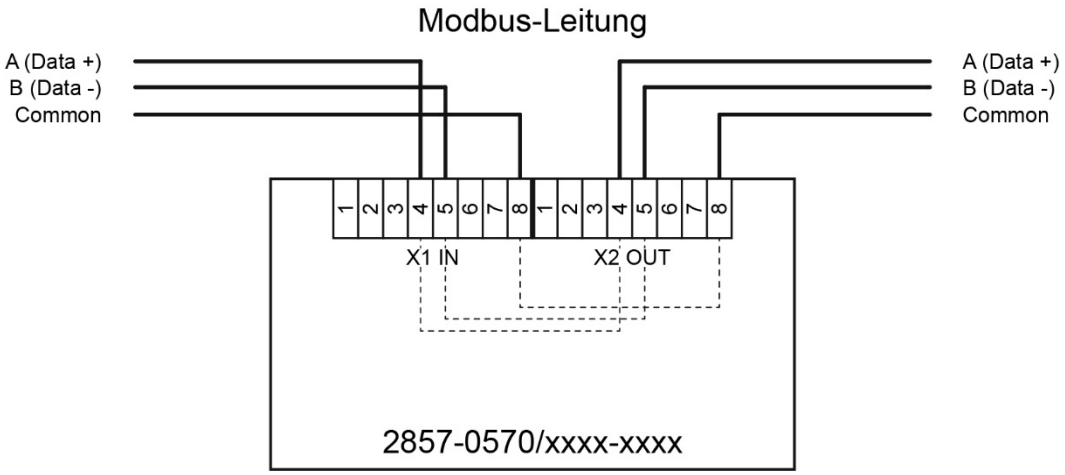


Figure 7: Power Measurement Module on Modbus

3.3.4 Configuration interface "Config"

A WAGO USB Communication Cable (Art.-Nr. 750-923) can be connected here.

To configure the power measurement module for visualizing measured values as the power is measured and for firmware updates, an engineering PC with the WAGO Interface Configuration Software is used.

Communication via the power measurement module and the PC is via the interface “Config” on the front side. This interface is designed as a 4-pin header used specifically for WAGO communication solutions.
The operating system recognizes the communication cable as a virtual COM port.

Figure 8: Configuration interface "Config"

3.3.5 Supply Connection "POWER"

An SELV with 24 VDC must be connected at the supply connection “POWER.”
The terminals are the Push-in CAGE CLAMP® design with pushers and have a test slot.

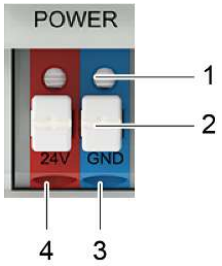


Figure 9: Power

Position	Designation	Connection	Description
1	Test slot for associated CAGE CLAMP® connection		
2	Push-button		Push-button to open the CAGE CLAMP®
3	GND	Ground	Digital output, Ground (GND) or S0 interface
4	24 V	Supply Voltage +24 VDC	SELV

3.3.6 Memory Card Slot “µSD” for Micro SD Cards

There is a slot for micro SD cards on the front of the power measurement module. A push/push mechanism locks the memory card in the housing.

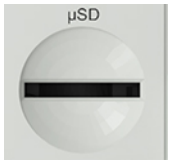


Figure 10: Memory Card Slot

3.3.7 Functional Earth Connection

The functional earth connection is established automatically via the DIN-rail contact when it is snapped onto the rail.

3.4 Indicators

Table 3: LEDs and Error Indication

LED Display			Explanation
"PWR" LED is illuminated.			Power supply is connected.
"PWR" LED is flashing and "ERR" LED is illuminated.		4 Hz	Firmware loader enabled/loading/waiting for upload.
"µSD" LED is flashing.			The memory card is being written.
"TxD/RxD" LED is flashing.			Modbus RTU is enabled.
"DO" LED is illuminated.			DO is enabled.
"PWR" LED and "ERR" LED flash alternately.			Firmware Upload
"ERR" LED is flashing.		2 Hz	**Transient state active:** Measured values not yet stable **Transient state ended:** Theshold values exceeded or undershot
"ERR" LED is flashing.		8 Hz	Tamper Detect (fault current detection)
"ERR" LED is illuminated.			Group error message

3.5 Circuit Diagram

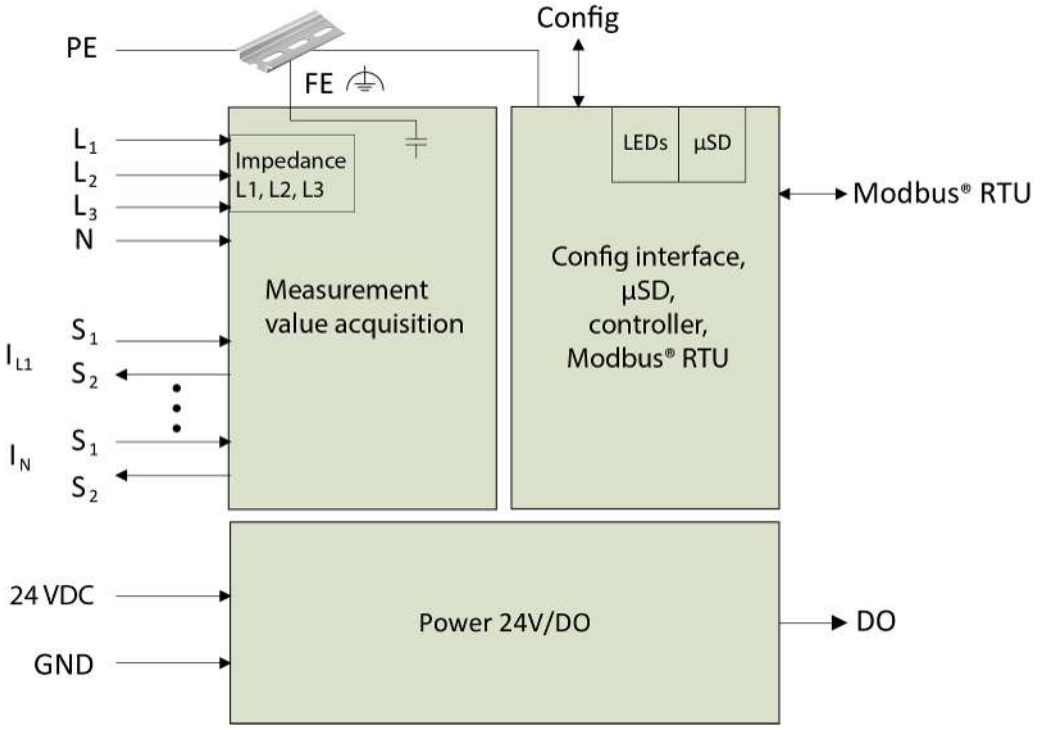


Figure 11: Schematic Circuit Diagram

The areas:

- Measurement value acquisition,
- configuration interface, µSD, controller, Modbus RTU and
- Power 24 V/DO

are electrically isolated from each other.

The N connection is capacitively connected to the mounting rail via the spring contact to enable functional grounding.

3.6 Technical Data

3.6.1 Product

Table 4: Technichal Data – Product

Property	Value
Width	72 mm
Height	90 mm
Depth from upper edge of DIN-rail	55 mm
Weight	117.6 g
Degree of protection	IP20

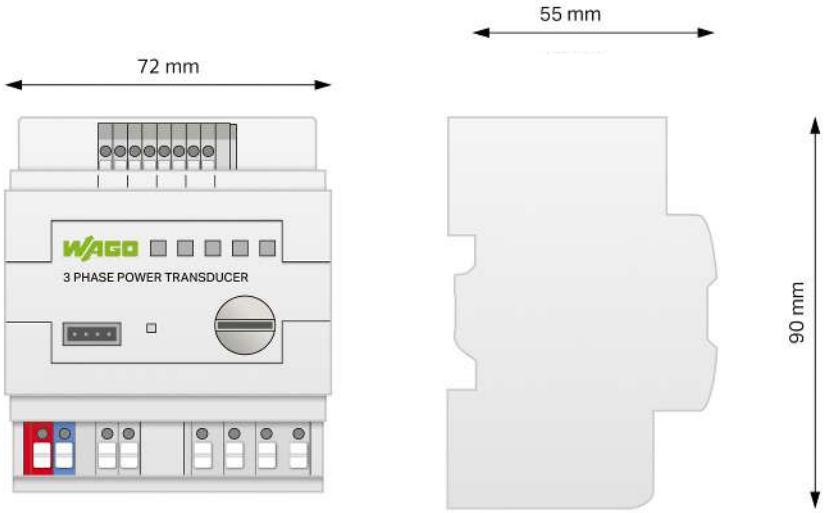


Figure 12: Dimensions

3.6.2 Input

Table 5: Technical Data – Power Supply

Property	Value
Supply Voltage	SELV 24 VDC (± 30 %)
Current consumption	< 50 mA + I_{DO} [1)]
[1)] The output current I_{DO} from the digital output DO must also be taken into account for the power consumption.	

Table 6: Technical Data – Measurement Inputs

Property	Value
Number of inputs	▪ 3 voltage measurement inputs ▪ 4 differential current measurement inputs
Standard Voltage measurement range (rms) AC ▪ Phase voltage U_{Lx-N} ▪ Line-to-line voltage U_{Lx-Ly}	 ▪ 70 … 277 VAC ▪ 120 … 480 VAC
Voltage measurement range	▪ 4-wire 3-phase network (4-L) max. 277 / 480 VAC ▪ 3-wire 3-phase network (3-L) unearthed max. 480 VAC ▪ 3-wire 3-phase network (3-L) earthed max. 240 VAC ▪ 2-wire networkwerk (2-L) max. 240 VAC
Measurement category	CAT III

Property	Value
Resolution	100 mV
Input resistance, typ. (Voltage inputs)	1429 kΩ
Current measurement range (rms) AC	Depends on the used LVCT, max. 65535 A
Resolution	typ. 1 mA
Input resistance, typ. (current inputs)	44 kΩ
Frequency range ▪ Line frequency ▪ Harmonic analysis	▪ 50 … 60 Hz ▪ 0 … 2665 Hz
Limit frequency	15.9 kHz
Signal form	Arbitrary periodic signals (with limit frequencies taken into account)
Test voltage	3.51 kVAC; 50 … 60 Hz; 1 Minute

Table 7: Technical Data – Isolation type per EN/UL 61010-2-201 and EN/UL 61010-2-030

Property	Value
Measurement inputs / system	
System voltage U_{LN} [2)]	≤ 300 V
Input requirement I_{Lx}	Low Voltage Current Transformer (LVCT) with basic insulation
Isolation type	Reinforced insulation
Overvoltage category	III
Measurement category	CAT III
Adjacent modules	
System voltage U_{LN} [2)]	≤ 300 V
Isolation type	Reinforced insulation
Overvoltage category	III
[2)] The system voltage is derived from the line-to-neutral voltage for common mains supply systems and is used for determining insulation coordination.	

3.6.3 Special Requirements for Measurements with Higher Voltages outside the scope of UL

Note

Above 300 V system voltage ratings are not permissable for UL!

Thus the following requirements for Measurements with Higher voltages without Voltage Measurement Transformer (VT) are outside the scope of UL.

The following information applies to voltages U_{Lx-N} 400 VAC and U_{Lx-Ly} to 690 VAC (see **Overview "Common Mains Supply Systems and Line Voltages" [▸ 101]**), when the N port of the product is not used.

Table 8: Technical Data – Measurements with Higher Voltages

Property	Value
Nominal voltage [3)]	
▪ Phase voltage U_{Lx-N}	400 VAC
▪ Line-to-line voltage U_{Lx-Ly}	690 VAC
Test voltage	3.51 kVAC; 50 … 60 Hz; 1 Minute
Isolation type per EN 61010-1	
Measurement inputs / system	

Property	Value
Isolation type	Impedance and supplementary Insulation
N port requirement	Not connected/occupied
I_{LX} input requirement	Low Voltage Current Transformer (LVCT) with basic insulation
Line/neutral conductor voltage	600 VAC
Overvoltage category	III
Adjacent modules	
Isolation type	Impedance and supplementary Insulation
Line/neutral conductor voltage	600 VAC
Overvoltage category	III
[3] See Overview "Common Mains Supply Systems and Line Voltages" [▸ 101].	

3.6.4 Measured Variables

Table 9: Technical Data – Measured Variables

Eigenschaft	Description
Measurement method	▪ A/D input signal conversion with 8 Hz sampling rate and 24-bit quantization synchronized over all 7 measurement inputs. ▪ Measurement value calculation with digital signal processor.
Measured variables	
Voltage	▪ Voltage (rms) $U_{Lx–N}$ ▪ Min./Max. Voltage (rms) $U_{Lx–N}$ ▪ Arith. average value Voltage $U_{Lx–N}$ ▪ Peak value Voltage $U_{Lx–N}$ ▪ Line-to-line voltage (rms) $U_{Lx–Ly}$
Current	▪ Current (rms) I_{Lx} ▪ Min./Max. Current (rms) I_{Lx} ▪ Arith. average value Current I_{Lx} ▪ Peak value Current I_{Lx} ▪ Current (rms) N
Power	▪ Active power P_{Lx} ▪ Min./Max. Active power P_{Lx} ▪ Active power total ▪ Reactive power P_{Lx} ▪ Reactive power total ▪ Apparent power P_{Lx} ▪ Apparent power total

Eigenschaft	Description
Energy	▪ Active energy E_{Lx} ▪ Active energy import E_{Lx} ▪ Active energy export E_{Lx} ▪ Active energy total ▪ Active energy import total ▪ Active energy export total ▪ Reactive energy E_{Lx} ▪ Reactive energy inductive E_{Lx} ▪ Reactive energy capacitive E_{Lx} ▪ Reactive energy total ▪ Reactive energy inductive total ▪ Reactive energy capacitive total ▪ Apparent energy L_x
Frequency	▪ Line frequency f_{Lx} ▪ Min./Max. Line frequency f_{Lx}
Phase angle	▪ phi L_x
Power factor (PF)	▪ Cos phi PF_{Lx} ▪ Power factor PF_{Lx} ▪ Power factor PF_{Lx}
Harmonics analysis up to 41st harmonic	▪ Current (rms) ▪ Voltage (rms) ▪ HD/THD Current ▪ HD/THD Voltage
Measurement accuracy	
Voltage [5]	≤ 0.3 % of measurement range final value (max. Value)
Current	≤ 0.5 % of measurement range final value (max. Value)
Active power	≤ 0.5 % of measurement range final value (max. Value)
Phase angle	±1.0°
Frequency	±0.01 Hz
Harmonic analysis measurement values	≤ 1 %
[5] Refers to: U_{Lx-Ly} 690 V / U_{Lx-N} 400 V.	

3.6.5 Communication

Table 10: Technical Data – Communication

Property	Description	Factory setting
Fieldbus protocol	Modbus RTU/RS-485	
Bus length	Max. 1200 m (depending on transmission rate)	
Communication interfaces "X1 IN" and "X2 OUT"	2 × RJ-45 ports for forming daisy chain configuration	
Configuration interface "Config"	4-pole male terminal, serial, for configuring and visualizing the measurement value with PC via communication cable (Art.-Nr. 750-923)	
Data logging	With micro SD memory cards.	

Property	Description	Factory setting
Transmission parameter [6]		
Bus address	1 … 277	1
Transmission parameter	9600 Baud 19200 Baud	19200 Baud
Number of data bits	8	
Number of stop bits	0.5; 1; 2; 2.5	1
Parity	None; Even; Odd	Even
Bus termination	150 Ω; 120 Ω/1 nF; None	None
[6] Configurable via service interface.		

3.6.6 Wiring

⚠ CAUTION

Inadequate wire cross sections cause temperature increases!

To avoid increasing thermal risks and risk of injury, only use conductor cross-sections sufficient for the required maximum load current. The conductor cross-sections specified in the technical data refer exclusively to the mechanical connection capacity of the clamping points.

Table 11: Technical Data, Wiring – Expected Environmental Temperature for Connecting Cables

Use in the scope	Temperature of the connecting cables
EN 61010-1	≤ 25 K above the expected max. environmental temperature
UL 61010-1	≥ 95 °C

Table 12: Technical Data – Wiring: WAGO Clamp Series 804

WAGO Clamp Series 804	
Voltage Measurement Inputs; **Supply connection**;**Switch output**	
Connection technology	Push-in CAGE CLAMP® with Push-button
Solid "s"	0,25 … 2,5 mm² / 20 … 12 AWG
Fine-stranded "f"	0,25 … 2,5 mm² / 20 … 12 AWG
Strip length	10 … 11 mm / 0,39 … 0,43 in

Table 13: Technical Data – Wiring: WAGO Clamp Series 805

WAGO Clamp Series 805	
Current Measurement Inputs	
Connection technology	Push-in CAGE CLAMP® with Push-button
Solid "s"	0,2 … 1,5 mm² / 24 … 16 AWG
Fine-stranded "f"	0,2 … 1,5 mm² / 24 … 16 AWG
Strip length	9 … 10 mm / 0,35 … 0,39 in

3.6.7 Mechanical Conditions

Observe installation instructions regarding vibration resistance.

Vibration resistance	Maximum 0,7 g

3.6.8 Environmental Requirements

Table 14: Technical Data – Environmental Requirements

Property	Value
Ambient temperature, operation	–40 … +70 °C
Ambient temperature, storage	–40 … +85 °C
Protection type	IP20
Operating altitude (max.)	2000 m

3.6.9 Guidelines, approvals and standards

The applicable guidelines, approvals and standards for the product can be found on the product detail page at: **www.wago.com/2857-570/024-009**.

4 Functions

4.1 Functions Overview

The product supports three operating modes:

- Current Measurement
- Voltage Measurement
- Power Measurement

4.2 Measurement Principle

The power measurement module uses seven A/D converters to capture the current and voltage values of all three phases and the current in the neutral conductor.

4.3 Measured Value Overview

The power measurement module provides the measured AC values of these measured variables per phase (L_x, L_y = L1, L2 or L3).
However, depending on the network topology, not all measured values are always calculated. For more information, see Communication per Modbus RTU.

Table 15: Measured Value Overview – Voltage

Measured Value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
RMS Voltage L1-N	X	–	–	X
RMS Voltage L2-N	X	–	–	–
RMS Voltage L3-N	X	–	–	–
Max. RMS Voltage L1-N	X	–	–	X
Max. RMS Voltage L2-N	X	–	–	–
Max. RMS Voltage L3-N	X	–	–	–
Min. RMS Voltage L1-N	X	–	–	X
Min. RMS Voltage L2-N	X	–	–	–
Min. RMS Voltage L3-N	X	–	–	–
RMS Voltage L1-L2	X	X	X	–
RMS Voltage L1-L3	X	X	X	–
RMS Voltage L2-L3	X	X	X	–
Arith. average value Voltage L1-N	X	–	–	X
Arith. average value Voltage L2-N	X	–	–	–
Arith. average value Voltage L3-N	X	–	–	–
Peak value Voltage L1-N	X	–	–	X

Measured Value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
Peak value Voltage L2-N	X	–	–	X
Peak value Voltage L3-N	X	–	–	X

Table 16: Measured Value Overview – Current

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
RMS Current L1	X	X	X	–
RMS Current L2	X	X	X	–
RMS Current L3	X	X	X	X
Max. RMS Current L1	X	X	X	X
Max. RMS Current L2	X	X	X	–
Max. RMS Current L3	X	X	X	–
Min. RMS Current L1	X	X	X	X
Min. RMS Current L2	X	X	X	–
Min. RMS Current L3	X	X	X	–
Arith. average value Current L1	X	X	X	X
Arith. average value Current L2	X	X	X	–
Arith. average value Current L3	X	X	X	–
Peak value Current L1	X	X	X	X
Peak value Current L2	X	X	X	X
Peak value Current L3	X	X	X	X
RMS Current N	X	–	–	X

Table 17: Measured Value Overview – Power

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
Active power L1	X	X	X[1)]	X
Active power L2	X	–	X[1)]	–
Active power L3	X	X	X[1)]	–
Max. value Active power L1	X	–	–	X
Max. value Active power L2	X	–	–	–
Max. value Active power L3	X	–	–	–
Min. value Active power L1	X	–	–	X
Min. value Active power L2	X	–	–	–
Min. value Active power L3	X	–	–	–
Reactive power L1	X	X	X[1)]	X
Reactive power L2	X	–	X[1)]	–
Reactive power L3	X	X	X[1)]	–

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
Apparent power L1	X	X	X[1)]	X
Apparent power L2	X	–	X[1)]	–
Apparent power L3	X	X	X[1)]	–

Table 18: Measured Value Overview – Energy

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
Active energy L1	X	–	–	X
Active energy L2	X	–	–	–
Active energy L3	X	–	–	–
Active energy import L1	X	–	–	X
Active energy import L2	X	–	–	–
Active energy import L3	X	–	–	–
Active energy export L1	X	–	–	X
Active energy export L2	X	–	–	–
Active energy export L3	X	–	–	–
Active energy total	X	X	X	X
Active energy import total	X	X	X	X
Active energy export total	X	X	X	X
Reactive energy L1	X	–	–	X
Reactive energy L2	X	–	–	–
Reactive energy L3	X	–	–	–
Reactive energy inductive L1	X	–	–	X
Reactive energy inductive L2	X	–	–	–
Reactive energy inductive L3	X	–	–	–
Reactive energy capacitive L1	X	–	–	X
Reactive energy capacitive L2	X	–	–	–
Reactive energy capacitive L3	X	–	–	–
Reactive energy total	X	X	X	X
Reactive energy inductive total	X	X	X	X
Reactive energy capacitive total	X	X	X	X
Apparent energy L1	X	–	–	X
Apparent energy L2	X	–	–	–
Apparent energy L3	X	–	–	–

Table 19: Measured Value Overview – Limit frequency

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
Line frequency L1	X	X	X	X
Line frequency L2	X	–	–	–
Line frequency L3	X	X	–	–
Max. Line frequency L1	X	X	X	X
Max. Line frequency L2	X	–	–	–
Max. Line frequency L3	X	X	–	–
Min. Line frequency L1	X	X	X	X
Min. Line frequency L2	X	–	–	–
Min. Line frequency L3	X	X	–	–

Table 20: Measured Value Overview – Phase angle phi

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
Phase angle phi L1	X	X	X	X
Phase angle phi L2	X	–	X	–
Phase angle phi L3	X	X	X	–

Table 21: Measured Value Overview – Power Factor

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
cos phi L1	X	–	–	X
cos phi L2	X	–	–	–
cos phi L3	X	–	–	–
Power factor PF L1	X	–	–	X
Power factor PF L2	X	–	–	–
Power factor PF L3	X	–	–	–
Power factor LF L1	X	–	–	X
Power factor LF L2	X	–	–	–
Power factor LF L3	X	–	–	–

Table 22: Measured Value Overview – Upper Harmonic L1

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
RMS Current L1	X	X	X	–
Fundamental component Current L1	X	X	X	X
Upper harmonic component Current L1, 1. ... 40. upper harmonic	X	X	X	X
Distortion Current L1	X	X	X	X
RMS Voltage L1	X	X	X	–

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
Fundamental component Voltage L1	X	–	–	X
Upper harmonic component Voltage L1, 1. ... 40. upper harmonic	X	–	–	X
Distortion Voltage L1	X	–	–	X

Table 23: Measured Value Overview – Upper Harmonic L2

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
RMS Current L2	X	X	X	–
Fundamental component Current L2	X	X	X	–
Upper harmonic component Current L2, 1. ... 40. upper harmonic	X	X	X	–
Distortion Current L2	X	X	X	–
RMS Voltage L2	X	X	X	–
Fundamental component Voltage L2	X	–	–	–
Upper harmonic component Voltage L2, 1. ... 40. upper harmonic	X	–	–	–
Distortion Voltage L2	X	–	–	–

Table 24: Measured Value Overview – Upper Harmonic L3

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
RMS Current L3	X	X	X	–
Fundamental component Current L3	X	X	X	–
Upper harmonic component Current L3, 1. ... 40. upper harmonic	X	X	X	–
Distortion Current L3	X	X	X	–
RMS Voltage L3	X	X	X	–
Fundamental component Voltage L3	X	–	–	–
Upper harmonic component Voltage L3, 1. ... 40. upper harmonic	X	–	–	–
Distortion Voltage L3	X	–	–	–

Table 25: Measured Value Overview – Total

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
Active power total	X	X	X	X
Reactive power total	X	X	X	X
Apparent power total	X	–	X	X

Measured value	4-wire threephase network	3-wire threephase network (ARON)	3-wire threephase network	2-wire network (1 phase network)
Rotary field	X	X	X	X
Power factor PF Total	–/X [1)]	–	–/X [1)]	–/X [1)]

Note

Meaning of "upper harmonic"

"First harmonic" refers to the vibration at the fundamental frequency (fundamental component), and "first upper harmonic" refers the vibration at twice the fundamental frequency. Therefore, in general, the nth harmonic corresponds to the (n-1)th upper harmonic.

4.4 Description of Measured Values

Calculation of Current and Voltage

The product calculates the **True RMS value** for the voltage and current per period applied at the measurement inputs. See figure below.

$$I_{eff} = \sqrt{\frac{1}{N}\sum_{k=0}^{N-1} i_k^{\,2}}$$

$$U_{eff} = \sqrt{\frac{1}{N}\sum_{k=0}^{N-1} u_k^{\,2}}$$

Figure 13:

- i_k: Sampling value of current
- u_k: Sampling value of voltage
- I_{eff}: RMS of current
- U_{eff}: RMS of voltage
- N: Number of sampling rate

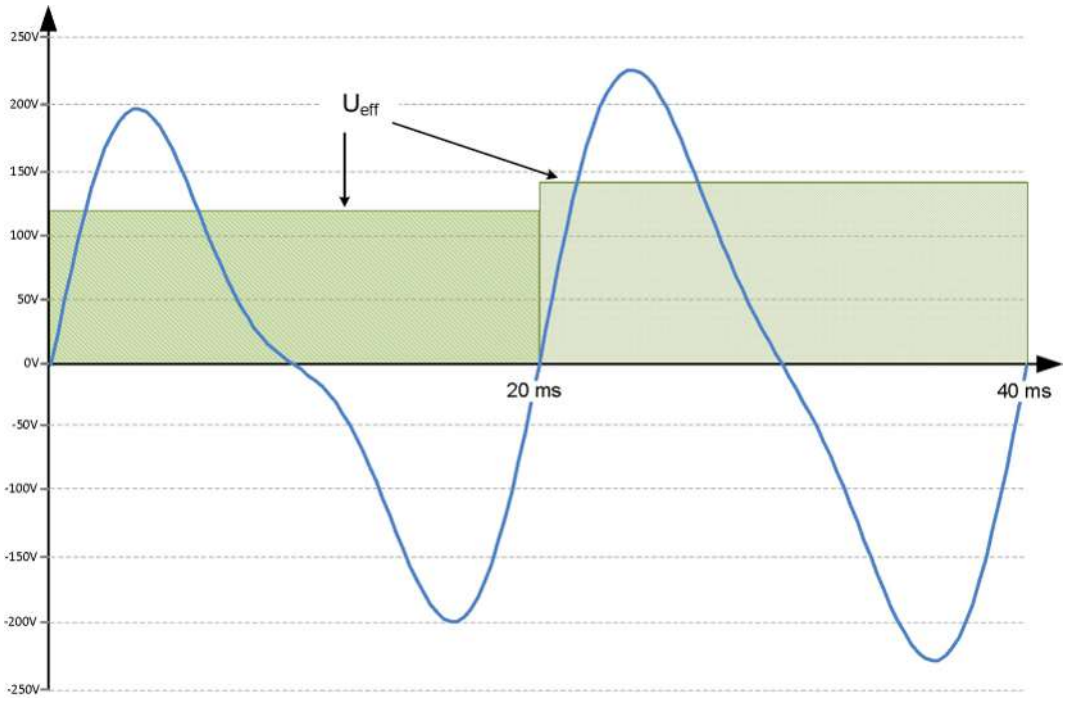


Figure 14: RMS Calculation (Example – Not to Scale)

The current and voltage RMS values are calculated for each period and refreshed every two periods (2T). In a 50 Hz power system, this corresponds to refresh rate of 40 ms.

The product is designed for measurements with a LVCT so high currents can be measured. The transformation ratios are parameterized and then taken into account when the measured values are calculated.

The**arithmetic mean value** for the phase current and voltage is calculated on the basis of the RMS values. The observation interval for which the mean value should be calculated can be set with the Interface Configuration Software or parameters 21, 22 and 23.

The **min. and max. RMS values** for the current and voltage are also determined over a configurable time interval.
A **reset interval** can be set with parameters 24, 25 and 26. This interval can be activated with parameter 2 (bits 8 ... 10).

Peak current and voltage values can also be recorded, for one selectable phase (L1 or L2 or L3). The observation interval can be set according to number of half-waves (Interface Configuration Software or parameters 11, 12 and 13).

Arith. average value, min./max. values and the peak value are not available for the neutral conductor current.

Calculation of line voltages $U_{Lx–Ly}$ is performed on the basis of the phase voltages and the corresponding phase angles.

Calculation of Power

Individual, synchronous sampling values for current and voltage are used for calculating active power (P). Phase shifts between the currents and voltages are taken into account in the power calculation. Positive values occur when the power is "exhausted" by a load, i.e., the current has a phase shift of –90° to +90° relative to the voltage (operation under load, quad-

rants I and IV). Negative values occur when the power is "fed in" by a generator, i.e., the current has a phase shift of 90° ... 270° relative to the voltage (generator operation, quadrants II and III).

Note

Check correct connection for negative power values

If you incorrectly measure negative power values, check whether you have connected the corresponding voltage transformer, current transformer, LVCT or Rogowski coil in the right direction.

Active power min. and max. values are determined over a configurable time interval.

In real networks, not all loads are purely resistive. Thus, currents and voltages are phase-shifted. However, this does not affect the method for determining the RMS values for current and voltage previously described. The power measurement module calculates both the reactive power (Q) and the apparent power (S) for each phase.

Calculation of Energy

Time-based integration of power yields the level of energy for each phase. The power measurement module provides the values for active, reactive and apparent energy. Values for the individual phases and an overall value are provided both for active and reactive energy. A distinction can also be drawn between import and export of active energy and capacitive and inductive reactive energy (see figure below).

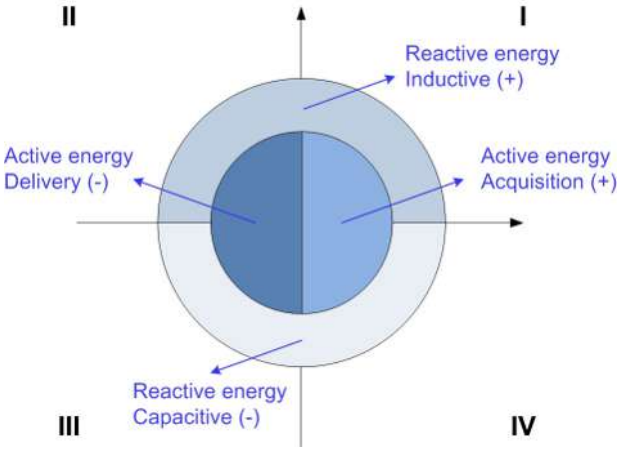


Figure 15: Assignment of Active and Reactive Energy in the Four Quadrants

The values of all energy meters are saved in the I/O module. They work internally in the resolutions Wh, varh or VAh (software version 3.0 or higher: kWh, kvarh or kVAh) and for Rogowski coils in the resolutions kWh, kvarh or kVAh. The values can be set via the Interface Configuration Software.

The power measurement module also offers the option set NOLOAD threshold values ("response thresholds") for the energy measurement; i.e., as soon as these values are underrun. This can be applied to keep creepage currents from flowing into the energy metering. Variables such as phase angle and effective, apparent and reactive power, are configurable via DIP switch or interface configuration software. This gives you the option of not allowing

creepage currents that are inherent in the system to flow into the energy metering.
For each phase, active, reactive and apparent power can be determined individually via the Interface Configuration Software or parameters 27, 28 and 29.

Determining the Frequency

The phase frequencies are calculated using zero crossing detection of the sampled signals for each phase. The min. and max. frequencies are determined over a configurable time period (scd or parameters 24, 25, and 29).

Harmonic Analysis

Note

Meaning of "upper harmonic"

"First harmonic" refers to the vibration at the fundamental frequency (fundamental component), and "first upper harmonic" refers the vibration at twice the fundamental frequency. Therefore, in general, the nth harmonic corresponds to the (n-1)th upper harmonic.

The product calculates the frequency spectrum for the periodic input signals and analyzes the fundamental component and the first to the 40th upper harmonics for each phase, i.e. the first to the 41st harmonic of one phase. Then the other two phases can be analyzed.

The product always yields the RMS values for current and voltage of the fundamental component for the selected phase. It also provides the total harmonic distortion (THD) for current and voltage.

From the 40 upper harmonics, 3 can be selected and analyzed at the same time. The RMS value for current and voltage is calculated for each selected upper harmonic, along with the harmonic distortion (HD). The 3 upper harmonics can be freely selected, e.g., 4, 12 and 19, or 2, 35 and 40.

Calculation of Power Factors

The power factor **cos phi** is the cosine of the phase angle between voltage and current for the specific phase. Calculation of the power factor only takes into account the phase shifting of the fundamental components of voltage and current. The sign of "cos phi" indicates the following:

- Positive (plus) sign: Import of active power from the network
- Negative (minus) sign: Export of active power to the network

The **power factor PF** is the quotient of the active power (P) and apparent power (S) and takes the entire spectrum into account, i.e., the fundamental component and the upper harmonics.

$PF = P / S$

- Positive (plus) sign: Import of active power from the network
- Negative (minus) sign: Export of active power to the network

The **power factor LF** is the quotient of the amount for active power (P) and apparent power (S), multiplied by the sign of the reactive power (Q), and takes the entire spectrum into account, i.e., the fundamental component and the upper harmonics:

$LF = sign\ Q \cdot |P| / S$

- Positive (plus) sign: Positive reactive power
- Negative (minus) sign: negative reactive power

Note

Jump of power factor LF from +1 to -1

The LF value can jump between +1 and -1 when reactive power is very low. This behavior occurs as a result of digitalization noise.

The 4-quadrant representation has the following form:

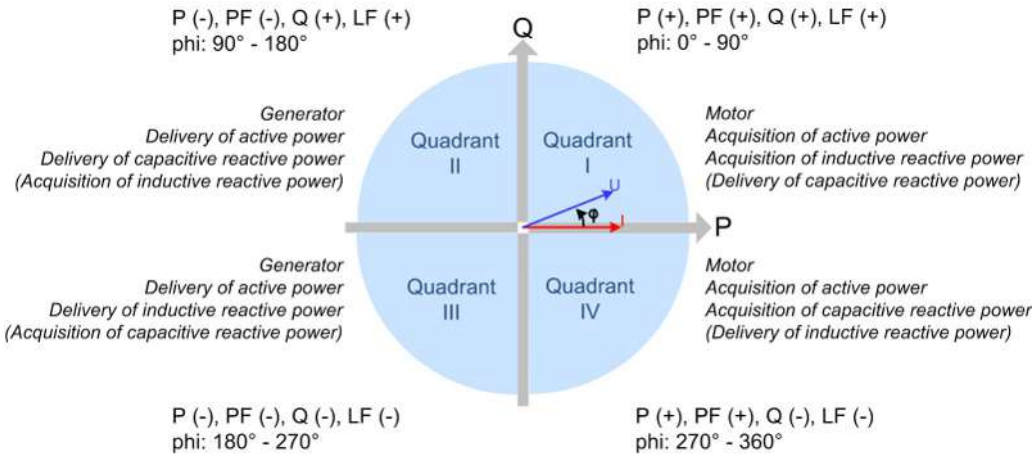


Figure 16: 4-Quadrant Representation of Active and Reactive Pow er

The four-quadrant display is also presented in the Interface Configuration Software. For more information, see "Configuration with the Interface Configuration Software."

Phase Angle

The phase angle between voltage and current is calculated for each phase using time-synchronous sampling. The phase angle is indicated in degrees.

Rotary Field Detection

The zero crossings of the voltage characteristics for the three phases are monitored by rotary field detection. The direction of rotation of a motor or machine can only be determined when the phase sequence L1–L2–L3 at the power measurement module has been connected the same way as at the motor and when the motor corresponds to the guidelines of VDE 0530-8 or DIN EN 60034-8 with regard to "Terminal designations and direction of rotation" (L1 on Uengine, L2 on V engine, L3 on W engine). Phase sequence L1–L2–L3 signals clockwise rotation; a reversed phase sequence signals counterclockwise rotation. Caution: It is not possible to detect double reversing.

Tamper Detect (fault current detection)

The "Tamper Detect" function can be used to detect fault currents resulting from defective machines and equipment. In a three-phase supply network, the following holds in the fault-free state: The sum of the instantaneous values of the line currents corresponds to the current in the neutral conductor. Therefore, the power measurement module calculates the sum of the instantaneous values of the line currents:

$$i_{SUM\,Lx}(t) = i_{L1}(t) + i_{L2}(t) + i_{L3}(t)$$

and subtracts the instantaneous value $i_N(t)$ of the neutral conductor current from this sum in a time-synchronous manner. This yields the fault current:

$i_{SUM\ Lx}(t) - i_N(t)$

If this is greater than the set threshold, (parameter 20), the overrun is signaled by the flashing red LED "ERR" and the switch output "D0."

Note

Current converter with "Tamper Detect" function!

For correct use of the "Tamper Detect" function, the current converters in all measurement paths must be of the same type.

4.5 Threshold Over-/Underrun

The power measurement module offers a threshold value monitoring function. For each phase, threshold values (limiting values) can be set for:

- Undervoltage,
- Overvoltage,
- Overcurrent
- Tamper Detect

parameters 3, 4, 5 for undervoltage, 14, 15, 16 for overvoltage, 17, 18, 19 for overcurrent, 20 for Tamper Detect).

These states are signaled by the flashing red "ERR" LED and switch output "DO" as a group error message:

- **U_{DO} alternating:** 24 VDC at switch output.
- **GND alternating:** 0 VDC at switch output.

4.6 Measurement accuracy

The influence of the measurement accuracy are listed here: **Measured Variables [▸ 20]**.

However, the values indicated only apply if the following conditions are met:

1. The measurement signals must be within the permitted limits specified in the technical data.
2. The Line frequency must be between 45 ... 65 Hz.

4.7 Communication per Modbus RTU

Register communication with the master (higher-level PLC) is per the "Modbus RTU" protocol. Three Modbus functions are implemented for this:

- 0x03 Read Holding Registers (read product parameters)
- 0x04 Read Input Registers (read measured values))
- 0x10 Write Multiple Registers (write produvt parameters)

The physical interfaces per RS-485 are the RJ-45 ports "X1 IN" and "X2 OUT." In addition, a line structure configuration ("Daisy Chain Configuration") can be facilitated via both interfaces.

Table 26: Communication – Modbus RTU

Property	Value
Interface	RS-485 (2-wire) via 2 × RJ-45 connector
Number of subscribers (max.)	32
Addressing	Via interface configuration software

If an error occurs during the transmission, an error message is sent to the sender. The error codes could be:

- 0x01 Illegal function (unsupported Modbus function)
- 0x02 Illegal data address (data telegram too long or too short))
- 0x03 Illegal data value (checksum incorrect)

The following register identifies the power measurement module:

Table 27: Identification Register

Adress	Byte	Name	Description	Access
0x0000	1	Product-ID	Product identification number	R
0x0000	2	FW-ID	Firmware version	R
0x0001	1	HW-ID	Hardware version	R

Table 28: Device Identification Number

Article number	Name	Product-ID
2857-570/000-009	3-Phase Power Measurement Module 333 mV LVCT	0x38

4.7.1 Modbus Configurator in WAGO I/O-PRO

This section describes an example how the Modbus configurator can be used to establish communication between the power measurement module and a PC, with the help of *WAGO I/O Systems 750/753*. The Modbus configurator can be called up through either *WAGO I/O-PRO* or **e!***COCKPIT*.

The following steps are exemplary and require the specific hardware configuration of the product with connection to a PC and PFC200 (Art.-Nr. 750-8206).

1. Launch WAGO I/O-*PRO*.
2. Create a new project. Click**[File> New]**.
   ⇨ The **Target Settings** dialog appears.
3. Under **Configuration**, select the hardware you are using.
4. Click the **[OK]** button
   ⇨ The **New POU** dialog appears.
5. Click the **[Cancel]** button because you do not want to create a new module.
6. In the main menu, select the **[Resources]** tab.
7. In the directory, select the **[PLC Configuration]** entry.
   ⇨ The **PLC Configuration** workspace appears.
8. In the tree structure, select the entry **[Modbus-Master(FIX)]**..
   ⇨ The tab **MODBUS Master configurator** opens.

9. Click the **[Network view]** button.
   ⇨ The dialog **MODBUS Master configurator** opens.
10. Right-click the entry **MODBUS master** and select **[Add Serial Interface]**.
11. The **Settings: Serial Interface** dialog opens.
12. Select the setting **"19200"** in the **Baud rate** selection box.
13. Select the setting **"Even"** in the **Parity** selection box.
14. Click the **[OK]** button.
    ⇨ The entry **Interface (COM2)** is created in the MODBUS master configurator dialog.
15. Right-click the entry **Interface (COM2)** and select **[Add Modbus Slave]**.
    ⇨ The dialog **MODBUS slave selection** opens.
16. Double-click the entry **[Generic MODBUS slave]**.
    ⇨ The entry is displayed in the **Choosen devices** area.
17. Click the **[OK]** button.
    ⇨ The entry **Modbus slave** is created in the MODBUS master configurator dialog.
18. Right-click the **Communication** input field; select **[Edit]**.
    ⇨ The **Communication settings** dialog opens.
19. Enter the value "1" in the **Modbus unit ID** input field.
20. Click the **[OK]** button.
    ⇨ The entry **Generic Variables** is created in the MODBUS master configurator dialog.
21. Right-click the entry **Generic Variables** and select **[Add]**.
    ⇨ A new variable is created in the MODBUS master configurator dialog.
22. Right-click the entry **Generic Variables** and select **[Add]**.
    ⇨ The new variable **xNewVar** is created in the MODBUS master configurator dialog.
23. Double-click the variable **[xNewVar]**.
24. Rename the variable tp **"rVoltageL1"**.
25. Click the input field **[Type > REAL]**.
26. Click the input field **[Access > read only]**
27. Right-click the input field **[Communication > Edit Addresses]**.
28. The dialog **MODBUS Adress** opens.
29. Select **[MODBUS-FC > Read input registers (FC4)]**.
30. Enter the adress "10" in the **Adress** input field.
31. Click the **[OK]** button.
    ⇨ The changed settings are applied.
    The values are displayed under “Communication” in the “MODBUS master configurator” dialog.
32. Click the **[OK]** button.
    ⇨ The dialog **MODBUS master configurator** is closed.
33. Click the**[Generate Code]** button.
    ⇨ Code is generated.

34. Click the **[Save Configuration]** button.
    ⇨ Configuration is saved.
35. In the main menu, click the **POUs** tab.
36. In the tree structure, click **[+]** in front of the **Generated Code** entry.
37. Select **[MBCFG_ModbusSlave (PRG)]**.
    ⇨ The program editor opens
38. Click **[Online > Login]**.
    ⇨ The solution is loaded into the controller.
39. Click **[Online > Start]**.

➡ The controller is started.

➡ The value of variable **rVoltageL1** is read out in the program editor.

A CODESYS function block (FB) is available for integrating the product into a PLC program. You can download it from the website: **www.wago.com**.

4.7.2 Parameter

The configured parameters are saved in the power measurement module as "ID 1 ... 40". They are explained in the following tables.

Table 29: Parameter 1 – Command Interface ‚Request'

Address 0x004D	Data type UINT16	Access W	Factory setting -none-
0x0004	Reset registers, parameters and calibration data to factory settings		
0x0005	Reset registers and parameters to factory settings		
0x0006	Reset calibration data to factory settings		
0x0011	Save energy consumption early		
0x0012	Initialize all energy meters to 0		
0x0021	Delete all min. and max. values		
0x0022	Min. current delete		
0x0023	Max. current delete		
0x0024	Min. Voltage delete		
0x0025	Max. Voltage delete		
0x0026	Min. Power delete		
0x0027	Max. Power delete		
0x0028	Min. Frequency delete		
0x0029	Max. Frequency delete		

Table 30: Parameter 2 – Parameter set 1

Address 0x004E	Data type UINT16	Access R/W	Factory setting 0x0000
0x004E	UINT16	R/W	
Bit 0 ... 5: Reserved			
Bit 6 ... 7: Phase Selection for Peak Measurement			
0:	Peak measurement for Phase 1 is active (Factory setting).		
1	Peak measurement for Phase 2 is active.		
2	Peak measurement for Phase 3 is active.		
3	-reserved-		

Address 0x004E	Data type UINT16	Access R/W	Factory setting 0x0000
Bit 8: Min./Max. Value Automatic Reset Activation Phase 1			
0	Automatic deletion Min. and Max. Current, Voltage and Power values is not activated (Factory setting).		
1	Automatic deletion Min. and Max. Current, Voltage and Power values is active.		
Bit 9: Min./Max. Value Automatic Reset Activation Phase 2			
0	Automatic deletion Min. and Max. Current, Voltage and Power values is not activated (Factory setting).		
1	Automatic deletion Min. and Max. Current, Voltage and Power values is active.		
Bit 10: Min./Max. Value Automatic Reset Activation Phase 3			
0	Automatic deletion Min. and Max. Current, Voltage and Power values is not activated (Factory setting).		
1	Automatic deletion Min. and Max. Current, Voltage and Power values is active.		
Bit 11: -Reserved-			
Bit 12: User Scaling (current transformer ratio) Phase 1			
0:	User scaling is deactivated; the transformation ratio is 1:1 (Factory setting).		
1	User scaling is activated; the transformation ratio is 1:(Divisorfor the current transformer).		
Bit 13: User Scaling (current transformer ratio) Phase 2			
0	User scaling is deactivated; the transformation ratio is 1:1 (Factory setting).		
1	User scaling is activated; the transformation ratio is 1:(Divisorfor the current transformer).		
Bit 14: User Scaling (current transformer ratio) Phase 3			
0	User scaling is deactivated; the transformation ratio is 1:1 (Factory setting).		
1	User scaling is activated; the transformation ratio is 1: (Divisorfor the current transformer).		
Bit 15: User Scaling (current transformer ratio) Neutral conductor			
0	User scaling is deactivated; the transformation ratio is 1:1 (Factory setting).		
1	User scaling is activated; the transformation ratio is 1:(Divisorfor the current transformer).		

Table 31: Parameter 3 – Undervoltage Threshold Phase 1

Address 0x0050	Data type FLOAT	Access R/W	Factory setting 0 V
0	Checking if undervoltage threshold is deactivated.		
≥1	Value for undervoltage threshold (max. 440 V)		

Table 32: Parameter 4 – Undervoltage Threshold Phase 2

Address 0x0052	Data type FLOAT	Access R/W	Factory setting 0 V
0	Checking if undervoltage threshold is deactivated.		
≥1	Value for undervoltage threshold (max. 440 V)		

Table 33: Parameter 5 – Undervoltage Threshold Phase 3

Address 0x0054	Data type FLOAT	Access R/W	Factory setting 0 V
0	Checking if undervoltage threshold is deactivated.		
≥1	Value for undervoltage threshold (max. 440 V)		

Table 34: Parameter 6 – LVCT Rated current

Address 0x00C2	Data type UINT16	Access R/W	Factory setting 60
1 … 65535	Value in A		

Table 35: Parameter 11 – Peak Value Measurement Observation Interval Phase 1

Address 0x0060	Data type UINT16	Access R/W	Factory setting 0x0014
0 … 19	-not permitted-		
20 … 254	Number of half waves for measuring peak values		
≥255	-not permitted-		

Table 36: Parameter 12 – Peak Value Measurement Observation Interval Phase 2

Address 0x0061	Data type UINT16	Access R/W	Factory setting 0x0014
0 … 19	-not permitted-		
20 … 254	Number of half waves for measuring peak values		
≥255	-not permitted-		

Table 37: Parameter 13 – Peak Value Measurement Observation Interval Phase 3

Address 0x0062	Data type UINT16	Access R/W	Factory setting 0x0014
0 … 19	-not permitted-		
20 … 254	Number of half waves for measuring peak values		
≥255	-not permitted-		

Table 38: Parameter 14 – Overvoltage Threshold Value Phase 1

Address 0x0064	Data type FLOAT	Access R/W	Factory setting 410 V
0	The overvoltage threshold check is deactivated.		
≥1	Overvoltage Threshold (max. 440 V)		

Table 39: Parameter 15 – Overvoltage Threshold Value Phase 2

Address 0x0066	Data type FLOAT	Access R/W	Factory setting 410 V
0	The overvoltage threshold check is deactivated.		
≥1	Overvoltage Threshold (max. 440 V)		

Table 40: Parameter 16 – Overvoltage Threshold Value Phase 3

Address 0x0068	Data type FLOAT	Access R/W	Factory setting 410 V
0	The overvoltage threshold check is deactivated.		
≥1	Overvoltage Threshold (max. 440 V)		

Table 41: Parameter 17 – Overcurrent Threshold Phase 1

Address 0x006A	Data type FLOAT	Access R/W	Factory setting 550 A
0	The overcurrent threshold check is deactivated.		
≥1	Overcurrent Threshold (max. 100000 A)		

Table 42: Parameter 18 – Overcurrent Threshold Phase 2

Address 0x006C	Data type FLOAT	Access R/W	Factory setting 550 A
0	The overcurrent threshold check is deactivated.		
≥1	Overcurrent Threshold (max. 100000 A)		

Table 43: Parameter 19 – Overcurrent Threshold Phase 3

Address 0x006E	Data type FLOAT	Access R/W	Factory setting 550 A
0	The overcurrent threshold check is deactivated.		
≥1	Overcurrent Threshold (max. 100000 A)		

Table 44: Parameter 20 – Tamper Detect Current Threshold (fault current)

Address 0x0070	Data type FLOAT	Access R/W	Factory setting 0 A
0	The threshold value check is deactivated.		
≥1	Current threshold (max. 100000 A)		

Table 45: Parameter 21 – Observation Interval, arith. average value Phase 1

Address 0x0072	Data type UINT16	Access R/W	Factory setting 0x0004
0	5 s		
1	10 s		
2	15 s		
3	30 s		
4	1 min		
5	5 min		
6	8 min		
7	10 min		
8	15 min		
≥9	-Reserved-		

Table 46: Parameter 22 – Observation Interval, arith. average value Phase 2

Address 0x0073	Data type UINT16	Access R/W	Factory setting 0x0004
0	5 s		
1	10 s		
2	15 s		
3	30 s		
4	1 min		
5	5 min		
6	8 min		
7	10 min		
8	15 min		
≥9	-Reserved-		

Table 47: Parameter 23 – Observation Interval, arith. average value Phase 3

Address 0x0074	Data type UINT16	Access R/W	Factory setting 0x0004
0	5 s		
1	10 s		
2	15 s		
3	30 s		
4	1 min		
5	5 min		
6	8 min		

Address 0x0074	Data type UINT16	Access R/W	Factory setting 0x0004
7	10 min		
8	15 min		
≥9	-Reserved-		

Table 48: Parameter 24 – Min./Max. Value Automatic Reset Interval Phase 1

Address 0x0075	Data type UINT16	Access R/W	Factory setting 0x000A
Activation: Parameter 2, Bit 8 required			
0 ... 65535:	Interval in s		

Table 49: Parameter 25 – Min./Max. Value Automatic Reset Interval Phase 2

Address 0x0076	Data type UINT16	Access R/W	Factory setting 0x000A
Activation: Parameter 2, Bit 9 required			
0 ... 65535:	Interval in s		

Table 50: Parameter 26 – Min./Max. Value Automatic Reset Interval Phase 3

Address 0x0077	Data type UINT16	Access R/W	Factory setting 0x000A
Activation: Parameter 2, Bit 10 required			
0 ... 65535:	Interval in s		

Table 51: Parameter 27 – Active Power NOLOAD

Address 0x0078	Data type FLOAT	Access R/W	Factory setting 0x0000 (deaktiviert)
0	The NOLOAD threshold is disabled.		
>0	NOLOAD threshold value in W		

Table 52: Parameter 28 – Reactive power NOLOAD Threshold (related to one phase)

Address 0x007A	Data type FLOAT	Access R/W	Factory setting 0x0000 (deaktiviert)
0	The NOLOAD threshold is disabled.		
>0	NOLOAD threshold value in var		

Table 53: Parameter 29 – Reactive power NOLOAD Threshold (related to one phase)

Address 0x007C	Data type FLOAT	Access R/W	Factory setting 0x0000 (deaktiviert)
0	The NOLOAD threshold is disabled.		
>0	NOLOAD threshold value in VA		

Table 54: Parameter 30 – Selection of Phase for Harmonic Analysis L_{sel}

Address 0x007E	Data type UINT16	Access W	Factory setting 0x0000
0	Harmonic analysis for phase 1 is active (Factory setting).		
1	Harmonic analysis for phase 2 is active.		
2	Harmonic analysis for phase 3 is active.		

Table 55: Parameter 31 – Selection of Upper Harmonic A

Address 0x007F	Data type UINT16	Access W	Factory setting 0x0002
2 ... 41:	Harmonic number (corresponds to first to 40th upper harmonic)		

Table 56: Parameter 32– Selection of Upper Harmonic B

Address 0x0080	Data type UINT16	Access W	Factory setting 0x0003
2 ... 41:	Harmonic number (corresponds to first to 40th upper harmonic)		

Table 57: Parameter 33 – Selection of Upper Harmonic C

Address 0x0081	Data type UINT16	Access W	Factory setting 0x0004
2 ... 41:	Harmonic number (corresponds to first to 40th upper harmonic)		

Table 58: Parameter 34 – Behavior of the Digital Output

Address 0x009A	Data type UINT16	Access W	Factory setting 0x0000
0	Inactive		
1	U_{DO} switching		
2	GND switching		
3	S0 interface		

Table 59: Parameter 36 – Pulse Width; Modue: S0 interface

Address 0x00A5	Data type UINT16	Access W	Factory setting 50
1 ... 1000 ms	Pulse width value		

Table 60: Parameter 37 – Overclocking Buffer; Mode: S0 interface

Address 0x00A6	Data type UINT16	Access W	Factory setting 10
1 ... 600 s	Overclocking buffer value		

Table 61: Parameter 38 – Voltage Transformer Ratio Phase 1, 2, 3

Address 0x005C	Data type UINT16	Access R/W	Factory setting 0x0001
0	-not permitted-		
≥ 1	Voltage Transformer Ratio divisor value (Max. Value = 0xFFFF).		

Table 62: Parameter 39 – Topology

Address 0x005F	Data type UINT16	Access R/W	Factory setting 0x0000
0	4-wire threephase network		
1	3-wire threephase network		
4	3-wire threephase network Aron		
5	1 phase		

Table 63: Parameter 40 – Modbus Terminating Resistor

Address 0x0091	Data type UINT16	Access W	Factory setting 0
0	No terminating resistor		

Address 0x0091	Data type UINT16	Access W	Factory setting 0
1	150 Ω (Line termination)		
2	120 Ω + 1 nF (when polarizing the line)		

4.7.3 Status word

The higher-level controller reads out the power measurement module status messages via Modbus. They are filed as "Status Word 1" in Register 0x0000.

The update interval is 40 ms.

Table 64: Status word 1

Register 0x0000 – Status word 1			
Function	**Data Type**	**Access**	**Factory setting**
Power measurement module status information	UINT16	R	0x0000
Bit 0: Transient Response Period Warning			
0	OK (transient response period elapsed)		
1	Measured values not yet stable; waiting for transient response to end.		
Bit 1: Reserved			
Bit 2: Threshold value Undervoltage L1			
0	Threshold value not reached		
1	Threshold value underrun		
Bit 3: Threshold value Overvoltage L1			
0	Threshold value not reached		
1	Threshold value reached or exceeded		
Bit 4: Threshold value Overcurrent L1			
0	Threshold value not reached		
1	Threshold value reached or exceeded		
Bit 5: Threshold value Undervoltage L2			
0	Threshold value not reached		
1	Threshold value underrun		
Bit 6: Threshold value Overvoltage L2			
0	Threshold value not reached		
1	Threshold value reached or exceeded		
Bit 7: Threshold value Overcurrent L2			
0	Threshold value not reached		
1	Threshold value reached or exceeded		
Bit 8: Threshold value Undervoltage L3			
0	Threshold value not reached		
1	Threshold value underrun		
Bit 9: Threshold value Overvoltage L3			
0	Threshold value not reached		
1	Threshold value reached or exceeded		
Bit 10: Threshold value Overcurrent L3			
0	Threshold value not reached		
1	Threshold value reached or exceeded		
Bit 11: Tamper Detect			
0	Fault Current $iSUM\ Lx\ (t) - iN\ (t) \leq$ Tamper Detect Threshold value		

Register 0x0000 – Status word 1	
1	Fault Current *iSUM Lx (t) – iN (t)* > Tamper Detect Threshold value
Bit 12: Rotating Field Indicator	
0	Rotating field correct L1–L2–L3 (clockwise)
1	Rotating field incorrect (counterclockwise)
Bit 13: S0 Interface Overclocking Status	
0	OK
1	S0 interface is overclocked.
Bit 14, 15: Reserved	

4.7.4 Measured Value Register

The higher-level controller has access to a number of measured value registers via Modbus. The measured values for the energies are in the data type INTEGER; all others are FLOAT. All registers have a size of four bytes (1 DWord). The byte sequence is as follows:

Table 65: Structure of Measured Value Register

Word 1 (high)																Word 2 (low)															
Byte 1 (high)								Byte 2 (low)								Byte 3 (high)								Byte 4 (low)							
MSB							LSB	MSB							LSB	MSB							LSB	MSB							LSB

In the table below, all measured variables are listed with the corresponding register addresses and update intervals.

ⓘ Note

The Measured Values are Dependent on the Network Topology!

All measured values are measured only in a 4-wire three-phase networks. In other networks, some values are not measured. See table below!

Table 66: Measured V

Register Address	Measured Variable	Measurement Unit	Register Access	Update Rate [ms]
0x0000	Status	none	R	40
0x0002	RMS Current L1	A	R	40
0x0004	RMS Current L2	A	R	40
0x0006	RMS Current L3	A	R	40
0x0008	RMS Current N	A	R	40
0x000A	RMS Voltage L1–N	V	R	40
0x000C	RMS Voltage L2–N	V	R	40
0x000E	RMS Voltage L3–N	V	R	40
0x0010	RMS Voltage L1–L2	V	R	500
0x0012	RMS Voltage L1–L3	V	R	500
0x0014	RMS Voltage L2–L3	V	R	500
0x0016	Active power L1	W	R	40
0x0018	Active power L2	W	R	40
0x001A	Active power L3	W	R	40
0x001C	Apparent power L1	VA	R	40
0x001E	Apparent power L2	VA	R	40

Register Address	Measured Variable	Measurement Unit	Register Access	Update Rate [ms]
0x0020	Apparent power L3	VA	R	40
0x0022	Reactive power L1	var	R	500
0x0024	Reactive power L2	var	R	500
0x0026	Reactive power L3	var	R	500
0x0028	Active power total	W	R	500
0x002A	Reactive power total	var	R	500
0x002C	Apparent power total	VA	R	500
0x002E	Line frequency L1	Hz	R	40
0x0030	Line frequency L2	Hz	R	40
0x0032	Line frequency L3	Hz	R	40
0x0034	Phase angle phi L1	°	R	500
0x0036	Phase angle phi L2	°	R	500
0x0038	Phase angle phi L3	°	R	500
0x003A	cos phi L1	none	R	500
0x003C	cos phi L2	none	R	500
0x003E	cos phi L3	none	R	500
0x0040	Power factor PF L1	none	R	40
0x0042	Power factor PF L2	none	R	40
0x0044	Power factor PF L3	none	R	40
0x0046	Power factor LF L1	none	R	40
0x0048	Power factor LF L2	none	R	40
0x004A	Power factor LF L3	none	R	40
0x004C	Max. RMS Current L1	A	R	40
0x004E	Max. RMS Current L2	A	R	40
0x0050	Max. RMS Current L3	A	R	40
0x0052	Min. RMS Current L1	A	R	40
0x0054	Min. RMS Current L2	A	R	40
0x0056	Min. RMS Current L3	A	R	40
0x0058	Arith. average value Current L1	A	R	5.000 … 900.000 (per Para. 21)
0x005A	Arith. average value Current L2	A	R	5.000 … 900.000 (per Para. 22)
0x005C	Arith. average value Current L3	A	R	5.000 … 900.000 (per Para. 23)
0x005E	Max. RMS Voltage L1–N	V	R	40
0x0060	Max. RMS Voltage L2–N	V	R	40
0x0062	Max. RMS Voltage L3–N	V	R	40
0x0064	Min. RMS Voltage L1–N	V	R	40
0x0066	Min. RMS Voltage L2–N	V	R	40
0x0068	Min. RMS Voltage L3–N	V	R	40
0x006A	Arith. average value Voltage L1–N	V	R	5.000 … 900.000 (per Para. 21)

Register Address	Measured Variable	Measurement Unit	Register Access	Update Rate [ms]
0x006C	Arith. average value Voltage L2–N	V	R	5.000 ... 900.000 (per Para. 22)
0x006E	Arith. average value Voltage L3–N	V	R	5.000 ... 900.000 (per Para. 23)
0x0070	Max. Active power L1	W	R	40
0x0072	Max. Active power L2	W	R	40
0x0074	Max. Active power L3	W	R	40
0x0076	Min. Active power L1	W	R	40
0x0078	Min. Active power L2	W	R	40
0x007A	Min. Active power L3	W	R	40
0x007C	Max. Line frequency L1	Hz	R	40
0x007E	Max. Line frequency L2	Hz	R	40
0x0080	Max. Line frequency L3	Hz	R	40
0x0082	Min. Line frequency L1	Hz	R	40
0x0084	Min. Line frequency L2	Hz	R	40
0x0086	Min. Line frequency L3	Hz	R	40
0x0088	Active energy L1	Wh/kWh	R	1100
0x008A	Active energy import L1	Wh/kWh	R/W	1100
0x008C	Active energy export L1	Wh/kWh	R/W	1100
0x008E	Reactive energy L1	varh/kvarh	R	1100
0x0090	Reactive energy inductive L1	varh/kvarh	R/W	1100
0x0092	Reactive energy capacitive L1	varh/kvarh	R/W	1100
0x0094	Apparent energy L1	VAh/kVAh	R/W	1100
0x0096	Active energy L2	Wh/kWh	R	1100
0x0098	Active energy import L2	Wh/kWh	R/W	1100
0x009A	Active energy export L2	Wh/kWh	R/W	1100
0x009C	Reactive energy L2	varh/kvarh	R	1100
0x009E	Reactive energy inductive L2	varh/kvarh	R/W	1100
0x00A0	Reactive energy capacitive L2	varh/kvarh	R/W	1100
0x00A2	Apparent energy L2	VAh/kVAh	R/W	1100
0x00A4	Active energy L3	Wh/kWh	R	1100
0x00A6	Active energy import L3	Wh/kWh	R/W	1100
0x00A8	Active energy export L3	Wh/kWh	R/W	1100
0x00AA	Reactive energy L3	varh/kvarh	R	1100
0x00AC	Reactive energy inductive L3	varh/kvarh	R/W	1100
0x00AE	Reactive energy capacitive L3	varh/kvarh	R/W	1100
0x00B0	Apparent energy L3	VAh/kVAh	R/W	1100
0x00B2	Active energy total	Wh/kWh	R	1100
0x00B4	Active energy import total	Wh/kWh	R	1100
0x00B6	Active energy export total	Wh/kWh	R	1100
0x00B8	Reactive energy total	varh/kvarh	R	1100
0x00BA	Reactive energy inductive total	varh/kvarh	R	1100
0x00BC	Reactive energy capacitive total	varh/kvarh	R	1100
0x00BE	Peak value Voltage Lx–N, for one phase	V	R	40

Register Address	Measured Variable	Measurement Unit	Register Access	Update Rate [ms]
0x00C0	Peak value Current Lx, for one phase	A	R	40
0x00C2	Current rms fundamental component	A	R	40
0x00C4	Voltage rms fundamental component	V	R	40
0x00C6	Current rms upper harmonic A	A	R	40
0x00C8	Current rms upper harmonic B	A	R	40
0x00CA	Current rms upper harmonic C	A	R	40
0x00CC	Voltage rms upper harmonic A	V	R	40
0x00CE	Voltage rms upper harmonic B	V	R	40
0x00D0	Voltage rms upper harmonic C	V	R	40
0x00D2	Distortion factor THD Current	%	R	40
0x00D4	Distortion factor THD Voltage	%	R	40
0x00D6	HD Current upper harmonic A	%	R	40
0x00D8	HD Current upper harmonic B	%	R	40
0x00DA	HD Current upper harmonic C	%	R	40
0x00DC	HD Voltage upper harmonic A	%	R	40
0x00DE	HD Voltage upper harmonic B	%	R	40
0x00E0	HD Voltage upper harmonic C	%	R	40
0x00E2	Power factor PF Total	–	R	40

5 Planning

5.1 Structure Guidelines

5.1.1 Warning Messages for Structure Guidelines

⚠ DANGER

Install protection against electric shock!

All wiring for the measurement system shall be provided with protection against shock hazard voltages along with the corresponding safety signs!

⚠ WARNING

DIN-Rail Protection Connection!

If voltage is hazardous active on the product, a protective connection of the DIN-rail to PE is required.

- Take this protective connection into account in your planning!

5.1.2 Safety Measures at the Installation Location

The product is an open type device.

It must only be installed in suitable enclosures, cabinets or electrical operating rooms that meet the following requirements at a minimum:

⚠ DANGER

Install protection against electric shock!

All wiring for the measurement system shall be provided with protection against shock hazard voltages along with the corresponding safety signs!

- Offer adequate protection against direct or indirect contact.
- Offer adequate protection against UV irradiation.
- Restrict access to authorized personnel and may only be opened with tools.
- Ensure the required pollution degree in the vicinity of the system.
- Prevent fire from spreading outside of the enclosure.
- Guarantee mechanical stability.

5.1.3 Overcurrent Protection

Protect the power supply as specified in the technical product data. Use:

- External fuses
- Other overcurrent protection devices (e.g. electronic circuit breakers)

5.1.4 DIN-Rail Characteristics

- The material must have high corrosion resistance.

- The DIN-rail geometry must not be altered.
- Prevent bending and twisting (torsion) e.g., by using sufficient attachment points.
- Use countersink-head screws, blind rivets, etc., to countersink the attachment points beneath the node structure.
- The component DIN-rail contact (CuSn6) must not form a galvanic element with the DIN-rail that is capable of generating a differential voltage of more than 0.5 V (saline solution of 0.3% at 20°C/68°F).

5.1.5 EMC Installation

- **Ground DIN-rails.**
  Ground the DIN-rails to divert electromagnetic interference.
- **Use shielded cables for data and signal lines.**
  Electromagnetic interference is reduced and signal quality increased. Measurement errors, data transmission faults and interference due to excessive voltage can be prevented!
- **Keep data and signal lines separate from interference sources.**
  Route data and signal lines separately from all power supply cables and other sources of high electromagnetic emissions (e.g., frequency converters or drives).
- **Connect the cable shielding with the ground potential.**
  Integrated shielding is mandatory to meet technical specifications regarding measurement accuracy. Establish the connection between the cable shielding and ground potential at the inlet of the cabinet or housing. This grounding allows induced interferences to dissipate and be kept away from devices in the cabinet or housing.
- **Improve shielding performance with a large contact area.**
  A low-impedance connection between shielding and ground achieves better shielding performance. For this purpose, connect the shielding over a large surface area, e.g., using the WAGO Series 790 Shield Connection System. This is especially recommended for large-scale systems where equalizing or high impulse currents may occur.

5.1.6 Data Security

Professional planning and design is an important requirement for securing data confidentiality, availability and integrity.

Random Influences

Data transmission and processing can be disrupted by random influences, such as temporary electromagnetic disturbances. Proper setup can significantly reduce the likelihood of corruption or destruction of data.

For additional information see: EMC Installation [▸ 49].

Deliberate Influences

Use in ETHERNET Areas

ETHERNET products are designed for use in local networks. Please note the following when using ETHERNET products in your system:

- Do not connect control components and control networks to an open network such as the Internet or an office network.
  WAGO recommends putting control components and control networks behind a firewall.

- In the control components, close all ports and services not required by your application to minimize the risk of cyber attacks and to enhance cybersecurity.
  Only open the ports and services for the duration of the commissioning/configuration.
- Limit physical and electronic access to all automation components to authorized personnel only.
- To reduce the risk of unauthorized access to your system, change the default passwords during initial commissioning.
- To reduce the risk of unauthorized access to your system, regularly change the passwords used.
- To verify that the measures taken meet your security requirements, regularly perform threat analyses.
- To restrict access to and control of individual products and networks, employ a "defense-in-depth" mechanism in your system's security configuration.

Additional document

- 🕮 **White Paper Cybersecurity in Production Facilities**

All the documentation and information is available at: **www.wago.com**.

5.2 Voltage Measurement

⚠ DANGER

Do not work on products while energized!

Hazardous electrical voltage can cause electric shock or burns!

- Always disconnect all power supplies from the product before mounting, installing, troubleshooting or performing maintenance.

⚠ DANGER

The voltage measurement transformer used must comply with IEC 61869!

If determination of the measurement topology indicates that voltage measurement transformers must be used, the transformers must comply with the standard IEC 61869.

⚠ CAUTION

Use safety fuses in voltage paths!

To protect the voltage path against short circuit and overload, apply a safety fuse (0,5 A, slow).

- For applications in areas covered by UL, only safety fuses having a UL approval are permitted for use.

ⓘ Note

Use of voltage measurement transformers not verified for UL!

The use of voltage measurement transformers has not been verified for North America (UL).

Please observe the following:

- Maximum voltage of the network to be measured (see **Special Requirements for Measurements with Higher Voltages outside the scope of UL [▸ 19]**).
- Connection terminal N on the product is reference potential for all voltage inputs.

The power measurement module can be used to measure voltage.

To measure the voltages of a 4-wire 3-phase network, connect the four wires with connection terminals L1, L2, L3 and N.

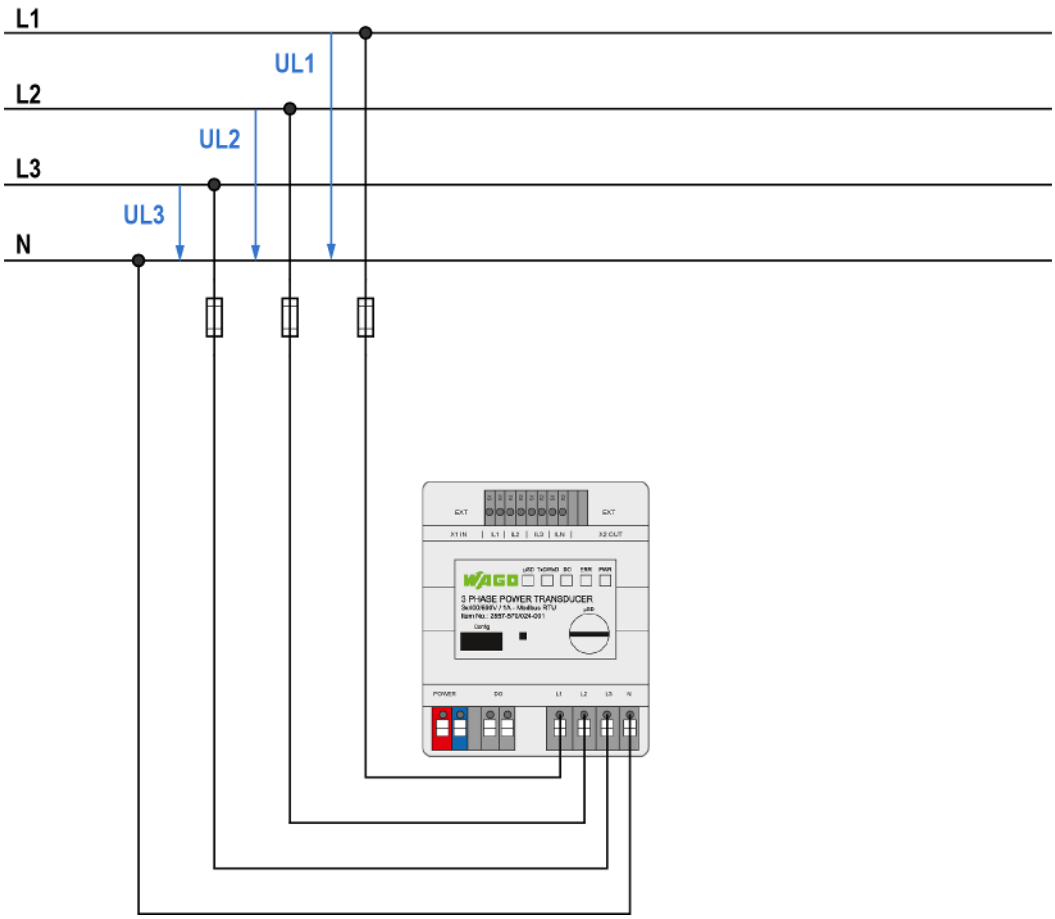


Figure 17: Connection Example Voltage Measurement

5.3 Current Measurement

⚠ DANGER

Always use current measurement transformers or Rogowski coils for current and power measurements

Current measurement transformers or Rogowski coils corresponding to the requirements of standard IEC 61869 must always be used for current and power measurements. For North America (UL) the requirements for current measurement transformers shall be observed, see "Installation Regulations Specified by Approvals."

The transformer or coil are necessary to ensure adequate isolation from the system in case of electrical fault. Electrical faults can cause shock or burns. Furthermore, current measurement without a current measurement transformer can lead to a short circuit in the power network and destruction of the product.

ⓘ Note

UL-listed current measurement transformers and Rogowski coils!

When the applications/devices are operated in locations covered by UL, only UL-listed current measurement transformers and Rogowski coils must be used that comply with the standards UL 2808.

The power measurement module can be used to measure current and can handle up to four currents simultaneously.

Consider the permitted input signals (current, voltage) for the measurement range of the products and the rated voltage of all measuring circuit terminals when selecting the current measurement transformers or Rogowski coils.

The insulation of the connecting cables of the current measurement transformer or Rogowski coil must correspond to the basic insulation from the mains supply system.

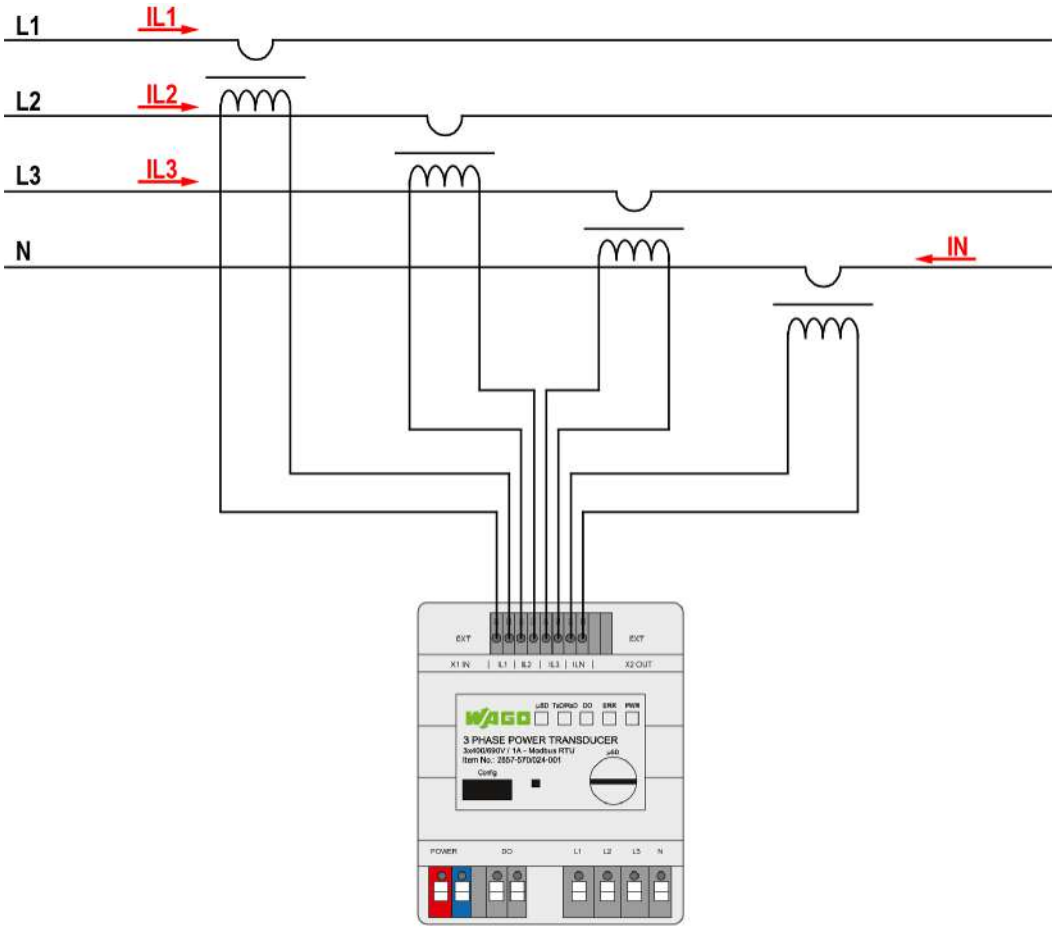


Figure 18: Connection Example Current Measurement

5.4 Power Measurement

5.4.1 Power Measurement in 4-Wire 3-Phase Networks

The power measurement module can be used to measure voltage. To measure the voltages of a 4-wire 3-phase network, connect the four wires with connection terminals L1, L2, L3, N and LVCT.

3-Phase Power Measurement with N-Conductor; without voltage transformer

Please note the following:

- System voltage: ≤ 300 V.
- Mains supply voltage: ≤ 277 / 480 V
- Connection terminal N on the product is reference potential for all voltage and current inputs.
- For measurements with higher voltages see **Special Requirements for Measurements with Higher Voltages outside the scope of UL [▸ 19]**.
- The current transformer in the N-conductor is optional.

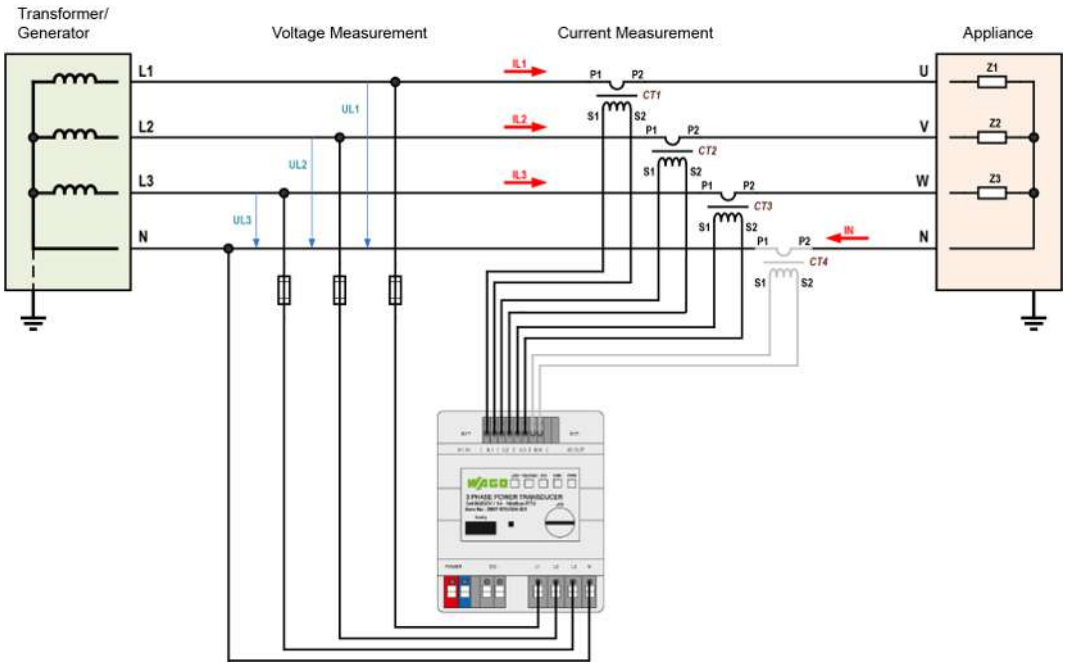


Figure 19: 3-Phase Power Measurement with N-Conductor; without voltage transformer

3-Phase Power Measurement with N-Conductor; with voltage transformer

Please note the following:

- System voltage: > 300 V.
- Max. Terminal block voltage: u_{Lx} < 300 V.
- Connection terminal N on the product is reference potential for all voltage and current inputs.
- The current transformer in the N-conductor is optional.

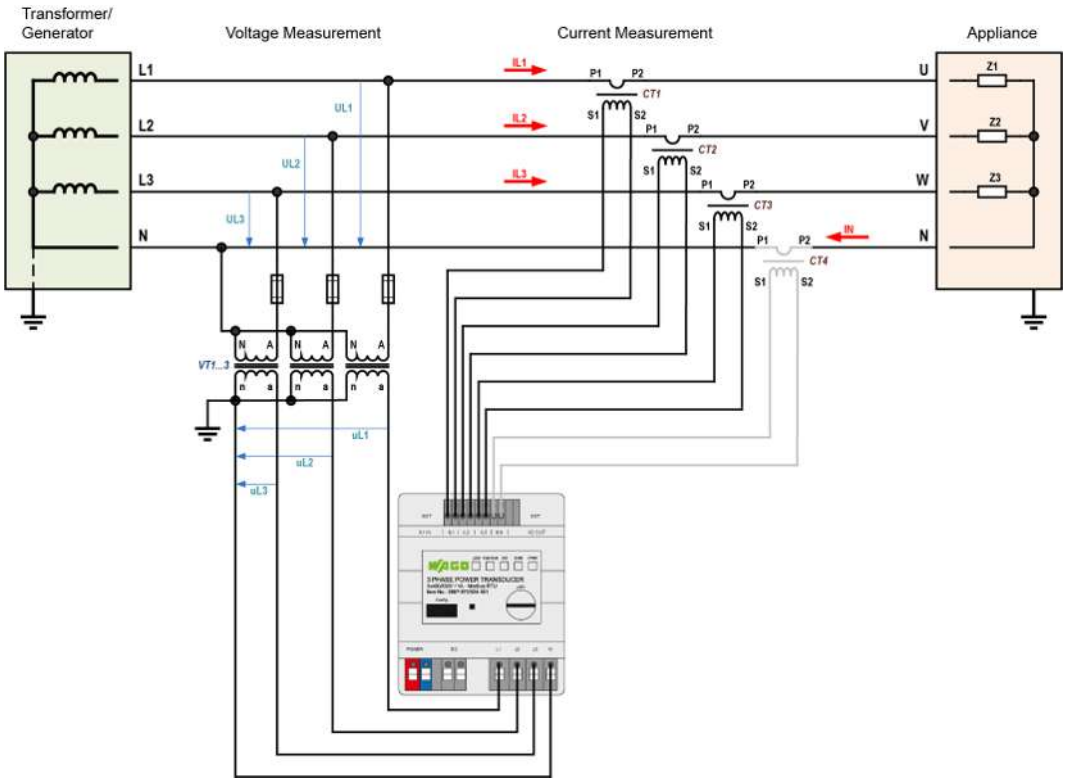


Figure 20: 3-Phase Power Measurement with N-Conductor; with voltage transformer

3-Phase Power Measurement without N-Conductor; without voltage transformer

Please note the following:

- System voltage: ≤ 600 V.
- Mains supply voltage: ≤ 400 / 690 V
- For measurements with higher voltages see **Special Requirements for Measurements with Higher Voltages outside the scope of UL [▸ 19]**.

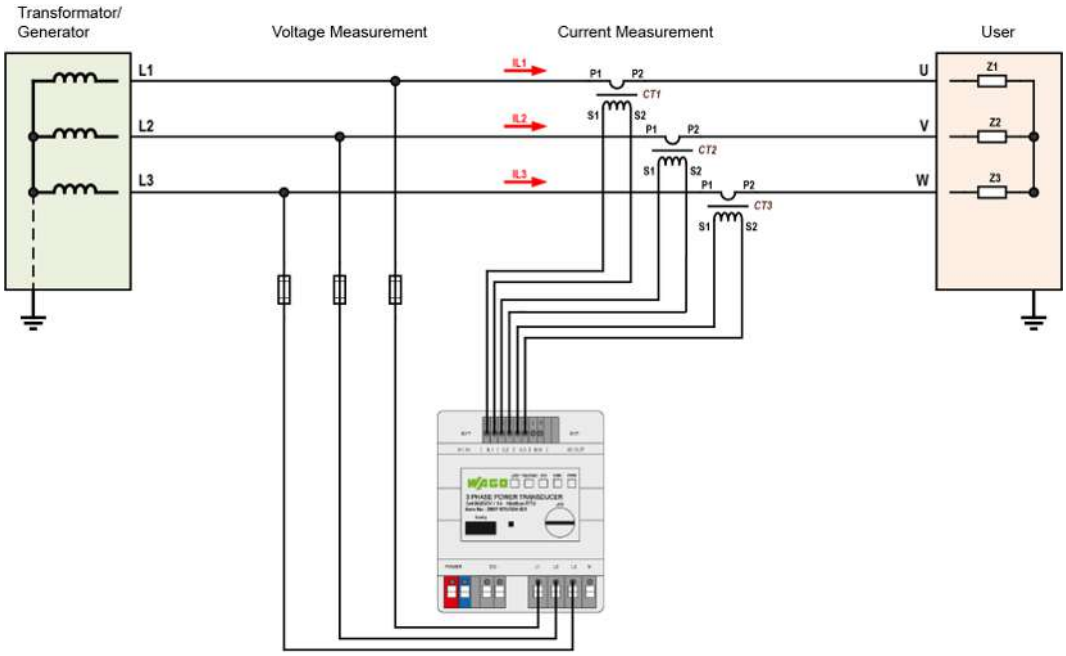


Figure 21: 3-Phase Power Measurement without N-Conductor; without voltage transformer

1-Phase Power Measurement with N-Conductor; without voltage transformer

Please note the following:

- System voltage: ≤ 300 V.
- Mains supply voltage: ≤ 277 / 480 V
- Connection terminal N on the product is reference potential for all voltage and current inputs.
- The current transformer in the N-conductor is optional.

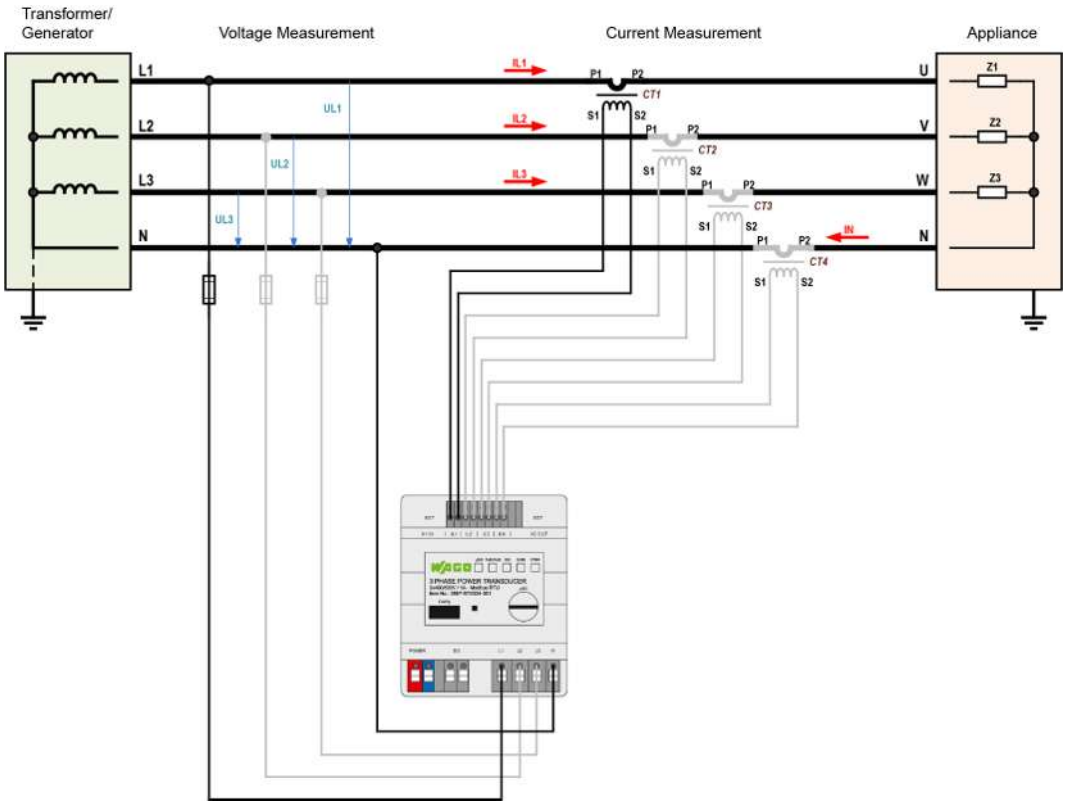


Figure 22: 1-Phase Power Measurement with N-Conductor; without voltage transformer

1-Phase Power Measurement with N-Conductor; with voltage transformer

Please note the following:

- System voltage: > 300 V.
- Max. Terminal block voltage: u_{Lx} < 300 V.
- Connection terminal N on the product is reference potential for all voltage and current inputs.

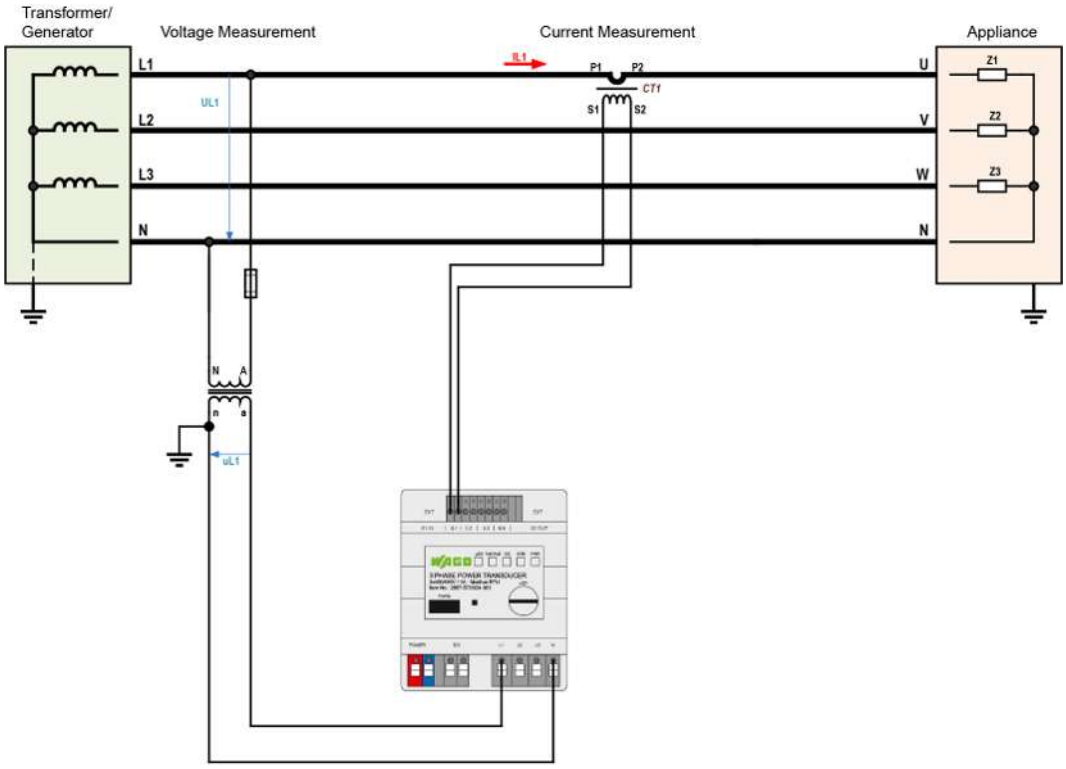


Figure 23: 1-Phase Power Measurement with N-Conductor; with voltage transformer

1-Phase (Split-Phase) 3-Wire-System

Please note the following:

- Permissable system voltage: ≤ 300 V.
- Mains supply voltage: 240 / 480 V
- Connection terminal N on the product is reference potential for all voltage and current inputs.
- The current transformer connected to the neutral conductor is not mandatory and can be used optionally. Thus, the transformer is grayed out in the connection example.

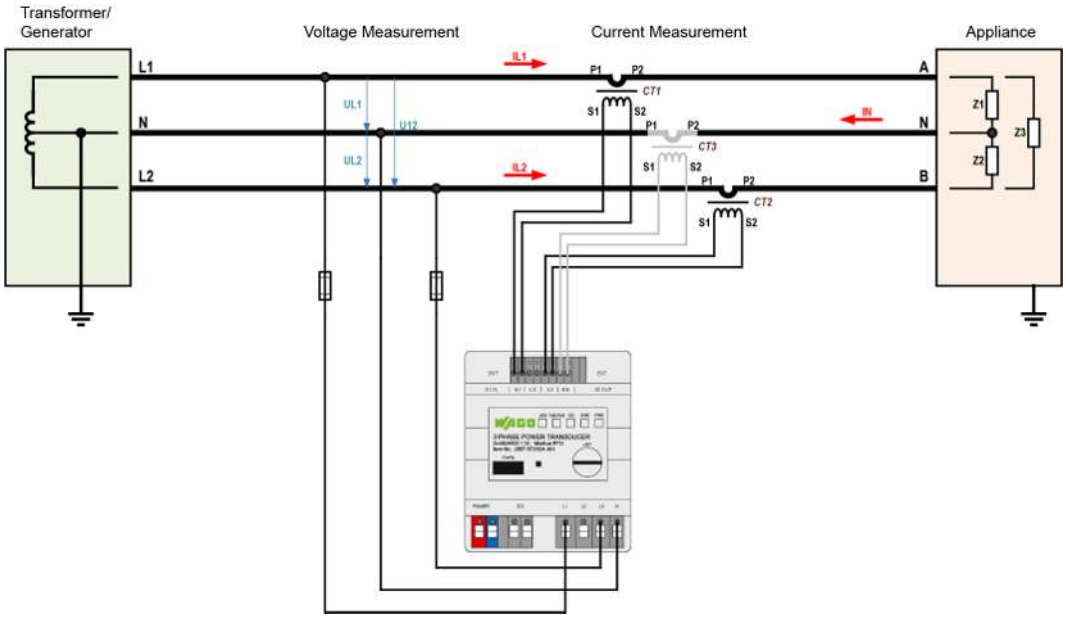


Figure 24: 1-Phase (Split-Phase) 3-Wire-System

5.4.2 Power Measurement in 3-Wire 3-Phase Networks

To measure the voltages and currents of a 3-wire three-phase network, connect the four wires with connection terminals L1, L2, L3 and the current transformers or Rogowski coils with the current measurement inputs.

3-Phase Power Measurement without N-Conductor; without voltage transformer (ARON)

Please observe the following:

- Mains supply voltage:
  - 3-Phase 3-wire systems with earthed phase: ≤ 240 V.
  - 3-Phase 3-wire systems unearthed phase: ≤ 277 V.
- Connection terminal N on the product is reference potential for all voltage inputs.
- The current transformer connected to the reference conductor (L2) is not mandatory and can be used optionally. Thus, the transformer is grayed out in the connection example.

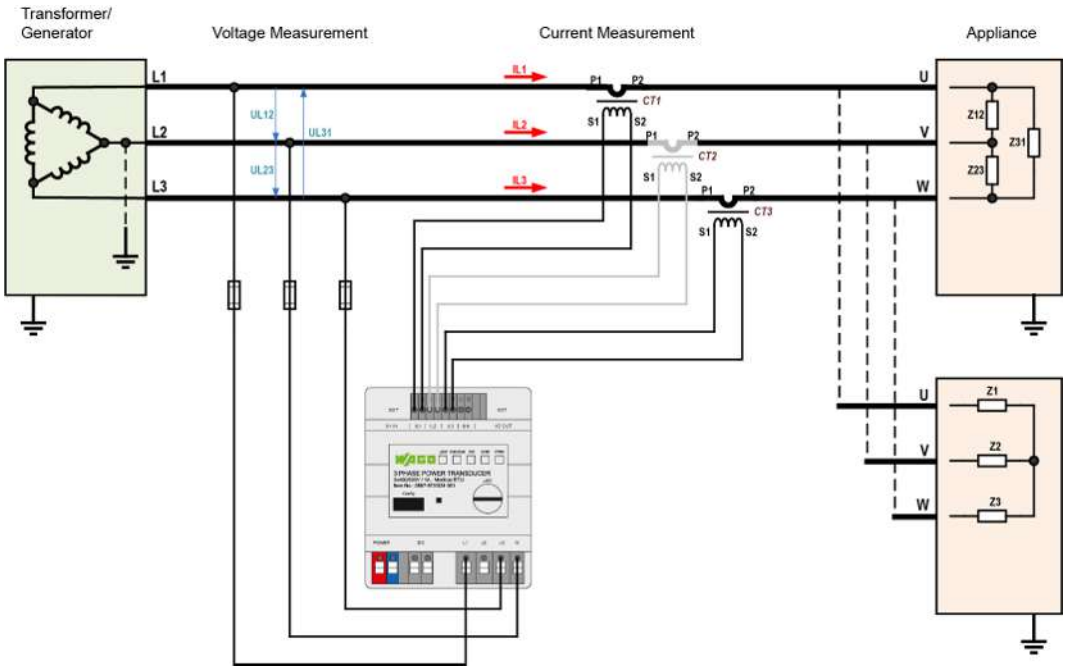


Figure 25: 3-Phase Power Measurement without N-Conductor; without voltage transformer (ARON)

3-Phase Power Measurement without N-Conductor; with voltage transfomer (ARON)

Please observe the following:

- System voltages > 300 V.
- Maximum terminal voltage: u_{Lx} < 300 V.
- Connection terminal N on the product is reference potential for all voltage inputs.
- The current transformer connected to the reference conductor (L2) is not mandatory and can be used optionally. Thus, the transformer is grayed out in the connection example.

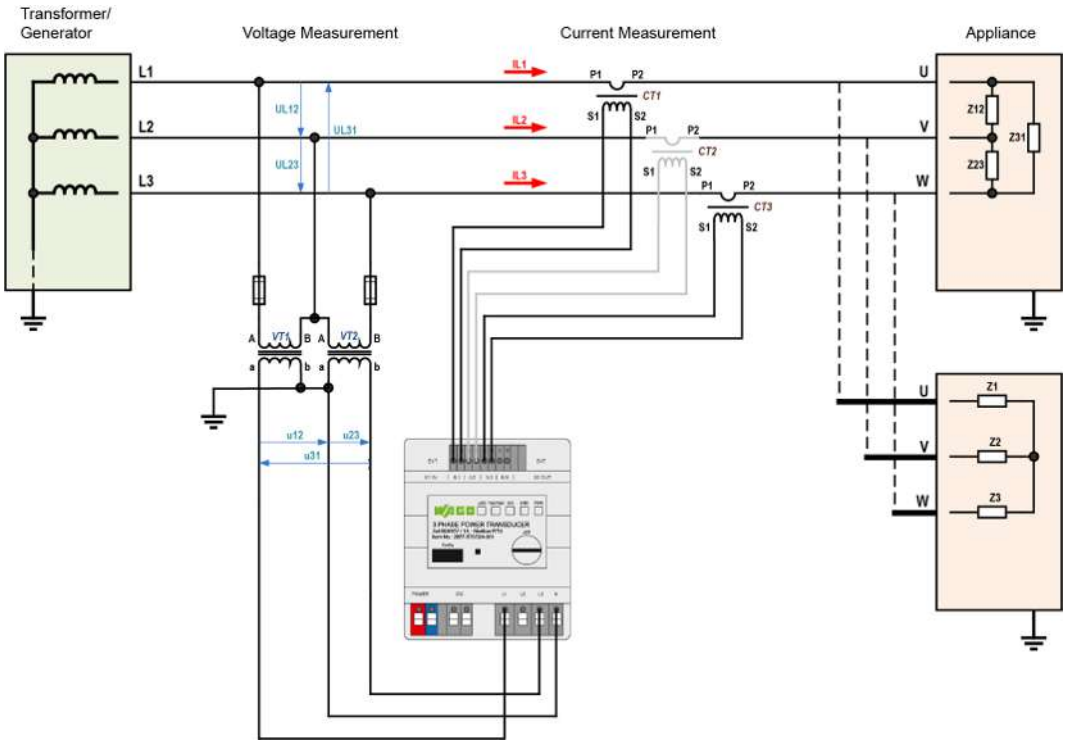


Figure 26: 3-Phase Power Measurement without N-Conductor; with voltage transfomer (ARON)

6 Transport and Storage

6.1 Transport and Storage

The original packaging offers optimal protection during transport and storage.

- Store the product in suitable packaging, preferably the original packaging.
- Only transport the product in suitable containers/packaging.
- Make sure the product contacts are not contaminated or damaged during packing or unpacking.
- Observe the specified ambient climatic conditions for transport and storage.

7 Installation and Removal

⚠ WARNING

Accidental Contact with Hazardous Active Voltage!

When voltage is hazardous active, accidental contact may result in an electric shock.

1. Always disconnect all voltages from the system before starting work on the system!
2. Make sure the system do not carry any voltage!

Mount the product per EN 60715 by snapping it onto the DIN-rail without tools:

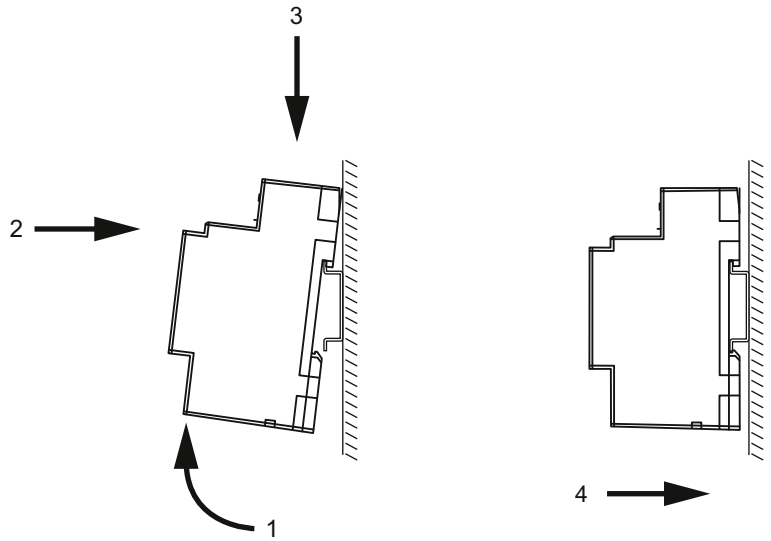


Figure 27: Mounting the product on the DIN Rail

1. Tilt the product slightly.
2. Place the product, with the DIN-rail guide, on the top edge of the DIN-rail.
3. Press the product onto the DIN-rail.
4. Push down until the product audibly snaps into place.
   ⇨ If the product does not lock into place automatically, pull down the DIN-rail mounting/removal latch with an operating tool while pressing the product onto the bottom fastener.
5. Gently shake the product to ensure that it is correctly locked into place.
6. To ensure secure fastening on the DIN-rail, fit end stops on either side of the product (with a block arrangement: on either side of the products).

Removal from the DIN-Rail

⚠ CAUTION

Hot Surface!

The surface of the housing heats up during operation. Under special conditions (e.g., in the event of a fault or increased surrounding air temperature), touching the product may cause burns.

- Allow the product to cool down before touching it!

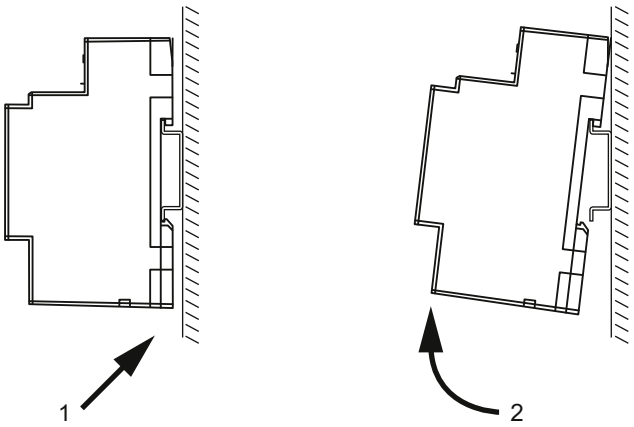


Figure 28: Remove the product from the DIN Rail

1. To remove the product, pull down the DIN-rail removal latch. Use an operating tool for this purpose.

   ⇨ The product is now unlocked.

2. Tilt the product forward and unhook it from the DIN-rail.

8 Connection

Protection against dangerous contact voltages

⚠ DANGER

Install protection against electric shock!

All wiring for the measurement system shall be provided with protection against shock hazard voltages along with the corresponding safety signs!

⚠ DANGER

Always use current measurement transformers or Rogowski coils for current and power measurements

Current measurement transformers or Rogowski coils corresponding to the requirements of standard IEC 61869 must always be used for current and power measurements. For North America (UL) the requirements for current measurement transformers shall be observed, see "Installation Regulations Specified by Approvals."

The transformer or coil are necessary to ensure adequate isolation from the system in case of electrical fault. Electrical faults can cause shock or burns. Furthermore, current measurement without a current measurement transformer can lead to a short circuit in the power network and destruction of the product.

⚠ DANGER

When measuring voltage and power, always observe specifications for measurement topologies, supply networks, voltage levels and voltage measurement transformers

For voltage and power measurement, the product must only be used according to the specifications for voltage levels and voltage measurement transformers specified for the respective supply network and measurement topology.

Otherwise, adequate isolation from the system may no longer be possible in the event of a fault. This can cause electric shock or burns.

ⓘ Note

The three voltage measurement paths are not electrically isolated from the four current measurement paths!

The N connection forms the device-internal reference potential for all electrical measurements. Unwanted additional potential differences between the N connection and the current connections can lead to incorrect measured values and destruction of the product.

- Do not ground the power connections.

Connection examples are available at Planing.

8.1 Push-in CAGE CLAMP® Connections

Connect Conductor

Note

Only connect one conductor to each CAGE CLAMP® connection!

Each CAGE CLAMP® connection only permits connection of one conductor. Do not connect more than one conductor on a single connection.

If more than one conductor needs to be routed to one connection, connect them in an up-circuit wiring assembly – for example, using WAGO through terminal blocks.

Solid, stranded and fine-stranded conductors can be plugged in directly into the Push-in CAGE CLAMP®. For all other conductor types, the Push-in CAGE CLAMP® and CAGE CLAMP® must be opened with an operating tool. Only one conductor may be connected per clamping unit to connect a conductor.

To connect a conductor, proceed as follows:

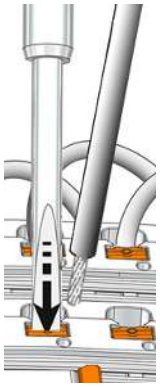


Figure 29: Opening Push-in CAGE CLAMP®

✓ You need an operating tool.

1. Use the operating tool to press and hold the push-button next to the respective connection to open the Push-in CAGE CLAMP®.
2. Insert the conductor into the corresponding connection opening.
3. Release the push-button to close the Push-in CAGE CLAMP®.

➡ The conductor is now securely clamped.

Remove Conductor

To remove a conductor, proceed as follows:

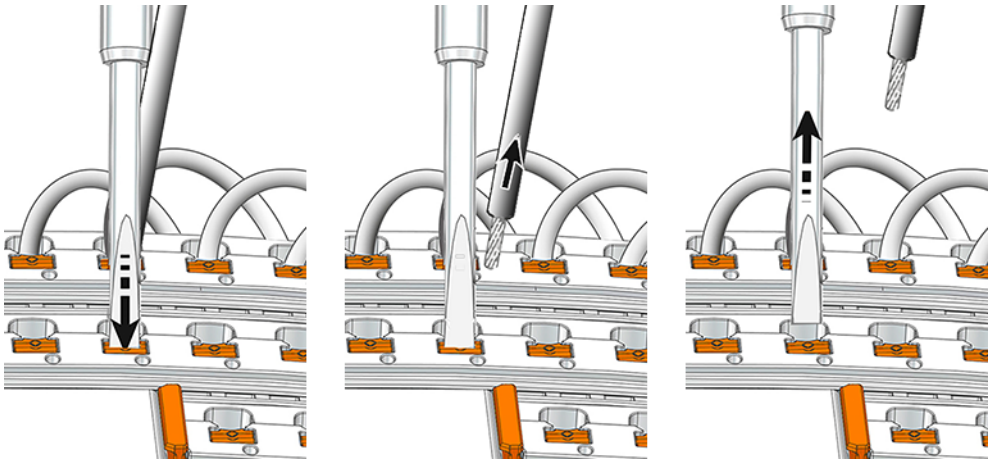


Figure 30: Removing conductor

✓ You need an operating tool.

1. Use the operating tool to press and hold the push-button next to the respective connection to open the Push-in CAGE CLAMP®.
2. Remove the conductor.
3. Release the push-button to close the Push-in CAGE CLAMP®.

➡ The conductor is now disconnected.

8.2 Conecting Modbus RTU

You can connect the product to adjacent Modbus devices via the "X1 IN" and "X2 OUT" interfaces

The Modbus RTU wires for registering communication with the subordinate controller (PLC) are connected to “X1 IN” und “X2 OUT.” This is an example of how the connections can be assigned:

- **Connection X1 IN:** PLC controller or up-circuit Modbus device
- **Connection X2 OUT:** Down-circuit Modbus device

Use a patch cable (shielded twisted pair; Category 5e or higher) to connect to the two adjacent bus devices. For more detailed information, see **Modbus-RTU interface "X1 IN" and "X2 OUT" [▸ 15]**.

9 Diagnostics

Protection against Hazardous Touch Voltages

No hazardous touch voltage is produced when the signal conditioner is used with appropriate current transformers according to the specifications. Secondary voltage is a low voltage level. The following fault cases can result in high voltage levels:

- Open current path for one or more transformers
- General insulation fault

Negative Power Values

If power measurements yield negative power values, check whether you have connected the corresponding current transformer or Rogowski coil with the correct orientation.

10 Configuration

The product is configured with the Interface Configuration Software.
The software offers the following functions:

- Graphical representation of the power measurement module
- Visualizing, recording and exporting measured values as CSV files
- Settings for the application
- Settings for measurements of the individual phases
- Settings of the product itself
- Energy value saving settings
- Saving all settings
- Modbus communication settings
- Data logging settings

10.1 System Requirements

Table 67: Minimum System Requirements

Component	Requirements
Operating system	▪ Windows® 8 (32 and 64 bit) ▪ Windows® 8.1 (32 and 64 bit) ▪ Windows® 10 (32 and 64 bit) ▪ Windows® 11 (32 and 64 bit)
Memory	2 GB
Free hard disk space	150 MB
Processor	1 GHz or higher, 32 bit (x86) or 64 bit (x64)
Screen resolution	800 × 600 pixels

Table 68: Recommended System Specifications

Component	Requirements
Operating system	Windows® 11 (32 and 64 bit)
Memory	8 GB
Free hard disk space	250 MB
Processor	1 GHz or higher, 64 bit (x64)
Screen resolution	1920 × 1080 pixels

10.2 Install WAGO Interface Configuration Software

✓ You must be on the WAGO website (↗ **www.wago.com**).

✓ You must have administrator rights for the PC on which the software will be installed.

1. In the search field, enter **WAGO Interface Configuration Software G2**.

   ⇨ You will see two suggestions: **WAGO Interface Configuration Software G2 SMALL** and **FULL**. If you download the FULL variant, the *Microsoft .NET Framework* is also installed in addition to the interface configuration software.

2. Decide which variant you need depending on whether you already have *Microsoft .NET Framework* installed on your computer.

3. To download **G2 WAGO Interface Configuration Software**, click **[Request]**.
   ⇨ You will be redirected to the **Request Download** registration page.
4. Fill in the registration information and click **[Submit]**.
   ⇨ After successful registration, you will be redirected to the download.
5. Click **[Download]**.
6. Start the installation process by double-clicking the installation file.
7. Choose whether to create a desktop icon and whether you want to launch the software immediately.
8. Click **[Finish]** to complete the installation.

➡ The **G2 WAGO Interface Configuration Software** is installed and ready for use.

10.3 Configure Product

You can use the software to configure the product either online or offline (see also**Dialog settings**.

Folgende Voraussetzungen müssen erfüllt sein, bevor Sie online mit der WAGO Interface Configuration ssoftware arbeiten können:

- The following requirements must be met before you can work online with the WAGO Interface Configuration software:
- The product must be supplied with power.

10.4 Starting the Software

After launching the software, a window opens in which the menu bar is displayed.

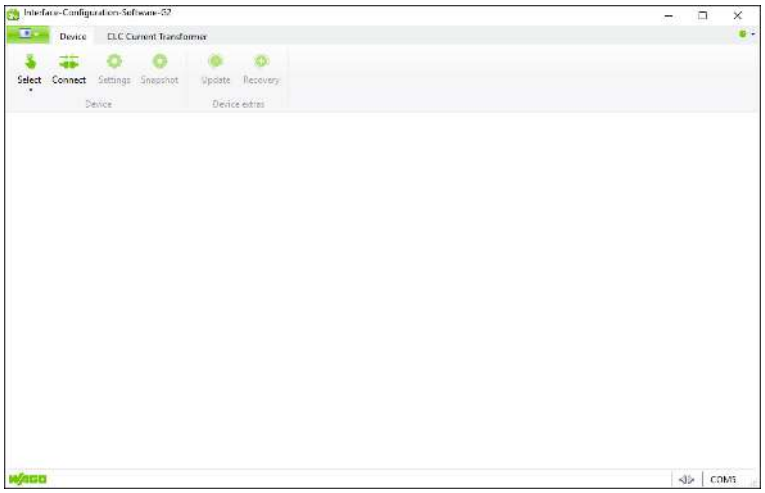


Figure 31: Start View

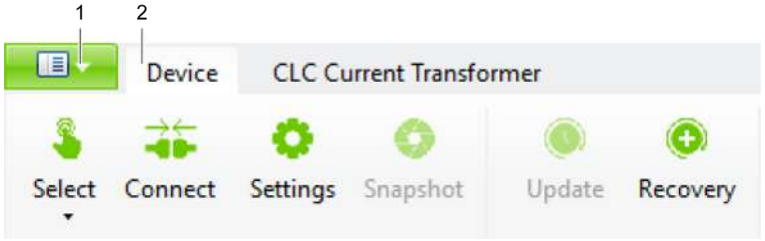


Figure 32: Start View - Tabs

Pos.	Tab
1	Backstage
2	Device

“Backstage” Tab

To create the product in the software for the first time, perform the following steps on the two tabs:

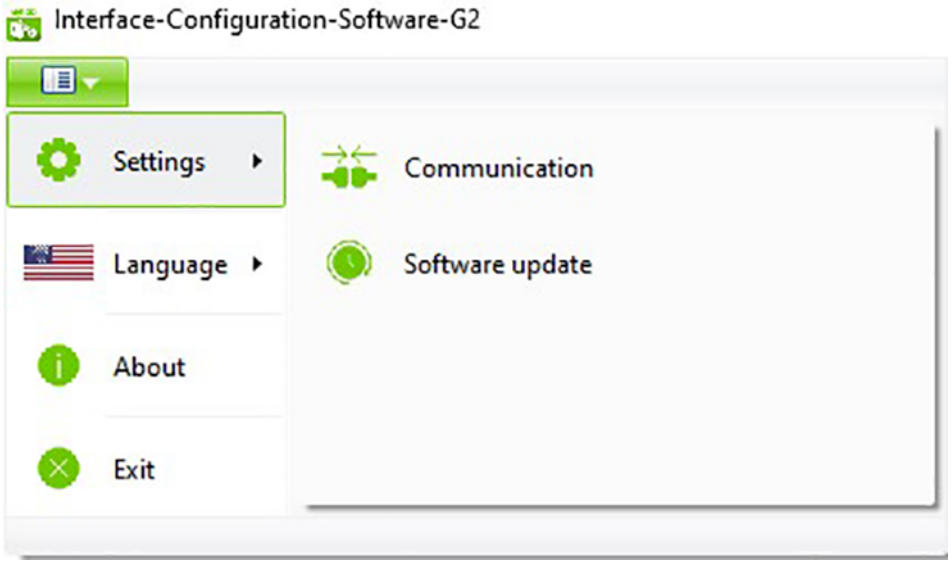


Figure 33: “Backstage” Tab

Menu item	Description
Settings	▪ Selects the communication (serial interface). ▪ Used for software updates
Language	Selects the display language for the software.
About	Displays information about the software (e.g., version).
Exit	Closes the software and the dialog.

On this tab, make the following settings:

1. Select Menu Item **[Settings]** < **[Communication]**.
2. In the *Communication settings* dialog under **COM Port**, select the corresponding entry for your connection between PC and Product (Example: **WAGO USB Service Cable**).
3. Click **[Save]**.

"Device" Tab

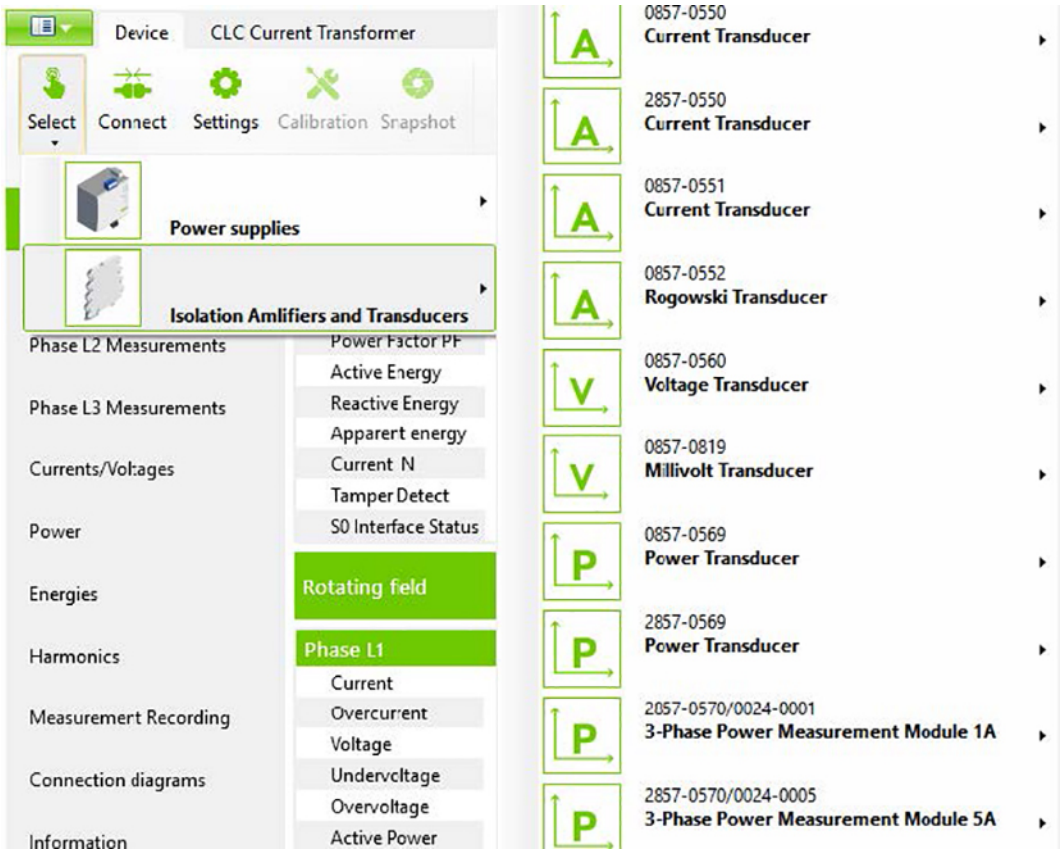


Figure 34: Device Tab – Menu item Select

On this tab, you initially only have two menu items available:

Menu item	Description
Select	Selects the product to connect to the software.
Connect	Connects the selected product to connect to the software.

The other menu items are not available until you have established the connection between your product and the software (see **Menu Bar**). The **Settings** menu item is an exception; this menu item is available as soon as a product has been manually selected or automatically detected by the software.

The settings you have to make on this tab depend on whether you are configuring your product offline or online:

Offline Configuration

For offline configuration, make the following settings:

1. Select the **[Select]** menu item.
2. Select the product you are using.

➡ Your product has been set up in the software.

You can now use the software to configure your product offline (see Dialog: *Settings*).

Online Configuration

If your product is already connected to the computer online, you can immediately select the *Connect* menu item. The software automatically detects which product is connected.

10.5 Graphical User Interface

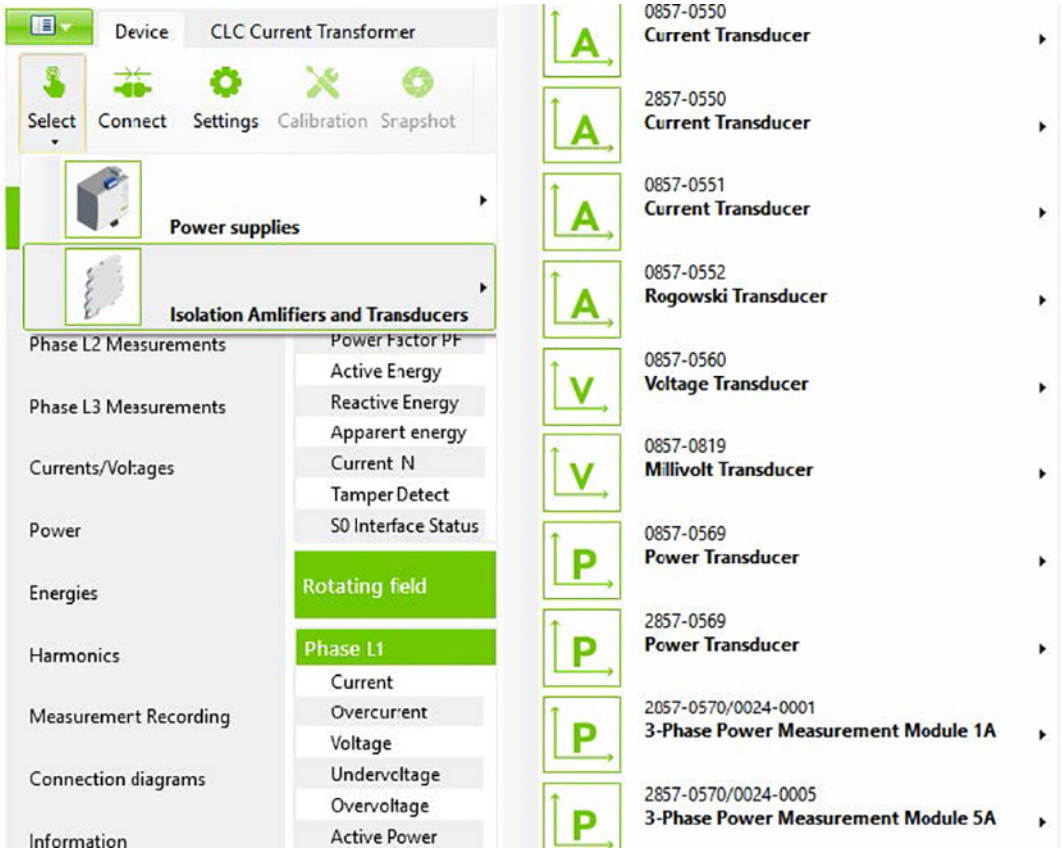


Figure 35: Display Area: Overview

Table 69: Display Area: Overview

Pos.	Area	Description
1	Menu Bar	The individual menu items and buttons for the general parameters are located here.
2	Selection Area	The individual buttons that lead to the corresponding measured value views are located here.
3	Measured value views	Depending on the view selected in the selection area, the specific measurement values are displayed here.
4	Product information	This section contains information on the connected product.
5	Footer	The footer indicates the status and interface of the active connection.

Menu Bar

The menu bar is divided into the *Backstage* and *Device* tabs. The *Backstage* tab is described in Starting the Software.
The description for the Device tab will be explained further below.

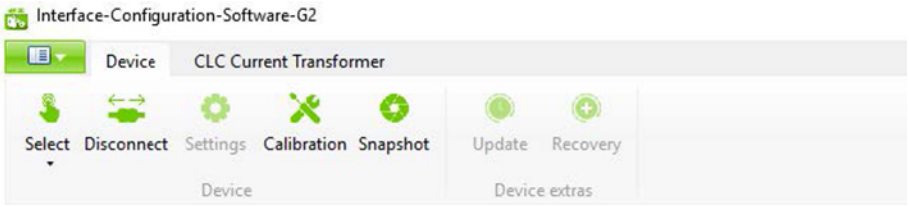


Figure 36: "Device" Tab

Table 70: "Device" Tab

Menu item	Description
Select	Open the product selection to select a new product (see Starting the Software).
Disconnect Connect	Connects/disconnects the connected product to/from the software.
Settings	Opens the dialog Settings.
Calibration	Used to calibrate the connected product.
Snapshot	Creates a snapshot of all parameters and measured values, which can be stored as a CSV file.
Update	Performs a firmware update on the product. The newest firmware update and corresponding information on compatibility can be obtained from WAGO Technical Support.
Restore	Not available for this product.

Making Settings

In this dialog, you can modify settings for the product. Two options are available:

- Online: With this option, the **[Save to Device]** button writes the settings directly to the product.
- Offline: With this option, the settings must be saved externally using the **[Export]** button. If a product is connected to the software later on, you can import these settings into the software with the **[Import]** button and then write them directly to the product with the **[Save to Device]** button.

The settings can be made in the following sections:

- Device settings
- Phase L1
- Phase L2
- Phase L3
- Phase N
- Date/Time
- Energy
- Modbus
- Factory settings
- SD card

Changes that have been made but not yet saved are marked with the pencil symbol.

Buttons

The buttons apply generally and are identical in all sections..

Figure 37: Dialog settings – Buttons

Table 71: Dialog Settings – Buttons

Menu item	Description
[Select]	Imports previously saved settings, e.g., w hen a product is replaced or configuration is performed offline.
[Disconnect] **[Connect]**	Saves the new settings externally. The saved settings can be imported into a product that is configured offline, a replacement product or a product used in a similar w ay, for example.
[Settings]	Resets all settings to the factory defaults.
[Calibration]	Reads all saved settings from the connected product.
[Snapshot]	Writes all the settings that have been made to the connected product.
[Update]	Closes the dialog. Any settings that have not been saved are lost.

The individual sections of the dialog are described below.

"Device settings" Tab

Device-specific settings can be parameterized here.

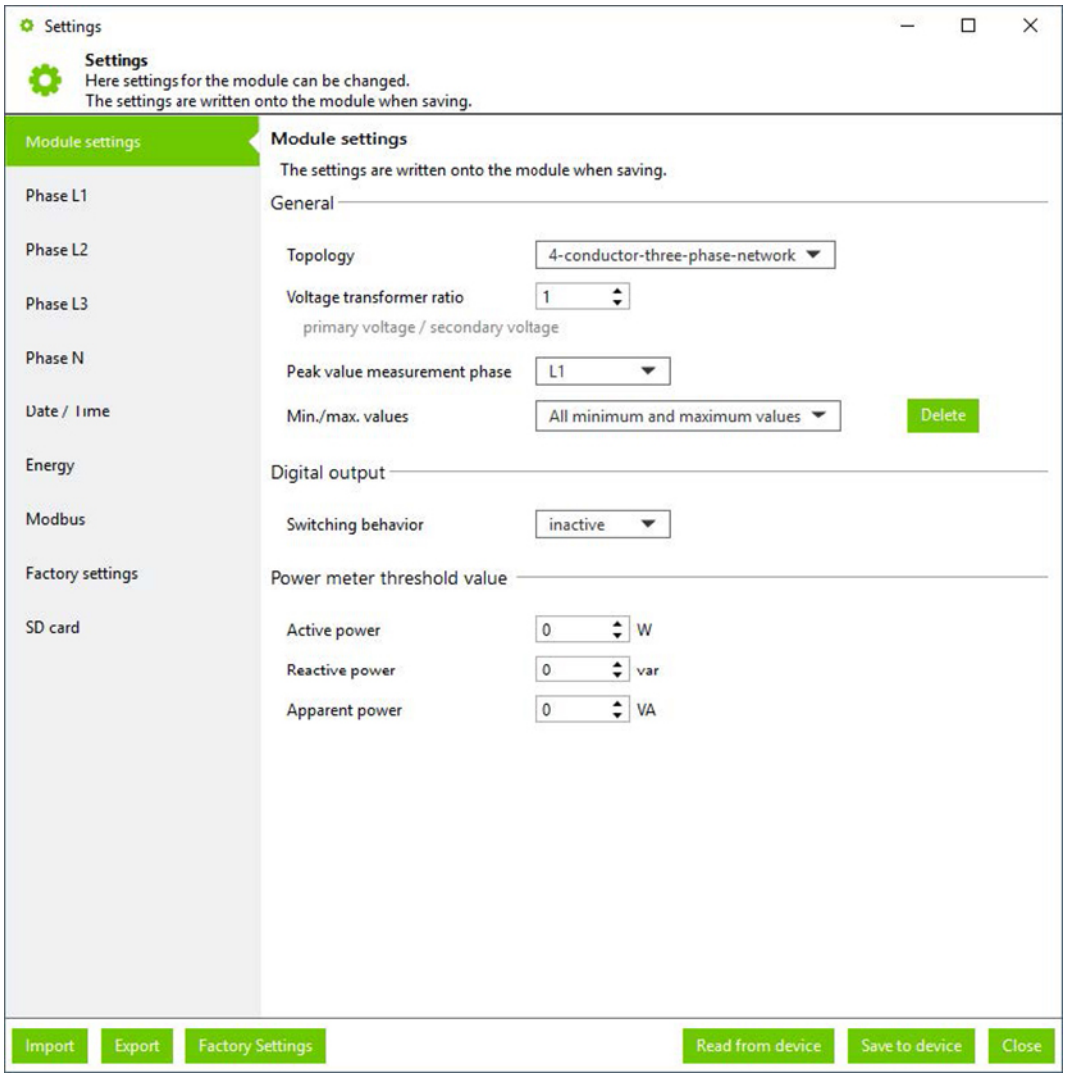


Figure 38: "Device settings" Tab

Table 72: Dialog settings – Device settings

Setting options	Description
General	
Topology	The topology can be selected here. The options are as follows ▪ 4-wire threephase network ▪ 3-wire threephase network (ARON) ▪ 3-wire threephase network ▪ 2-wire network
Voltage transformer (VT) (primary voltage/ secondary voltage)	The relationship between primary and secondary voltage can be set here.
Peak value measurement phase	The line conductor for which the peak value should be measured can be selected here. The options are as follows: ▪ L1 ▪ L2 ▪ L3
Min./Max. Values **[Delete]**	A minimum or maximum value that should be deleted can be selected here. It is also possible to delete all measured values. Deletes the selection.
Digital output	
Switching behavior	The digital output switching behavior can be selected here. The options are as follows: ▪ inactive ▪ S0 interface ▪ U_S switching ▪ GND switching
Energy meter	
Active power	Corresponding threshold values for active power, apparent power and reactive pow er can be selected here. Systemic leakage currents are not included in the energy measurement. The energy measurement is interrupted as soon as there is an underrun of one of the set values.
Reactive power	
Apparent power	

"Phase Lx" Tab

On this tab, the user scaling for phases L1 ... L3 can be parameterized.

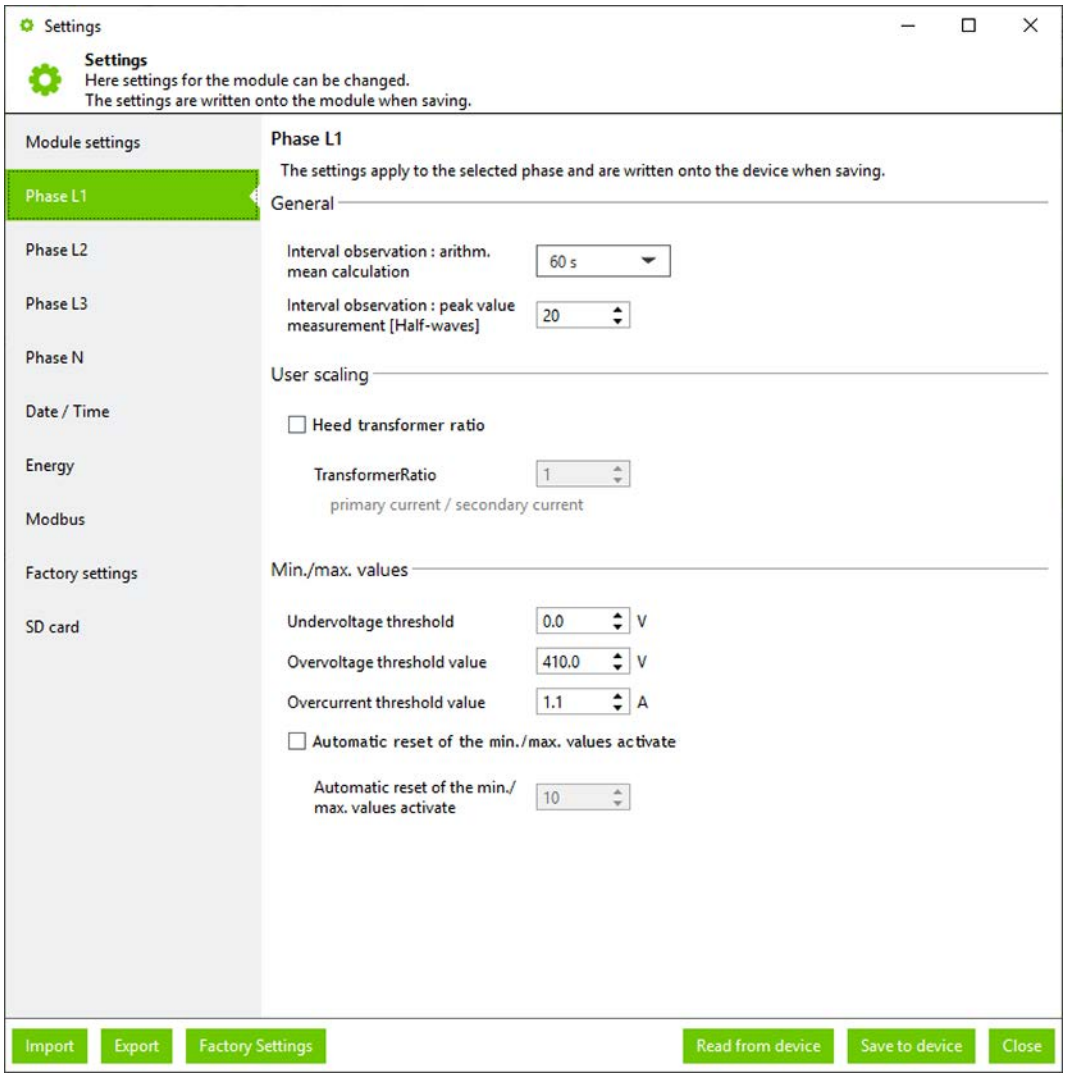


Figure 39: "Phase Lx" Tab

Table 73: Dialog Settings – Phase Lx

Setting options	Description
General Phase L1/L2/L3	
Interval observation: arith. average value	The interval for the arithmetic average value calculation can be entered here.
Interval observation: Peak value measurement (Halb-wellen)	The setting for the interval for the peak value measure-ment can be entered here
Min./Max. Value	
Undervoltage Threshold	The Undervoltage threshold value can be entered here. Values 0 V ... 440 V are possible.
Overvoltage Threshold Value	The Overvoltage threshold value can be entered here. Values 0 V ... 440 V are possible.
Overcurrent Threshold	The Overcurrent threshold value can be entered here. Values from 1 A ... 65535 A are possible.
Activate automatic reset: Min./Max. Value	If this control box is activated, the minimum and maxi-mum current, voltage and pow er values are automati-cally reset after a specified time.

"Phase N" Tab

On this tab, the user scaling for the neutral conductor can be parameterized

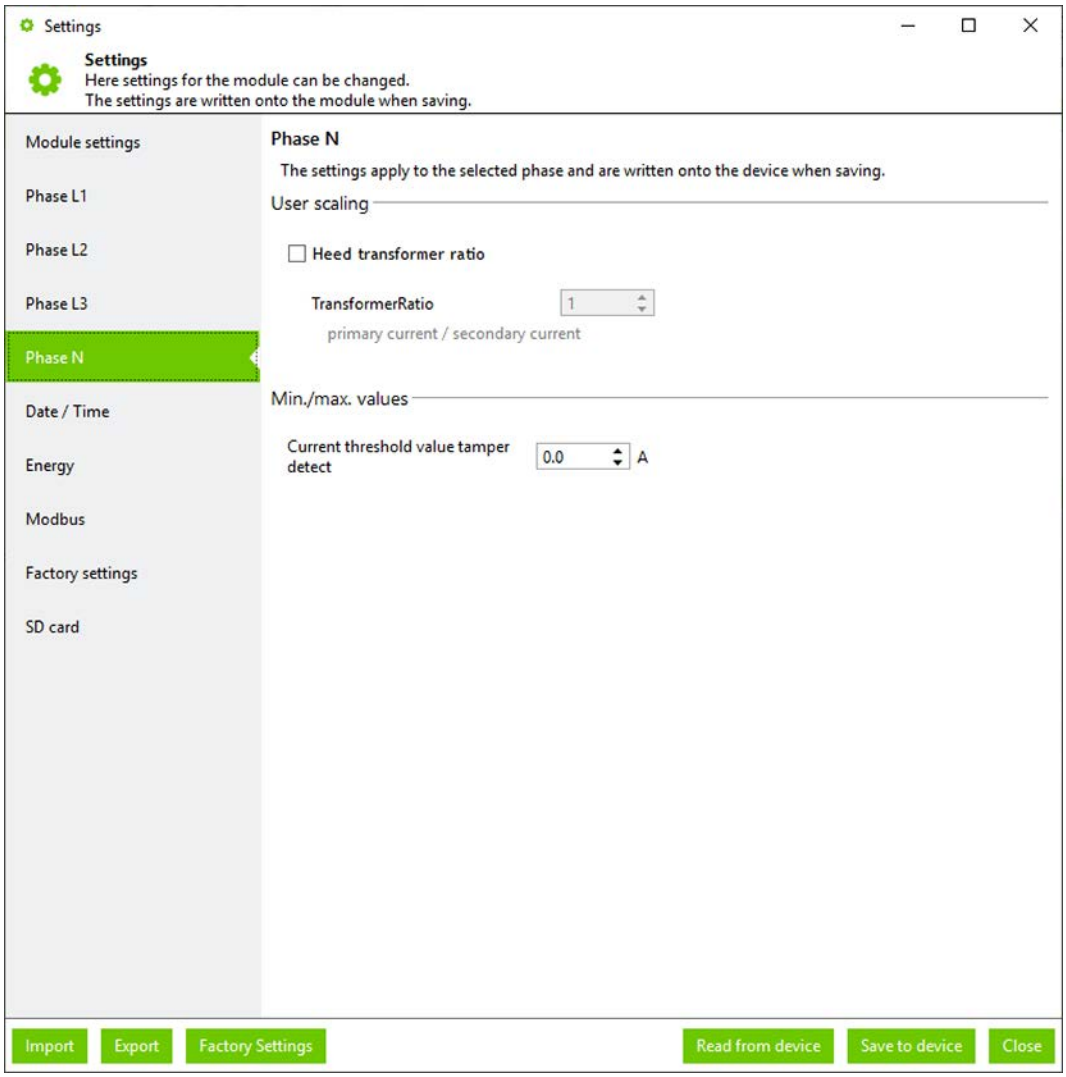


Figure 40: Dialog Settings – Phase N

Table 74: Dialog Settings – Phase N

Setting options	Description
Min./Max.Value	
Current threshold/Tamper Detect	The threshold value for the fault current detection (Tamper Detect) can be entered here.

"Date/Time" Tab

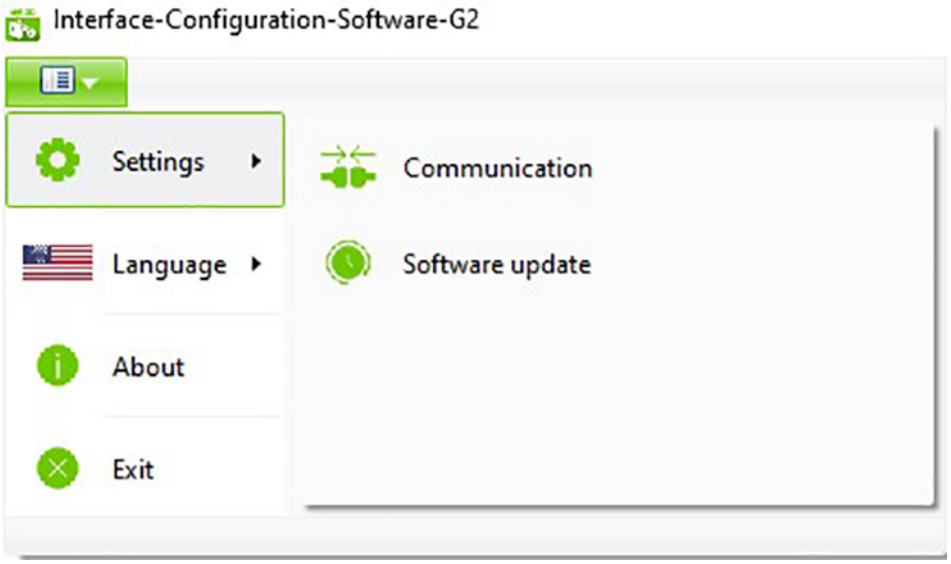


Figure 41: Dialog Settings – Date/Time

Table 75: Dialog Settings – Date/Time

Setting options	Description
Computer/Manual	You can set date and time: ▪ Adoption of the computer's system time or ▪ Date and time are manually set
[Apply]	Applies the changes made.
Connected Device	Displays the current information on the date and time of the connected product.

"Energy" Tab

The energy values for each phase can be adapted or reset here. This view is password-protected. The initial password is: *wago*.

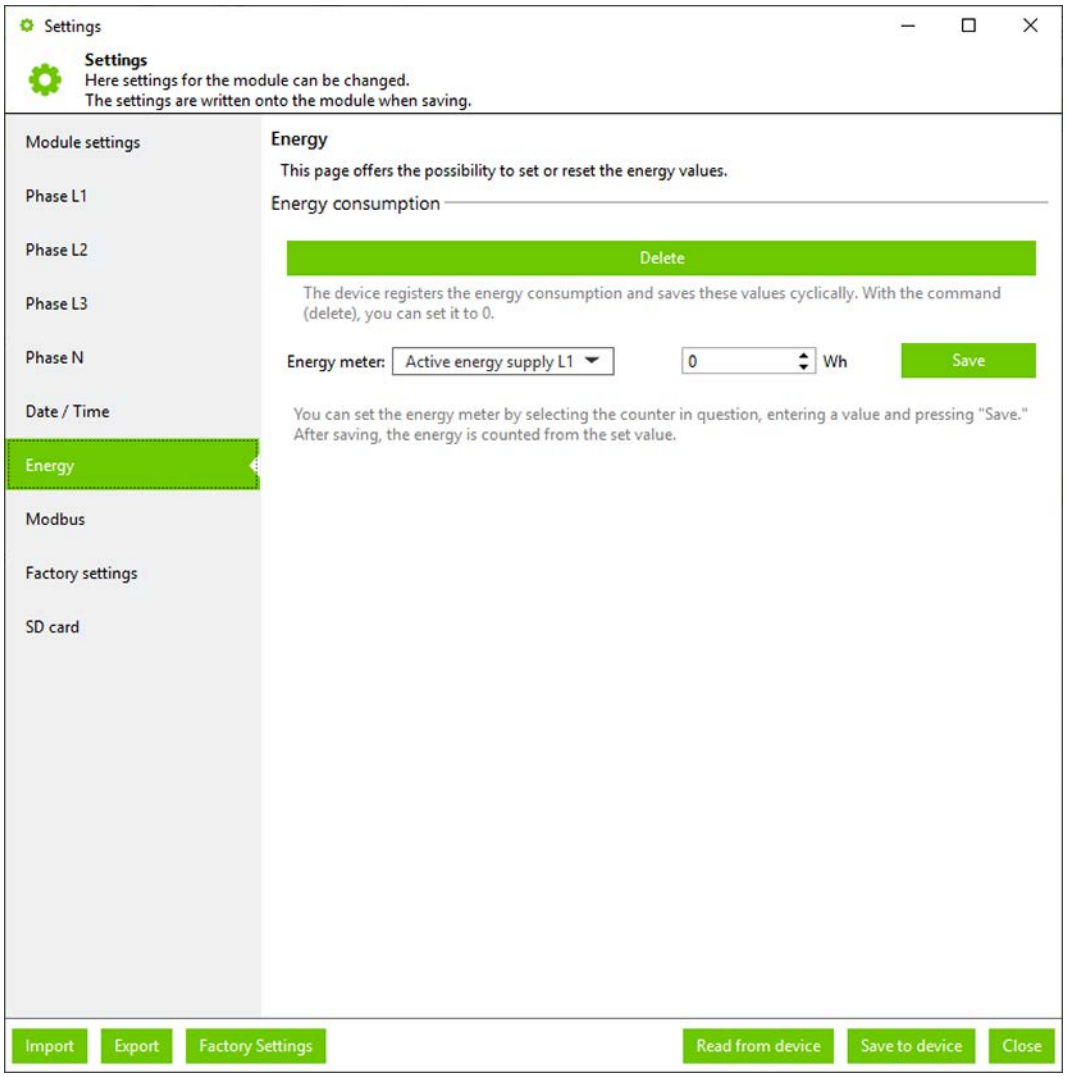


Figure 42: Dialog Settings – Energy

Table 76: Dialog Settings – Energy

Setting options	Description
Energy consumption **[Delete]**	Deletes the recorded energy range.

Setting options	Description
Energy meter	**Selection box:** Here, the energy meter can be selected: ▪ Active energy import L1 ▪ Active energy import L2 ▪ Active energy import L3 ▪ Active energy export L1 ▪ Active energy export L2 ▪ Active energy export L3 ▪ Reactive energy inductive L1 ▪ Reactive energy inductive L2 ▪ Reactive energy inductive L3 ▪ Reactive energy capacitive L1 ▪ Reactive energy capacitive L2 ▪ Reactive energy capacitive L3 ▪ Apparent energy L1 ▪ Apparent energy L2 ▪ Apparent energy L3 **Value:** The value the energy meter should be set to can be selected here. **[Save]:** Saves the new settings.

"Modbus" Tab

Settings that apply specifically to Modbus can be made here.

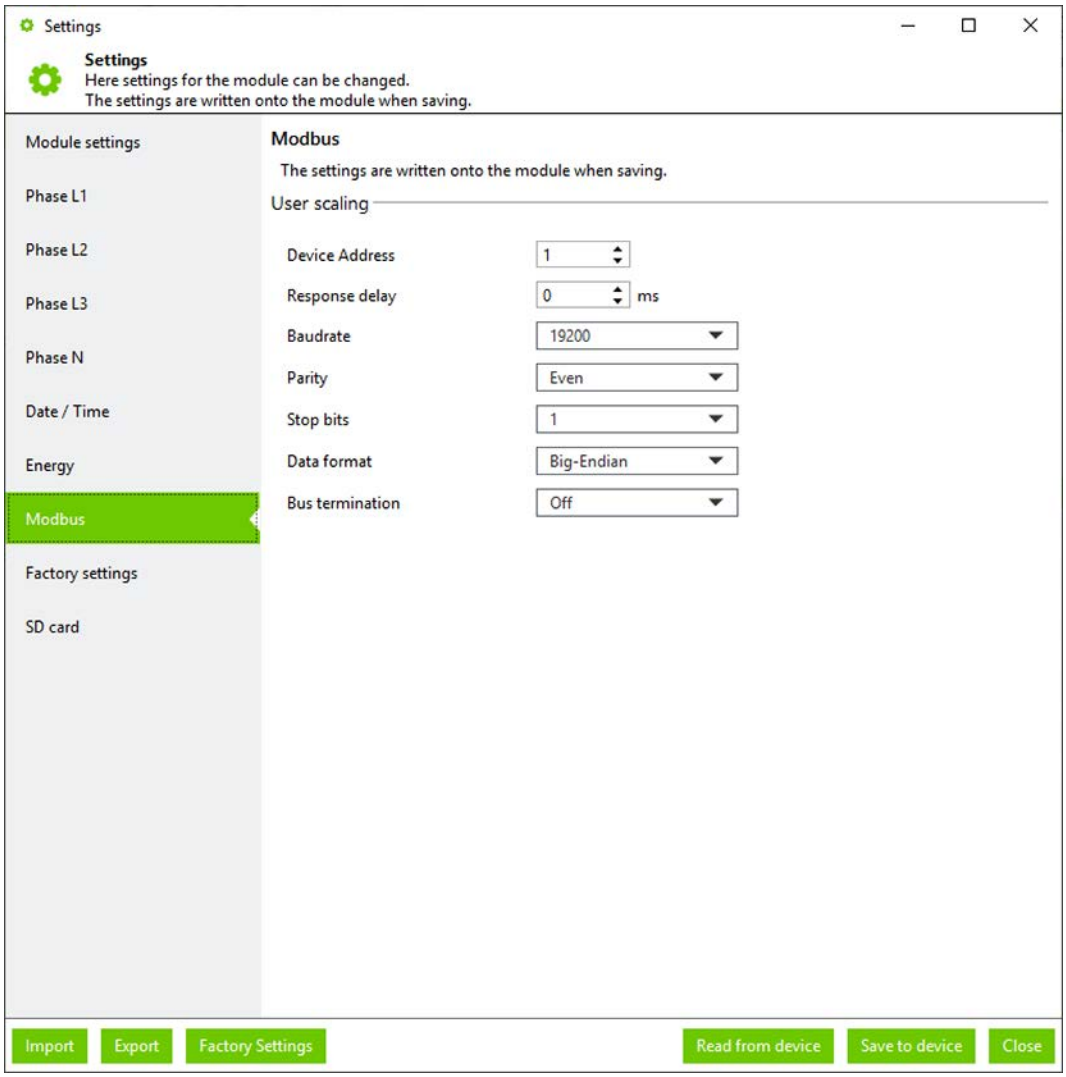


Figure 43: Dialog Settings – Modbus

Note

Set the correct Device Address, Baud Rate and Parity!

Each device on the bus must have a different address. But: The baud rate and parity must always be the same!

Table 77: Dialog Settings – Modbus

Setting options	Description
Device address	The device address can be entered here.
Response delay	The response delay can be entered here.
Baud rate	The baud rate can be selected here. The options are as follows: **▪ 19200 Baud** **▪ 9600 Baud**

Setting options	Description
Parity	The Parity can be selected here. The options are as follows: **▪ Gerade** **▪ Keine** **▪ Ungerade**
Stop bits	The stop bits can be selected here. The options are as follows: **▪ 0.5** **▪ 1** **▪ 2** **▪ 2.5**
Data format	The data format can be selected here. The options are as follows: **▪ Big Endian** **▪ Middle Endian** **▪ Little Endian**
Bus termination	The Bus termination can be selected here. The options are as follows: **▪ Off** **▪ 150 Ω** **▪ 120 Ω 1nF**

"Factory Settings" Tab

You can reset the product to the factory settings.

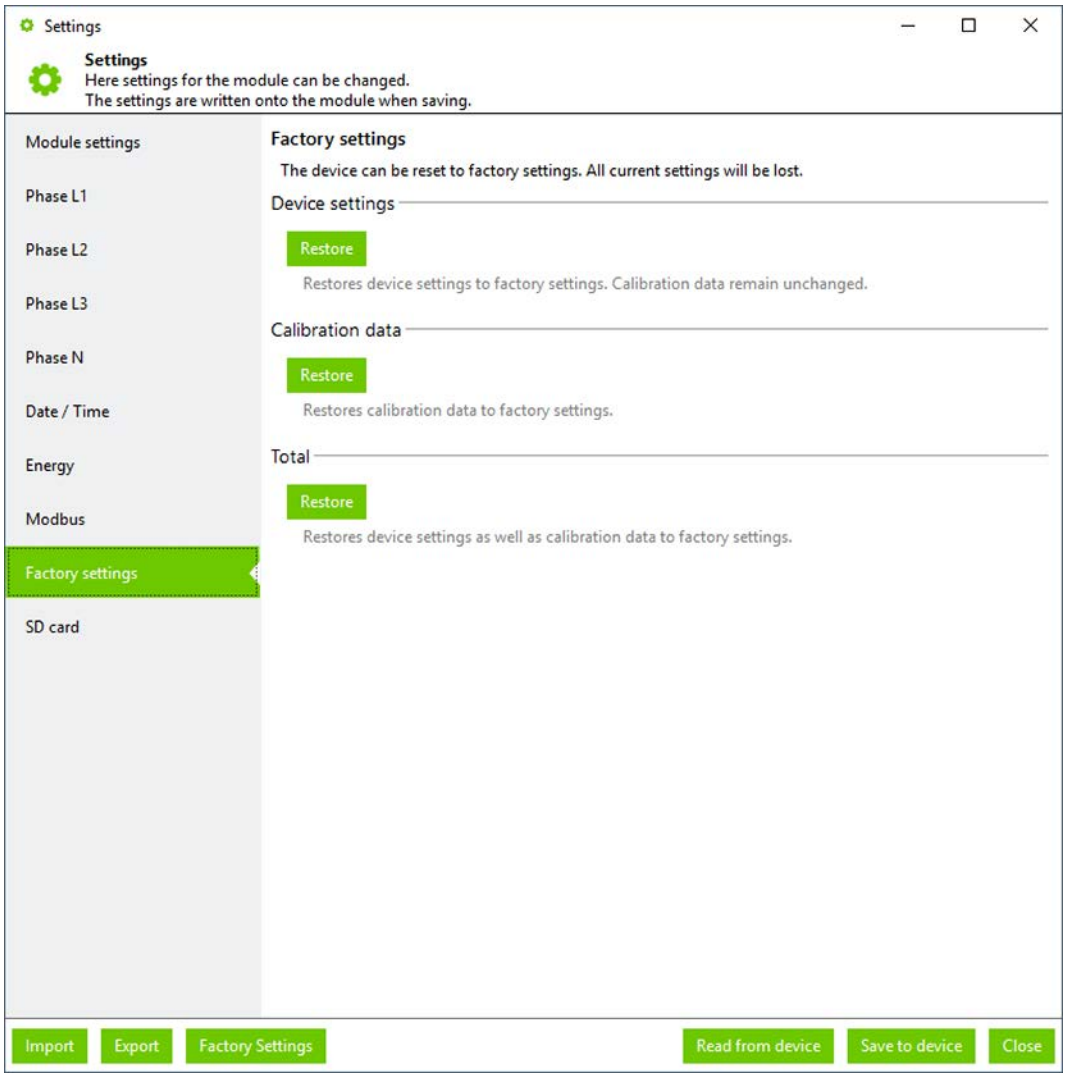


Figure 44: Dialog Settings – Factory Settings

Table 78: Dialog Settings – Factory Settings

Setting options	Description
Device Settings	Only the device settings are reset. Calibration data remains unaffected.
Calibration data	Only the calibration data is reset. The device settings are retained.
Total	All device settings and calibration data can be reset.

"SD card" Tab

The values to be saved on the SD card can be selected here. The time points or event values that should be written can also be set.

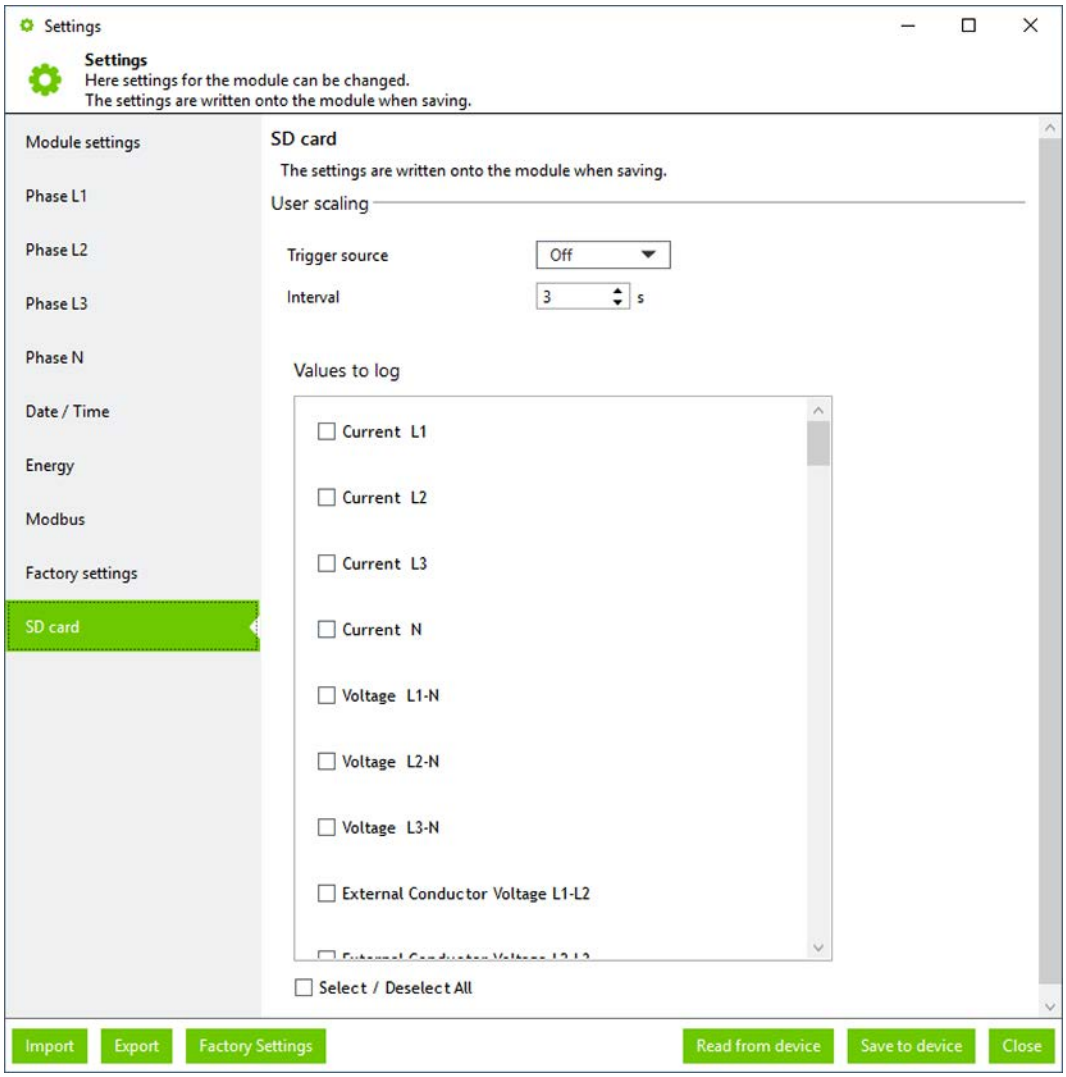


Figure 45: Dialog Settings – SD card

Table 79: Dialog Settings – SD card

Setting options	Description
Trigger source	The Trigger source can be selected here. The options are as follows: **▪ Off** **▪ Time-controlled** **▪ Event-controlled**
Interval	The trigger interval can be entered here.
Value for logging	The measured values that should be logged can be selected here.
Select/deselect all	Activates or deactivates all parameters.

Selection Area

The individual buttons for the corresponding measured value views are located here.

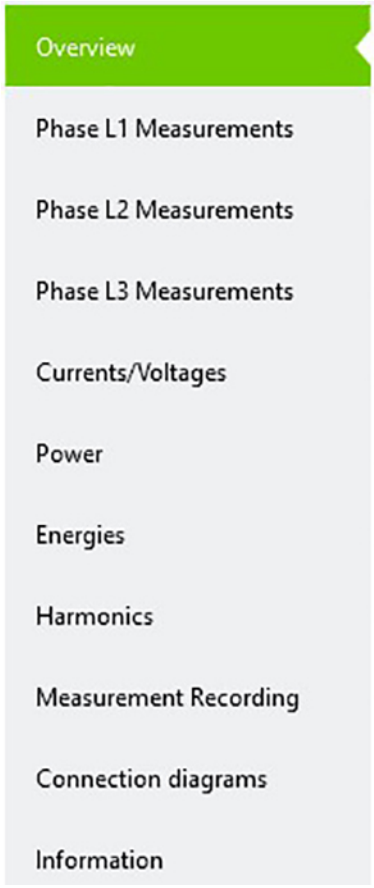


Figure 46: Selection Area

Depending on the selected button, the corresponding detailed view opens. The specific measured values are displayed in the individual views. In addition, specific parameters can be activated, deactivated or adapted here. All the views are described in the cection **Measured Value Views** below.

See also

- Starting the Software [▶ 70]

10.6 Measured Value Views

The specific measured values are displayed here. In addition, specific parameters can be activated, deactivated or adapted.

Measured Value View *Overview*

In this view, the measured values of the three phases are displayed next to each other.

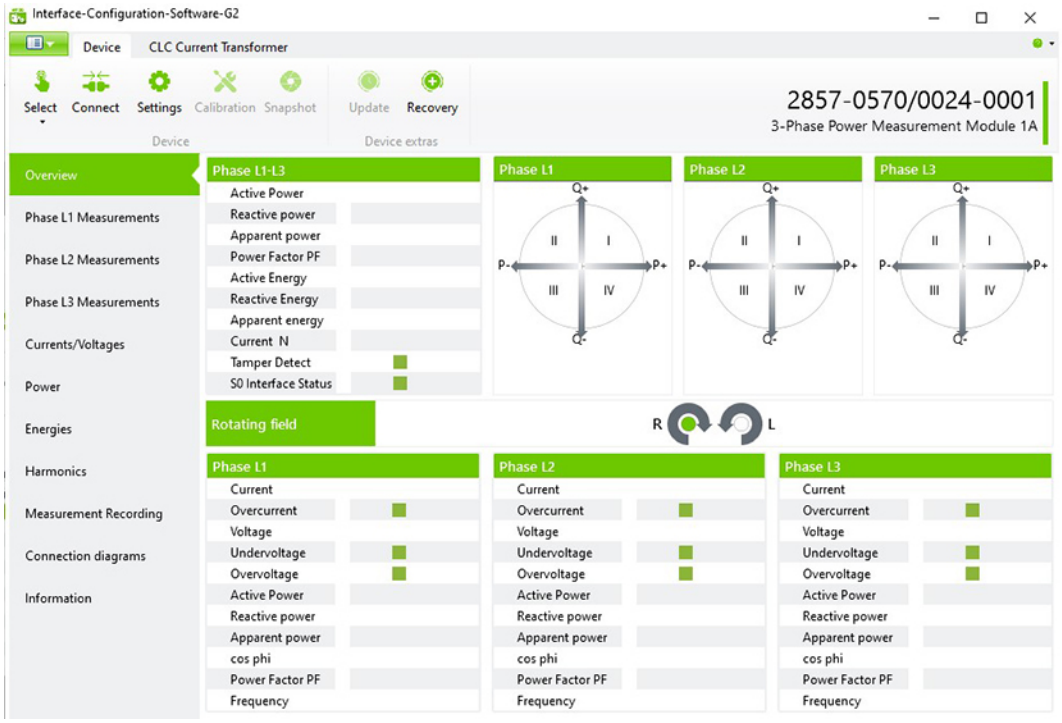


Figure 47: Measured Value View Overview

Measured Value View *Phase L1 ... L3*

There is a specific view for the measured values for each phase L1 ... L3 .
User scaling, min./max. values and general parameters can be configured on tabs *Phase L1, Phase L2 and Phase L3* . These are saved in the product.

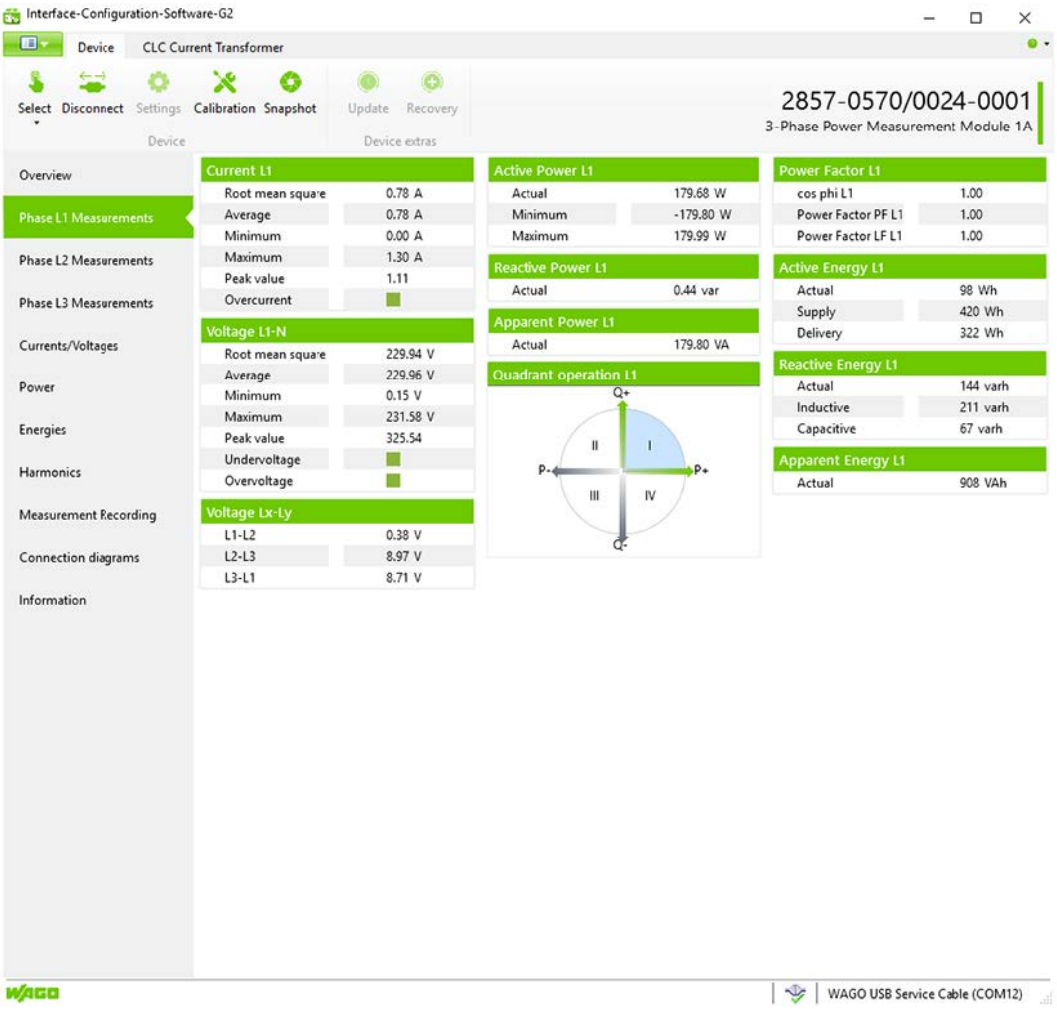


Figure 48: Example: Measured Value View Phase L1

Measured Value View *Currents/Voltages*

The specific currents and voltages are displayed in this view.

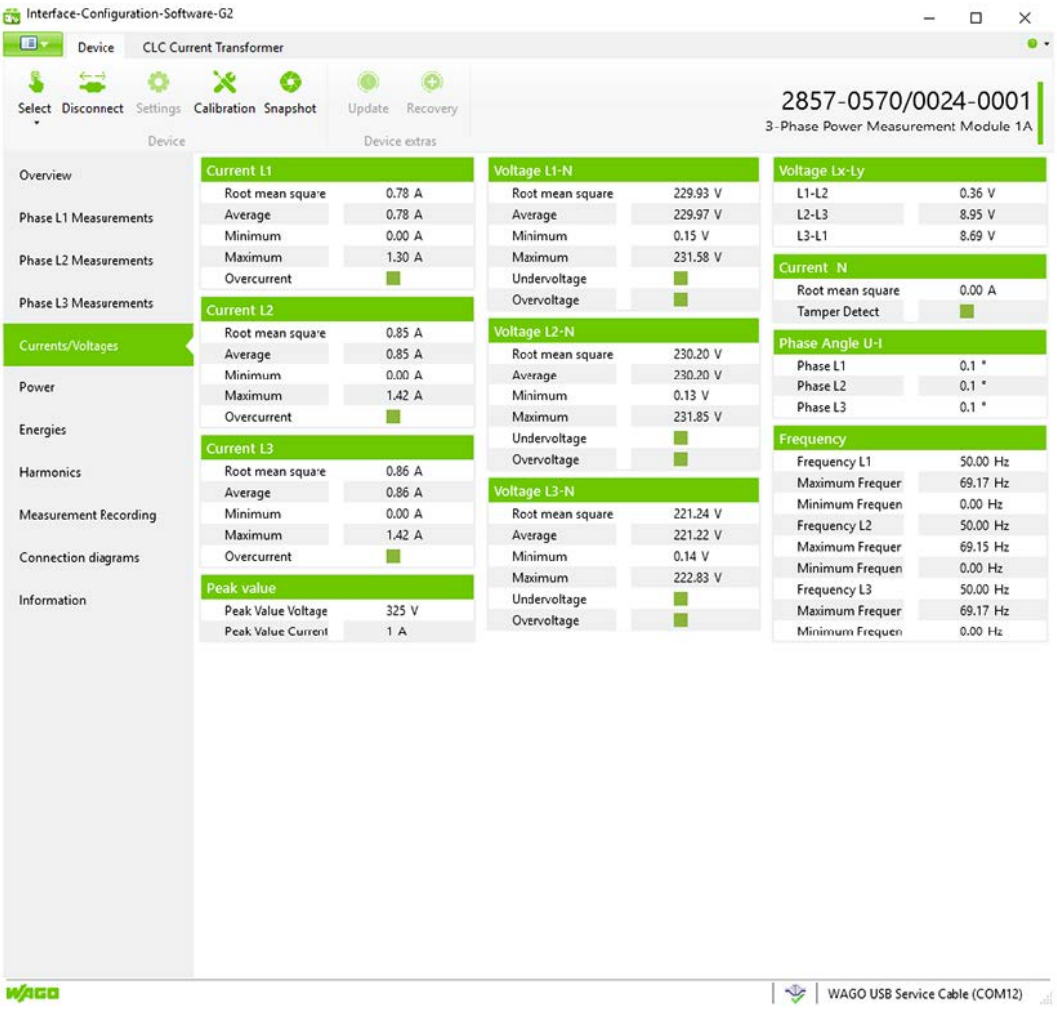


Figure 49: Measured Value View Currents/Voltages

Measured Value View *Power*

The specific services are displayed in this view.

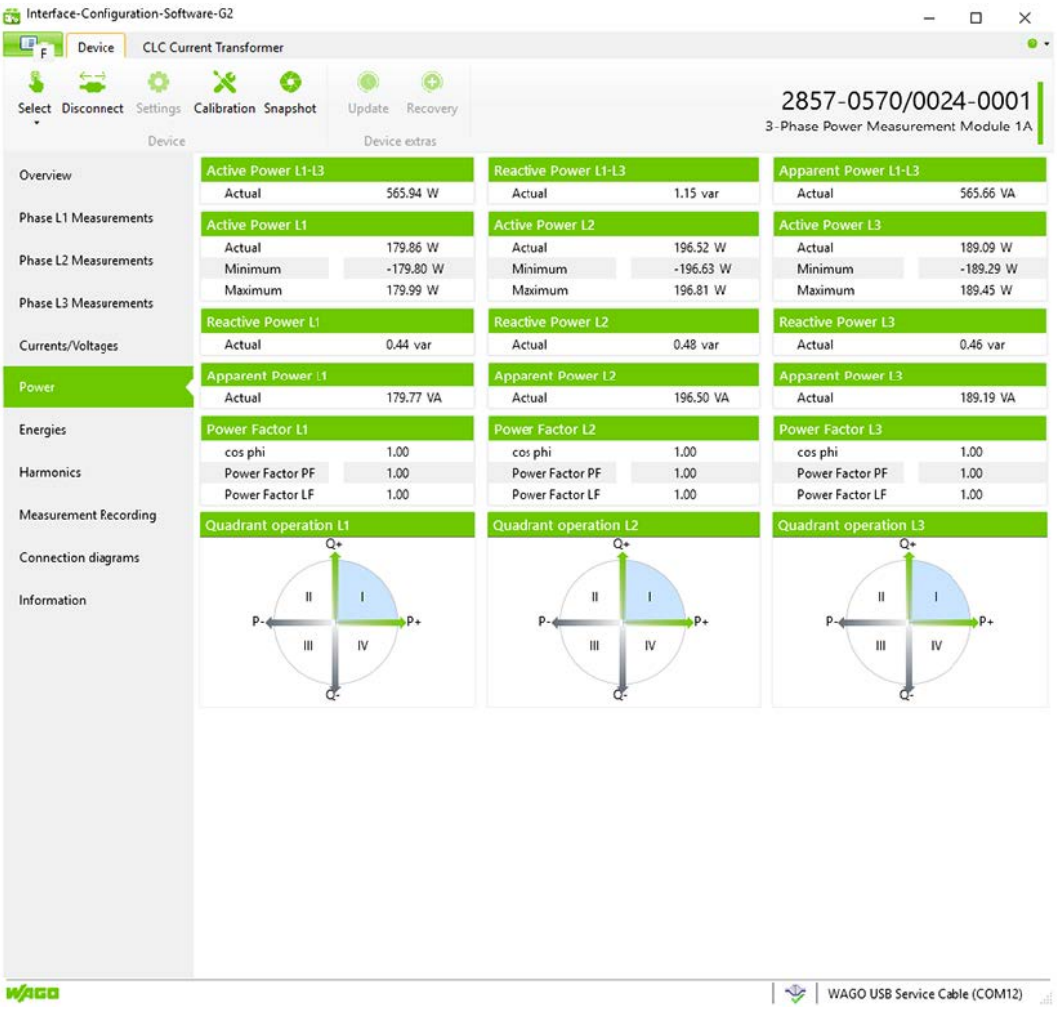


Figure 50: Measured Value View Power

Measured Value View *Energie*

In this view, the different energies are displayed.

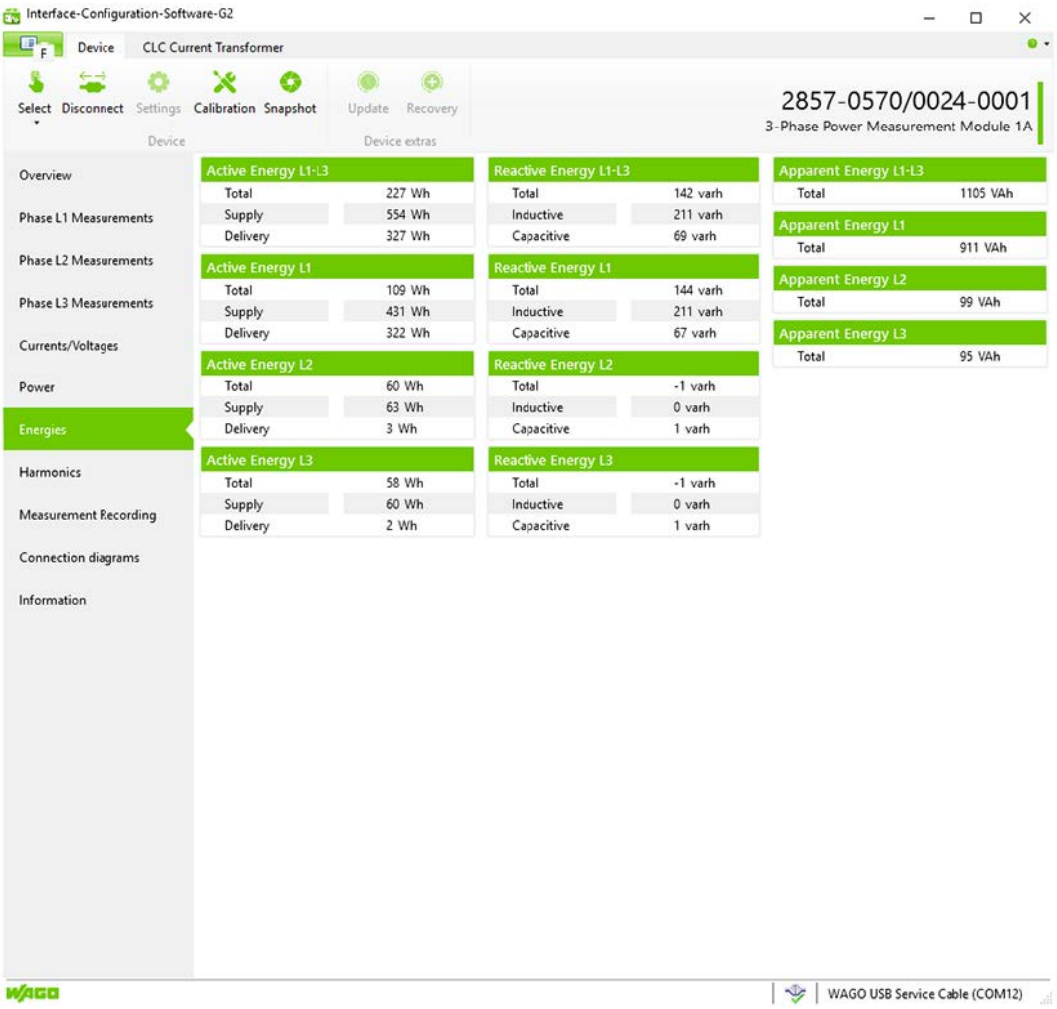


Figure 51: Measured Value View Energies

Measured Value View *Harmonics*

The 40 harmonics of all three phases are displayed in this view.

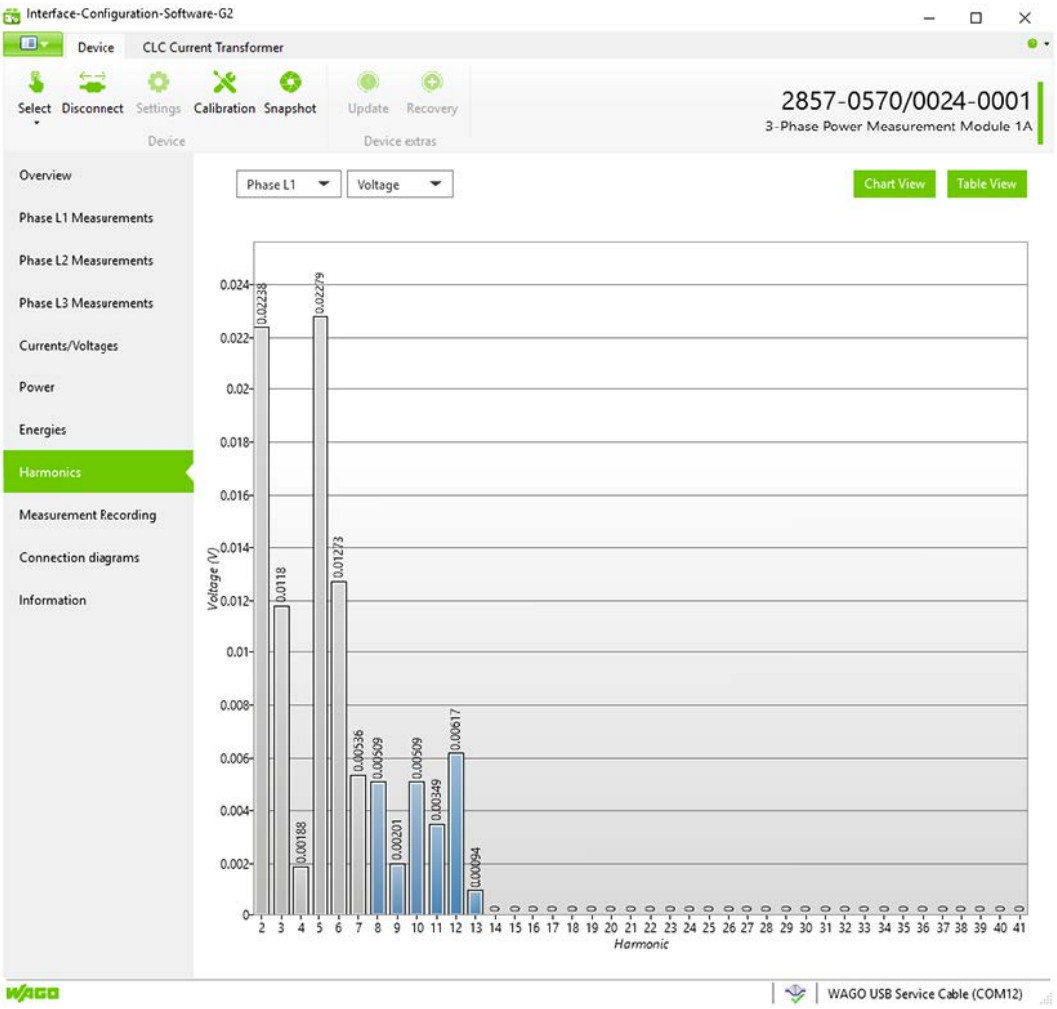


Figure 52: Measured Value View Harmonics

Table 80: Measured Value View Harmonics

Setting options	Description
Selection box for the phases	The phase to be analyzed can be selected here.
Selection box for the voltage channel/current channel	Whether the voltage channel or current channel should be observed can be selected here.

Measured Value View *Measured Value Trend*

In this view, the three measured variables are shown in their temporal trends.

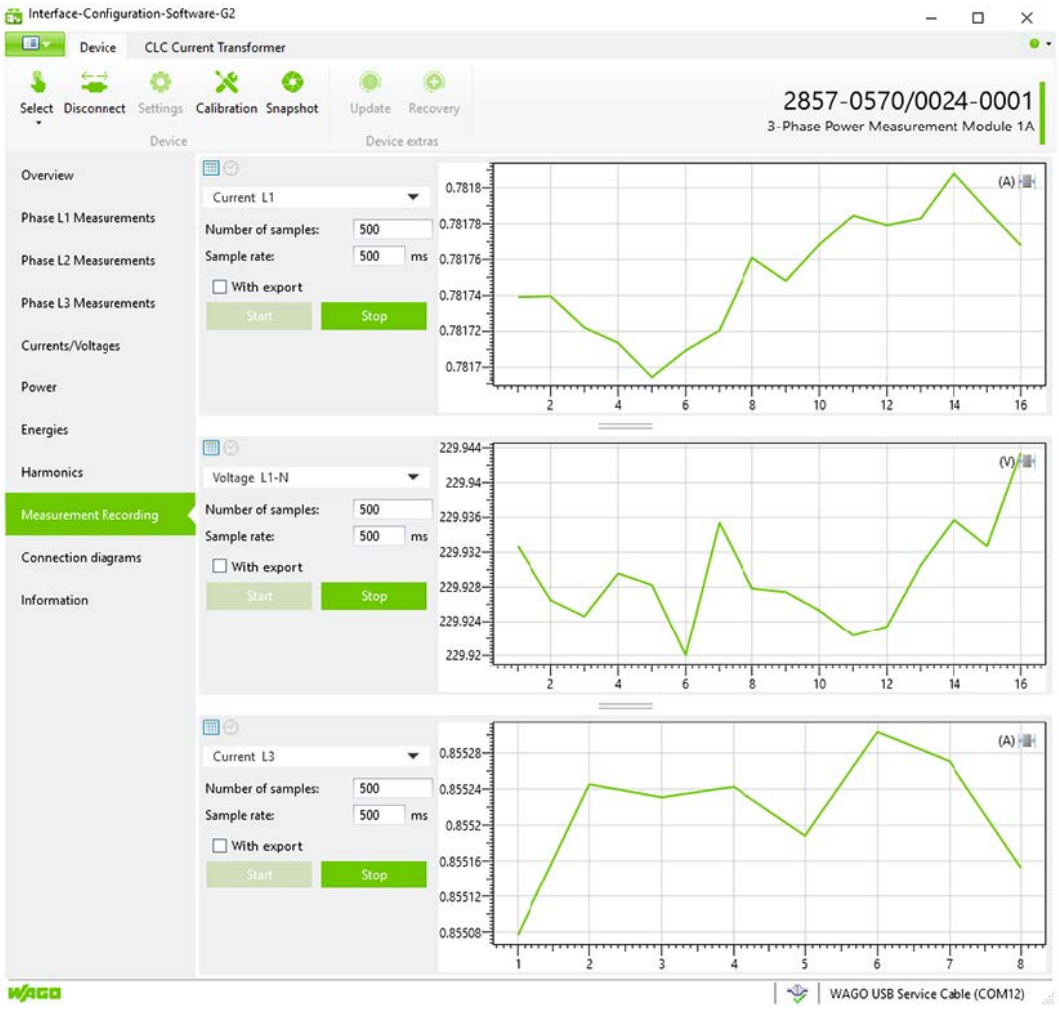


Figure 53: Measured Value View Measured Value Trend

Setting options	Description
Selection Box	The measured variable to be analyzed can be selected here.
No. of Measured Values	The number of measuring points can be entered here.
Scanning Rate	The scanning rate with which the measured values are read out can be entered.
With Export	Selection of whether the measurement is started with export (creation of a CSV file) or without export.
[Start]	**With Export** enabled: Opens the "Save As" dialog, where the saving location for a CSV file can be entered. Then the measurement starts. **With Export** disabled: Starts the measurement.
[Stop]	Stops the measurement prematurely.

1. Zoom in and out within the three graphical charts using the mouse wheel.
2. Shift the displayed region by holding down the left mouse button.
3. You can follow the current course again by clicking **[Next]**.

Measured Value View *Connection Diagram*

The various connection diagrams are displayed in this view.

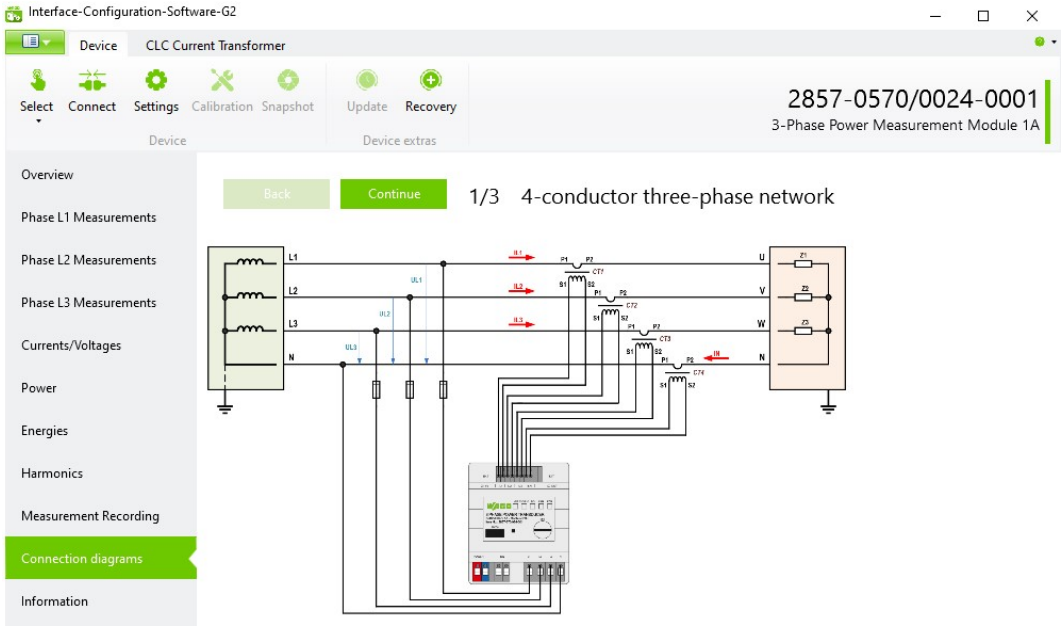


Figure 54: Measured Value View Connection Diagram

Measured Value View *Information*

Information on the connected product is displayed in this view.

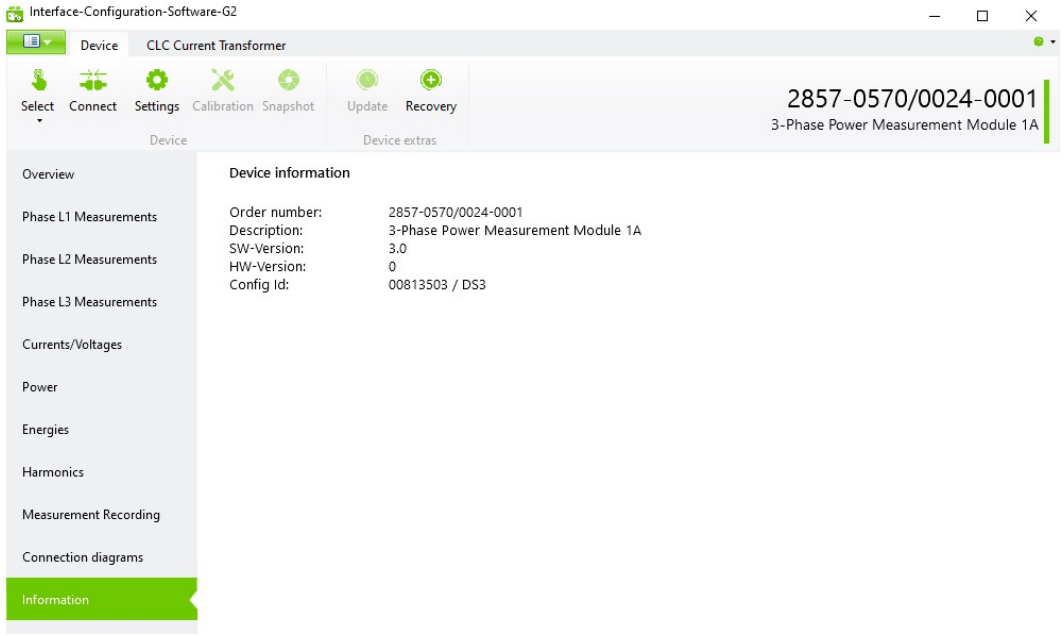


Figure 55: Measured Value View Information

Firmware Update

In addition to configuration and visualization, firmware updates can also be performed with the Interface Configuration Software.

11 Performing Measurements

During continuous measurement, the measured values can be processed in several ways.

Reading out the Measured Value Register

By default, the measured values are queried by the higher-level controller via Modbus by reading out the measured value registers (register communication).

See Communication per Modbus RTU.

Reading out the Energy Value at the S0 Interface

To determine the energy consumption, the energy values can be read out at the S0 interface. This requires the configuration of the “DO” as an S0 interface.
Ultimately, the same connection terminals are used..
The values are transmitted in the form of pulses. Pulse rates from 1 ... 10.000 pulses per kWh can be set.

Data logging with a Micro SD Memory Card

With the "data logging" function, the measured values can be cyclically saved on a micro SD card as a CSV file. All measured and calculated measurement values can be saved. Once the micro SD card is inserted, the measured values are automatically saved with the default settings.

The saving interval can be configured within a range of 1 s ... 3600 s in increments of 1 s.

Date and time are specified for each measured value. This information is provided by a real-time clock, which has an energy reserve of about eight hours.
Note that to ensure accurate time recording, this clock must be regularly synchronized with the system clock of a connected PC.

For more information about data logging, see "Configuration with the Interface Configuration Software".

These parameters support the "data logging function":

Table 81: Data logging

Parameter	Validity
RMS value current	L1
	L2
	L3
	N
RMS value voltage	L1-N
	L2-N
	L3-N
	L1-L2
	L1-L3
	L2-L3
Active power	L1
	L2
	L3

Parameter	Validity
Apparent power	L1
	L2
	L3
Reactive power	L1
	L2
	L3
Line frequency	L1
	L2
	L3
Phase angle phi	L1
	L2
	L3
cos phi	L1
	L2
	L3
Power factor PF	L1
	L2
	L3
Power factor LF	L1
	L2
	L3
Maximum RMS value current	L1
	L2
	L3
Minimum RMS value current	L1
	L2
	L3
Arithmetic mean current	L1
	L2
	L3
Maximum RMS value voltage	L1-N
	L2-N
	L3-N
Minimum RMS value voltage	L1-N
	L2-N
	L3-N
Arithmetic mean voltage	L1-N
	L2-N
	L3-N
Maximum Active power	L1
	L2
	L3
Minimum Active power	L1
	L2
	L3

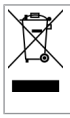
Parameter	Validity
Maximum Line frequency	L1
	L2
	L3
Minimum Line frequency	L1
	L2
	L3
Active energy	L1
Active energy import	
Active energy export	
Reactive energy	
Reactive energy inductive	
Reactive energy capacitive	
Apparent energy	
Active energy	L2
Active energy import	
Active energy export	
Reactive energy	
Reactive energy inductive	
Reactive energy capacitive	
Apparent energy	
Active energy	L3
Active energy import	
Active energy export	
Reactive energy	
Reactive energy inductive	
Reactive energy capacitive	
Apparent energy	
Active energy total	
Active energy import total	
Active energy export total	
Reactive energy total	
Reactive energy inductive total	
Reactive energy capacitive total	
Peak value voltage	
Peak value current	

The parameter default values are:

- Data logging inactive,
- Saving interval 10 s,
- Measured variables: Currents (rms); L1, L2, L3, N. Voltages (rms); L1–N, L2-N, L3–N. Active power; L2, L3.

12 Decommissioning

12.1 Disposal and Recycling

	**WEEE Mark** Electrical and electronic equipment may not be disposed of with household waste. This also applies to products without this mark.

Electrical and electronic equipment contain materials and substances that can be harmful to the environment and health. Electrical and electronic equipment must be disposed of properly after use. Environmentally friendly disposal benefits health, protects the environment from harmful substances in electrical and electronic equipment and enables sustainable and efficient use of resources.

- Observe the national and local regulations for the disposal of electrical and electronic equipment, lithium-ion batteries, lead–acid batteries and packaging.
- Clear any data stored on electrical and electronic equipment.
- Remove lithium-ion batteries, lead–acid batteries or memory cards that are added to the electrical and electronic equipment.
- Wear appropriate personal protective equipment when removing the lithium-ion batteries/lead–acid batteries.
- Dispose of the removed lithium-ion batteries/lead–acid batteries according to your local waste regulations (e. g. collection boxes at the retail or local collection points).
- Have electrical and electronic equipment sent to a local collection point.
- Dispose of all types of packaging to ensure a high level of recovery, reuse and recycling.
- Transport packages from the B2B area can be taken back free of charge via a return system in accordance with the Packaging Act. Please contact our service provider Interseroh directly. The corresponding certificate can be found at: **corporate-certificates**.
- Throughout Europe, Directives 2006/66/EC, 94/62/EC and 2012/19/EU (WEEE) apply. National directives and laws may differ.

13 Appendix

13.1 Installation Regulations Specified by Approvals

Because the following information refers to language-specific regulations, standards or certifications applicable to the specific installation and operation location, it is presented in the respective original language.

Statements on North American National differences according to UL 61010-1

Precautions on installing current transformers intended to be installed in panel boards or switchgears:

- To reduce risk of electric shock, always open or disconnect circuit from powerdistribution system (or service) of building before installing or servicing current transformers.
- The current transformers may not be installed in equipment where they exceed 75 percent of the wiring space of any cross-sectional area within the equipment.
- Restrict installation of current transformer in an area where it would block ventilation openings.
- Restrict installation of current transformer in an area of breaker arc venting.
- Not suitable for Class 2 wiring methods.
- Not intended for connection to Class 2 equipment.
- Secure current transformer and route conductors so that the conductors do not directly contact live terminals or bus.
- Only UL-listed energy monitoring current transformers intended for field installation shall be used.
- Use Copper Conductors Only

Due to the potential contact between hazardous live conductors with the output conductors of field-installed energy-monitoring current transformers, these incoming field-installed leads from switchgear units/panel boards shall be reclassified as NFPA 70 and C22.1 Class 1 wiring.

There shall be reliable segregation or separation by barriers between the following different circuits:

a) “Class 1” field wiring (such as current transformer output leads, voltage measurement leads, mains input power), I/O modules, and uninsulated live parts and

b) “Class 2” and “Class 3” field wiring, I/O modules, and uninsulated live parts.

Segregation is accomplished by clamping, routing, or equivalent means that provides a minimum permanent 6.0 mm (per NFPA 70, Article 725.136, and C22.1 Rule 4-010) between parts of different circuits.

Conductors provided with insulation rated for the highest voltage involved need not be separated or segregated.

Routing and separation between conductors and parts of different circuits can be achieved by provision of flexible tubing. The tubing shall be rated not less than the highest working voltage involved between the two circuits.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D Or nonhazardous locations only.

This equipment is an OPEN-TYPE device meant to be installed in an enclosure suitable for the environment and that is only accessible with the use of a tool.

English	French
WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR THE AREA IS FREE OF IGNITABLE CONCENTRATIONS.	AVERTISSEMENT – RISQUE D´EXPLOSION – NE PAS DÉBRANCHER PENDANT QUE LE CIRCUIT EST SOUS TENSION OU QUE L´EMPLACEMENT NE SOIT EXEMPT DE CONCENTRATIONS INFLAMMABLES.

For head stations containing SD card reader sockets only:

English	French
"WARNING: DO NOT CONNECT OR DISCONNECT SD-CARD WHILE CIRCUIT IS LIVE UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITABLE CONCENTRANTIONS OF FLAMMABLE GASES OR VAPORS."	AVERTISSEMENT: NE PAS BRANCHER NI DÉBRANCHER *SD-CARD* PENDANT QUE LE CIRCUIT EST SOUS TENSION À MOIS QUE L´EMPLACEMENT NE SOIT EXEMPT DE CONCENTRATIONS INFLAMMABLES.

For devices with Ether CAT/Ethernet connectors: Only for use in LAN, not for connection to telecommunication circuits.

For head stations only: The configuration interface Service connector is for temporary connection only. Do not connect or disconnect unless the area is known to be non-hazardous. Connection or disconnection in an explosive atmosphere could result in an explosion.

For devices containing fuses:

English	French
WARNING – EXPLOSION HAZARD. DO NOT REMOVE OR REPLACE FUSES UNLESS POWER HAS BEEN DISCONNECTED OR THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.	AVERTISSEMENT – RISQUE D´EXPLOSION. NE PAS RETIRER NI REMPLACER LES FUSIBLE À MOINS QUE L´ALIMENTATION N´AIT ÊTÊ COUPÉE OU QUE L´EMPLACEMENT NE SOIT EXEMPT DE CONCENTRATIONS INFLAMMABLES.

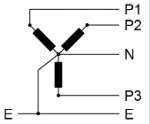
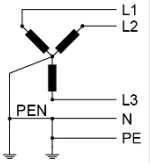
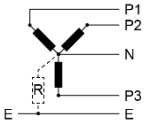
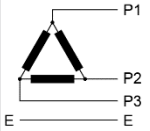
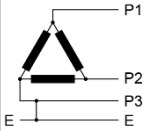
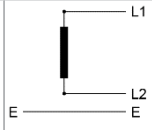
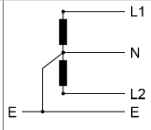
A switch suitable for the location where the equipment is installed shall be provided to remove the power from the fuse.

13.2 Overview "Common Mains Supply Systems and Line Voltages"

The following provides an overview of possible supply networks with the corresponding voltage levels.

The following common mains supply systems and their line voltages are derived from IEC, EN, UL 61010-1, table Annex I. Using this table, you can determine the system voltage depending on your existing network, with which you can determine the possible measurement topologies.

Table 82: Common Mains Supply Systems and Line Voltages within the scope of UL

3-phase 4-wire systems with earthed neutral conductor [1]	3-phase 4-wire systems with no earthed neutral conductor 2; [1, 2, 3]	3-phase 3-wire system not earthed	3-phase 3-wire systems with earthed phase	1-phase 2-wire system, AC or DC	Split 1-phase 3-wire system, AC or DC [1]	System voltage [5]
TT system:  TN-C-S system:  	IT system:  	 	 	 	 	
120 V / 208 V 127 V / 220 V	120 V/ 208 V	110 V, 115 V 120 V, 127 V	100 V 120 V	100 V 110 V, 115 V 120 V, 127 V	100 V / 200 V [4] 110 V / 220 V 115 V / 230 V 120 V / 240 V	150 V
220 V / 380 V 230 V / 400 V 240 V / 415 V 260 V / 440 V 277 V/ 480 V	230 V / 400 V 277 V/ 480 V	200 V 220 V, 230 V, 240 V, 277 V	200 V 240 V	220 V 230 V 240 V	220 V / 440 V 240 V/ 480 V	300 V

[1] Voltage specifications with forward slash:
1. Voltage specifications: Voltage between line conductor and neutral conductor
2. Voltage specifications: Voltage between the line conductors

[2] R is an impedance that may be connected between neutral conductor and ground. This impedance is normally 1500 Ω.

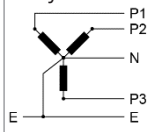
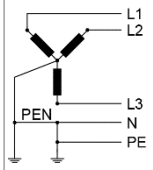
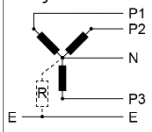
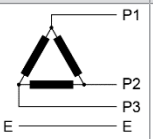
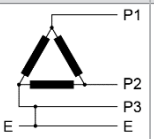
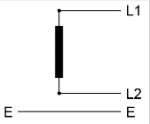
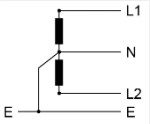
[3] When monitoring the isolation, the neutral conductor is considered to be earthed.

[4] These values are commonly used in Japan

[5] The system voltage is derived from the line-to-neutral voltage for common mains supply systems and is used for determining insulation coordination.

The following table shows the Common Mains Supply Systems and Line Voltages which are outside the scope of UL, for further information see **Special Requirements for Measurements with Higher Voltages outside the scope of UL [▸ 19]**.

Table 83: Common Mains Supply Systems and Line Voltages outside the scope of UL

3-phase 4-wire systems with earthed neutral conductor [1]	3-phase 4-wire systems with no earthed neutral conductor [1, 2, 3]	3-phase 3-wire system not earthed	3-phase 3-wire systems with earthed phase [1]	1-phase 2-wire system, AC or DC	Split 1-phase 3-wire syste, AC or DC [1]	System voltage[4]
TT system:  TN-C-S system:  	IT system:  	 	 	 	 	
347 V / 600 V 380 V / 660 V 400 V / 690 V	347 V / 600 V 400 V / 690 V					600 V

[1] Voltage specifications with forward slash:
1. Voltage specifications: Voltage between line conductor and neutral conductor
2. Voltage specifications: Voltage between the line conductors

[2] R is an impedance that may be connected between neutral conductor and ground. This impedance is normally 1500 Ω.

[3] When monitoring the isolation, the neutral conductor is considered to be earthed.

[4] The system voltage is derived from the line-to-neutral voltage for common mains supply systems and is used for determining insulation coordination.

13.3 Examples of CSV Files

13.3.1 Snapshot

The following table presents an example of a CSV file that was created with the Interface Configuration Software. Click **Snapshot** in the **Extras** menu. It lists the current measured values, the error messages and the parameter settings.

CSV file ‚Snapshot'		
Measured values		
Current (eff.) L1	1,979612231	A
Current (eff.) L2	0,062213849	A
Current (eff.) L2	0,062213849	A
Current (eff.) L3	0,063112609	A
Current (eff.) N	0,008522959	A
Voltage (eff.) L1-N	269,1612244	V
Voltage (eff.) L2-N	281,8621521	V
Voltage (eff.) L3-N	270,8454285	V
Line-to-line voltage L1-L2	12,70088577	V
Line-to-line voltage L2-L3	1,713913679	V
Line-to-line voltage L3-L1	11,01490498	V

CSV file ‚Snapshot'		
Active power L1	1,097641587	W
Active power L2	17,06621552	W
Active power L3	16,63612938	W
Reactive power L1	532,8337402	VA
Reactive power L2	17,53324127	VA
Reactive power L3	17,09260178	VA
Reactive power L1	-532,8253784	var
Reactive power L2	-4,050521851	var
Reactive power L3	-3,846014977	var
Frequency L1	49,99999619	Hz
Frequency L2	49,99999619	Hz
Frequency L3	49,99999619	Hz
Phase angle U-I L1	0	°
Phase angle U-I L2	0	°
Phase angle U-I L3	0	°
cos phi L1	0,001286041	
cos phi L2	0,972957373	
cos phi L3	0,974356353	
Power factor PF L1	0,002060008	
Power factor PF L2	0,9733634	
Power factor PF L3	0,973294139	
Power factor LF L1	-0,002136296	
Power factor LF L2	-0,973326802	
Power factor LF L3	-0,973326802	
Maximum Current (eff.) L1	1,980008841	A
Maximum Current (eff.) L2	0,079724401	A
Maximum Current (eff.) L3	0,080853127	A
Minimum Current (eff.) L1	1,97918272	A
Minimum Current (eff.) L2	0,059897725	A
Minimum Current (eff.) L3	0,060773019	A
Average Current (eff.) L1	1,980110526	A
Average Current (eff.) L2	0,062145382	A
Average Current (eff.) L3	0,063039444	A
Maximum Voltage (eff.) L1-N	360,8012085	V
Maximum Voltage (eff.) L2-N	377,819397	V
Maximum Voltage (eff.) L3-N	363,0617981	V
Minimal Voltage (eff.) L1-N	199,0415497	V
Minimal Voltage (eff.) L2-N	281,8067932	V
Minimal Voltage (eff.) L3-N	270,7977295	V
Average Voltage (eff.) L1-N	269,1274109	V
Average Voltage (eff.) L2-N	281,8670654	V
Average Voltage (eff.) L3-N	270,853302	V
Maximum Active power L1	4,253361225	W
Maximum Active power L2	29,67589951	W
Maximum Active power L3	28,926548	W
Minimal Active power L1	0,564652145	W
Minimal Active power L2	16,42240715	W

CSV file ‚Snapshot'		
Minimal Active power L3	16,01078987	W
Maximum Frequency L1	0	Hz
Maximum Frequency L2	0	Hz
Maximum Frequency L3	0	Hz
Minimal Frequency L1	0	Hz
Minimal Frequency L2	0	Hz
Minimal Frequency L3	0	Hz
Active energy L1	10	Wh
Active energy import L1	10	Wh
Active energy export L1	0	Wh
Reactive energy L1	-4237	varh
Reactive energy inductive L1	0	varh
Reactive energy capacitive L1	4237	varh
Apparent energy L1	4237	Wh
Active energy L2	31	Wh
Active energy import L2	31	Wh
Active energy export L2	0	Wh
Reactive energy L2	-5	varh
Reactive energy inductive L2	0	varh
Reactive energy capacitive L2	5	varh
Apparent energy L2	32	Wh
Active energy L3	30	Wh
Active energy import L3	30	Wh
Active energy export L3	0	Wh
Reactive energy L3	-5	varh
Reactive energy inductive L3	0	varh
Reactive energy capacitive L3	5	varh
Apparent energy L3	31	Wh
Total active energy	71	Wh
Total active energy import	71	Wh
Total active energy export	0	Wh
Reactive energy Total	-4247	varh
Reactive energy inductive Total	0	varh
Reactive energy capacitive Total	4247	varh
Peak value voltage	380,794281	V
Peak value current	2,801195383	A
Quadrant L1	4	
Quadrant L2	4	
Quadrant L3	4	
Tamper detect	inactive	
Rotating field	left	

13.3.2 Measured Value Trend

The following table presents an example of a CSV file that was created with the Interface Configuration Software. To do so, click [**Start**] in the **Measured Value Trend** measured value view. In this case, the measured variable "Current (rms) L1–N" was selected as a measurement sequence with 20 measured values.

Table 84: CSV file „Measured Value Trends" (Example)

3 Phase Measurement Transformer, 5 A **Current (eff.) L1-N**	
Measured values	
02.10.2021 09:48:14	1,979541779 A
02.10.2021 09:48:15	1,979541779 A
02.10.2021 09:48:15	1,979534745 A
02.10.2021 09:48:16	1,979534745 A
02.10.2021 09:48:16	1,979506612 A
02.10.2021 09:48:17	1,979506612 A
02.10.2021 09:48:17	1,979384542 A
02.10.2021 09:48:18	1,979384542 A
02.10.2021 09:48:18	1,979393959 A
02.10.2021 09:48:19	1,979393959 A
02.10.2021 09:48:19	1,979466677 A
02.10.2021 09:48:20	1,979466677 A
02.10.2021 09:48:20	1,979516029 A
02.10.2021 09:48:21	1,979516029 A
02.10.2021 09:48:21	1,979492545 A
02.10.2021 09:48:22	1,979492545 A
02.10.2021 09:48:22	1,97945261 A
02.10.2021 09:48:23	1,97945261 A
02.10.2021 09:48:23	1,979429126 A
02.10.2021 09:48:24	1,979429126 A

13.4 Accessories

The following accessories are available for the product:

Accessories	Arcticle number
WAGO Interface Configuration Software	Download at www.wago.com
WAGO USB Communication Cable, Length 2.5 m	750-923
WAGO USB Communication Cable, Length 5 m	750-923/000-001
WAGO Split-Core Current Transformer	855-4209/060-003 855-4209/100-001 855-4209/150-001 855-4209/200-001
Interface module RJ-45	289-175/790-108
ETHERNET connector, RJ-45	750-978/000-011
DC Power Supply	787-2850
Operating tool, Typ 2	210-720

T-wrench (for Art.-Nr. 855-8015)	855-8000
microSD memory card, 2 GB	758-879/000-3102

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