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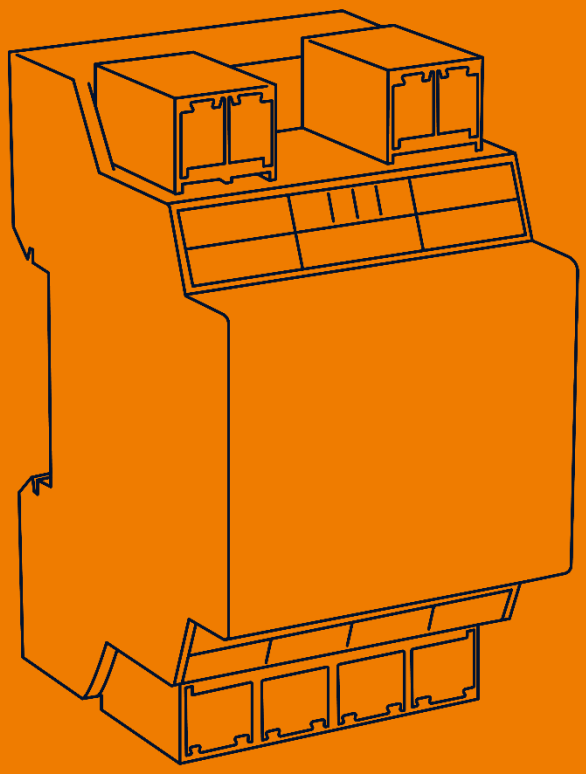

MIEZ
Current Extension Module

ALLES MIT SPANNUNG

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1 General

The current extension module 37100 has been developed for remote monitoring of power consumption. It is designed for mounting on a DIN rail or mounting plate and has no own display. This concept makes it suitable for a wide range of applications in power engineering and smart grids, building automation and individual production processes, as well as for remote infrastructure monitoring and automatic load management. The unit is not equipped with local controls and therefore cannot easily interfere with the functions it performs - simply put, it should not require special attention from non-professionals in easily accessible places. The module measures 12 currents via single-phase or three-phase current transformers. It enables the measurement of basic electrical parameters of up to four three-phase branch lines. It is connected via the Local Bus to the panel meter 37010, which is used for voltage measurements, concentration of measured data and access to a higher-level system. Up to five 37100-current-distribution-modules can be operated on a single bus, allowing compact measurements on up to 20 three-phase branch lines or of 60 currents.

1.1 Accessories

Each 37100 current extension module is supplied with a LocalBus cable (0.1 m).
Table 1 contains a list of accessories that can be specified or additionally purchased when ordering.

Table 1: Optional accessories

Designation	Description
Cable 3CT, 0.3 m (RJ12 - RJ12)	30 cm cable for three-phase current transformer
Cable 3CT, 0.5 m (RJ12 - RJ12)	50 cm cable for three-phase current transformer
Cable 3CT, 1 m (RJ12 - RJ12)	100 cm cable for three-phase current transformer
Cable 3CT, 3 m (RJ12 - RJ12)	300 cm cable for three-phase current transformer
Cable JC, 0.3 m (RJ12 – 0.5/6)	30 cm cable for 3 single-phase current transformers
Cable JC, 0.5 m (RJ12 – 0.5/6)	50 cm cable for 3 single-phase current transformers
Cable JC, 1 m (RJ12 – 0.5/6)	100 cm cable for 3 single-phase current transformers
Cable 3CT, 3 m (RJ12 – 0.5/6)	300 cm cable for 3 single-phase current transformers
LocalBus cable, 0.1 m	Cable for local bus, 0.1 m
LocalBus cable, 0.5 m	Cable for local bus, 0.5 m
LocalBus cable, 1 m	Cable for local bus, 1 m
LocalBus cable, 3 m	Cable for local bus, 3 m
LocalBus cable, KIT	50 m cable and 50 pieces RJ45 connectors

1.2 Measuring principles, signal processing, connection and measurement

- DC supply voltage 10 - 30 V, from local bus
- Four RJ12 connectors (6P6C) for indirect three-phase star or delta current measurement, single-phase measurement or measurements in Aron circuits
- Sampling rate 6.4 kHz, continuous measurement
- In combination with the panel meter 37010 it is possible to evaluate all common single-phase and three-phase measured quantities such as power (active, reactive and apparent power, deformation and fundamental active and reactive power), power factor, voltage harmonics and THD for voltages and currents

Recording of measured data

- Built-in precision real-time clock with backup battery
- The power distribution modules 37100 only save the electricity meter readings in the event of a power failure.

Data transmission and evaluation

- Configuration software available for free download https://portal.woehner.de
- System service ServiceTool.Online for downloading and processing of archived measurement data
- Tools to download, export and process data using custom scripts or via command line
- Data library for developing your own applications in C # / NET or for Linux (C / C ++, .NET Core)
- Data transfer, module set-up and firmware update are carried out with the local bus via the panel meter 37010

2 Operating the meter

2.1 Safety requirements for the use of the power distribution module 37100

Warning: When working with the unit, it is vital to take all necessary measures to protect against injury and electric shock to persons and property.

- The device may only be operated by persons with the necessary expertise for this type of work. This person must have detailed knowledge of the operation of the equipment listed in this description.
- When the unit is connected to components that are under dangerous voltage, it is vital to follow all necessary measures for the protection of the user and equipment against injury and damage caused by electric shocks.
- Persons carrying out installation or maintenance of the unit must be equipped with and use personal protective clothing and tools.
- If the analyser is used in a manner not specified by the manufacturer, the protection provided by the analyser may be impaired.
- If the analyser or its accessories are damaged or do not work properly, do not use it and send it for repair.

2.1.1 Meaning of the symbols used on the device

Warning - Read operating instructions!

AC - Alternating Voltage

DC - Direct Voltage

The CE marking guarantees compliance with European directives and regulations.

The device must not be disposed of with normal household waste.

Double or reinforced insulation of the unit (protection class II)

2.2 Installing the device

The power distribution module 37100 is designed for DIN rail mounting. Figure 1 shows the dimensions of the unit. The hole positions for wall mounting, to which the unit is screwed with three screws, are dimensioned over the dashed line. The maximum cable cross-section for plug-in connectors for power and voltage measurements is 2.5 mm² and 1.5 mm² for the RS-485 connector.

Sufficient natural air circulation should be ensured within the switchgear at the installation site and in the immediate vicinity. Do not install other equipment that could be a significant source of heat near the unit.

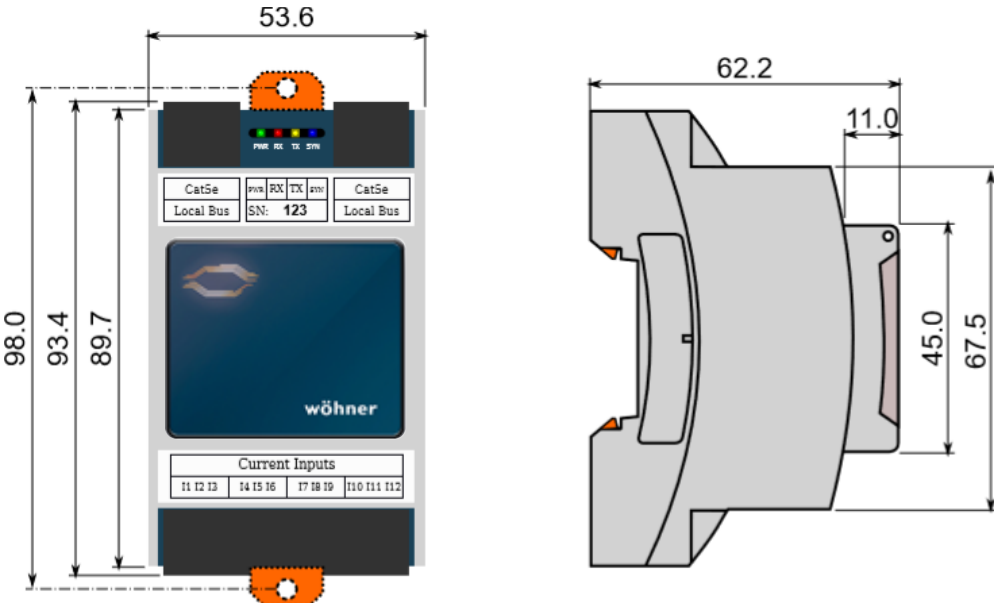

Figure 1: Dimensions of the current distribution module 37100

2.2.1 Measured currents

The current inputs are galvanically isolated from the local bus up to 150 V/CAT IV. The individual current inputs are not galvanically isolated from each other. When measuring currents in a 300 V/CAT IV network, a current transformer with the appropriate measurement category/insulation voltage must be used or the current transformer must be installed on an insulated primary conductor with a sufficiently high insulation voltage.

Current transformer secondary circuits are connected via one of the cables listed in Table 1 for RJ12 connectors (6P6C) and marked F1 to F4. Viewed from the front, the pins of the power connectors are in the following order connected:

All "S1" pins are galvanically connected to a common potential in the module. Therefore, if the secondary side of the MTP needs to be earthed (usually in high voltage and extra high voltage networks), the "S1" terminals must be earthed. If the "S2" terminals were connected during CT installation, all secondary circuits

would be connected in parallel and all current inputs would measure the same current.

F1						F2						F3						F4					
I1		I2		I3		I1		I2		I3		I1		I2		I3		I1		I2		I3	
S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1

The current distribution module 37100 is in the current input variant manufactured for the connection of standard CTs with rated output values of 333 mV. X/333 mV sensors have the advantage that they offer the possibility of using conductors with a small cross-section and disconnecting the connection without having to short-circuit the secondary side of the CT.

- Recommended conductor type LiYY 6 x 0.14 mm^2
- Crimp connector type: 6P6C (RJ12)
- Pin assignment: Depending on the current transformer used

Figure 2 shows an example of monitoring 20 three-phase terminals measured with five 37100 power distribution modules.

2.2.2 Local bus

The local bus uses the 8P8C connector to connect the 37100 power distribution modules to the 37010 panel meter. This is a proprietary bus that combines communication and synchronisation signals with the supply of external modules.

! **The physical layer of the local bus is not Ethernet compatible. Only additional power distribution modules 37100 can be connected to the unit. Never connect the port marked "LocalBus" to an Ethernet device, Ethernet hub, etc. - these can be damaged!**

The 37100 power distribution modules are equipped with two local bus connections, which makes it possible to set up a bus system. An example of a connection is shown in Figure 5. A maximum of five modules can be connected to a single local bus.
The panel meter 37010 automatically detects connected modules and then configures them. Measured variables are available in the live data immediately after connection, and user configurations of newly detected modules can be made in the settings. To clearly identify the modules in the settings, their serial numbers are used, which are printed on the label on the connectors of the local bus for easy installation.

- Recommended conductor type UTP CAT5e, 8 x AWG24
- Crimp connector type: 8P8C (RJ45)
- Pinout standard: TIA/EIA-568-B
- Cable variants: Straight or crossed (T568A ↔ T568B)

2.3 Description of the LED displays

PWR (green) lights up when the supply voltage is present.

SYN (blue) flashes every ten periods of the mains frequency synchronously with the synchronisation pulse.

TX (green) flashes when data is sent to the local bus.

RX (red) flashes when data is received from the local bus.

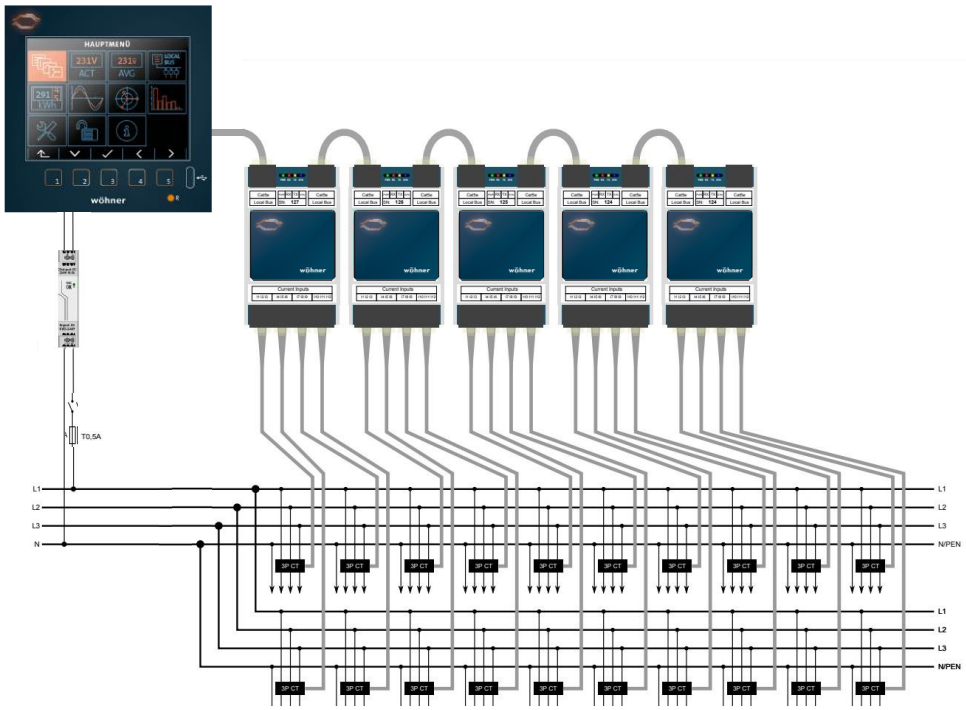

Figure 2: 20 outlets with 5 power distribution modules 37100

2.4 Module settings on the PC

It is recommended to set up the power distribution module 37100 before starting the measurement. The settings can be made from the computer via the panel meter 37010 in the ServiceTool.Daq application programme. For information on the procedure for connecting to a higher-level device, refer to the relevant user manual for the unit being used.

The window consists of five blocks:

- Message
  - Time window - Here you can set the averaging interval and the type of evaluation of minima and maxima and reset them manually.
- Slaves Modbus address block
  - Start address - sets the Modbus address at which the data of the first measured terminal is available. Further branch lines are available at successive addresses.

- Configured slaves - tree structure of configured modules
    - On the top level there are 5 positions for up to 5 power distribution modules 37100, with the following information displayed: unit name, unit type, serial number, firmware version.
    - Under each module there are 4 positions for each three-phase branch line, with the following information displayed: branch circuit name, connection type, Inom, CT ratio, current multiplier, Modbus address (MA).
    - Under each branch line there are 3 positions for each measuring channel, with the following information displayed: Inverted, input channel, assigned voltage, Inom, CT ratio and multiplier (for 3*1-Y connection).
- Detected but not configured slaves - List of detected modules that are not yet set up for measurements.
    - For each module that appears here, its type, serial number and firmware version are displayed.
    - Empty - This slot is empty.

- Parameters - Used to define individual elements in the tree. The adjustable parameters vary depending on the selected element (module/branch/channel) and also depend on the selected connection type.
    - Enabled - Enables/disables the selected branch line or channel.
    - Measurement data of deactivated branch lines/channels cannot be displayed. Deactivate branch lines/channels that are not used for measurements.
    - Name - Sets the module, branch line or channel name. It is mainly used to facilitate orientation in the measurement data.
    - Serial number - Used to assign the module in the tree to the detected power distribution module 37100.
    - Delete - Button to cancel the assignment of the selected element to the set-up module.
    - Connection - Selects the connection type of the selected branch line. The following three-phase connection types are available: Star (3Y), Triangle (3D) and Aron (3A). Also usable is the 3*1Y mode, which enables the measurement of three independent single-phase powers.
    - I_{NOM} - Nominal current of the selected branch line (3Y, 3D or 3A) or of the selected channel (3*1Y).
    - Ratio - conversion ratio of the current transformers at the selected branch line (3Y, 3D or 3A) or the selected channel (3*1Y).

- Multiplier - current multiplier of the selected branch line or channel. This can be used, for example, to correct the measured value in the case of an increase in sensitivity that occurs when the line is passed through the CT several times. The default value is 1 and has no effect.
- Input Channel - Allows the software to correct the wiring by assigning the physical measurement channels CH1 to CH3 to the logical channels CH1 to CH3. This is not set by default and the default option is left.
- Assigned voltage - For a 3*1Y connection, you can select the reference voltage channels L1 to L3 for the selected channels CH1 to CH3 for which powers, phase shifts, etc. are calculated. The standard option causes the assignments CH1-L1, CH2-L2 and CH3-L3.
- Inverted - This option allows the software to correct an incorrect connection of the selected channel. If the check box is activated, the polarity of the associated channel is inverted. Inversion is not performed by default and the box is not checked.

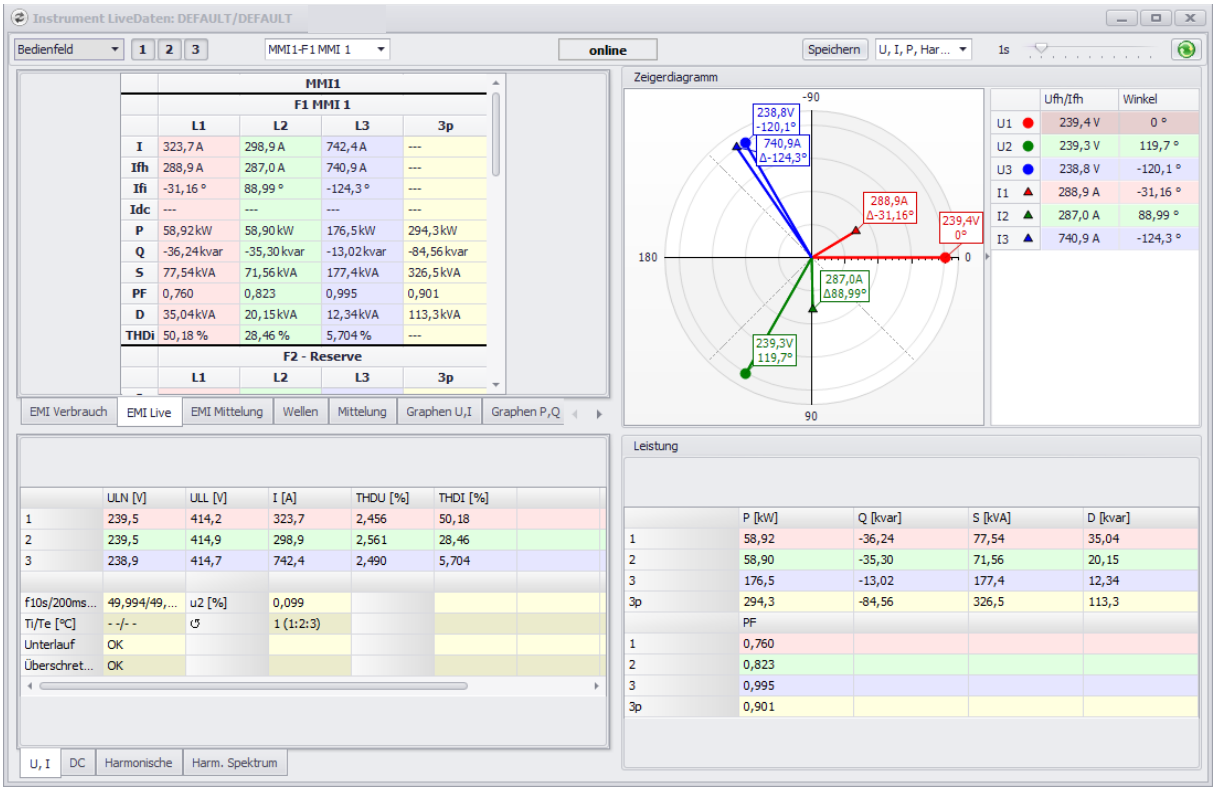

Figure 3: ServiceTool.Daq – live data window

2.5 Transmission of measured data to a PC

The power distribution module 37100 itself cannot record archives (only when operating together with the panel meter 37010 or other individual master modules). To transfer data to a PC, the application ServiceTool.Online or any application that reads data via Modbus from the higher-level panel meter must be used. When establishing a connection to a higher-level

device, all measured variables from all branch lines of the connected power distribution modules 37100 can be displayed and selected by switching over using the LiveData button at the top of the window. For information on the procedure for connecting to a higher-level device, refer to the relevant user manual for the device being used.

2.6 Display of the electricity meter reading

The power distribution module 37100 has a built-in three-phase four-quadrant current meter for all branch lines. The unit separately registers the imported active energy EP+ and the exported active energy EP-. In case of reactive energy, it registers the characteristics - capacitive power EQC and inductive power EQL or capacitive EQC+, EQC- and inductive EQL+, EQL- , especially in case of active energy import or export. It primarily provides the sum values of all phases. In star connections and single-phase systems, it also records the values of all types of energy in each individual phase.
The values can be read automatically via the panel meter 37010 with the ServiceTool.Online software and then processed in ServiceTool or, via ModBus communication protocol, in any other programme.

3 Technical specifications

3.1 Basic parameters

Device voltage - auxiliary power source	
Rated auxiliary voltage range **DC auxiliary voltage range**	12 - 26 VDC 10 - 29 VDC
Power supply	1.5 W
Maximum altitude during operation	2000 m
Pollution level	2
Connection	Internal circuits galvanically isolated from the local bus

Other technical data	
Operating temperature	- 25 to 60 °C
Storage temperature	- 40 to 80 °C
Rel. humidity during operation and storage	< 95% - non-condensing environment

EMC - Basic standards	EN 61326-1 ed. 2 EN 61000-6-2 ed. 3
EMC – Interference immunity	EN 61000-4-2 ed. 2: level 3 (6/8 kV) EN 61000-4-3 ed. 3: level 3 (10 V/m, 80 – 3000 MHz) EN 61000-4-4 ed. 3: level 4 (4 kV) EN 61000-4-5 ed. 3: level 4 (4/2 kV) measuring inputs EN 61000-4-5 ed. 3: level 3 (2 kV) communication EN 61000-4-6 ed. 4: level 3 (10 V, 0.15 – 80 MHz)
EMC – Interference emission	EN 55011 ed. 4, class A EN 61000-6-4 ed. 2 EN 61000-3-2 ed. 4 EN 61000-3-3 ed. 3
Communication interfaces	Local bus
Communication protocols	KMB, Modbus RTU
Sampling rate 50 Hz (60 Hz)	6.4 kHz (60 Hz currently not supported)
Protection class	II (front panel IP 40, complete unit IP 20)
Dimensions	54 x 45 mm (front panel); 54 x 94 x 61 mm (complete device)
Weight	max. 0.11 kg

3.2 Measured variables (with current extension module 37100)

General	
General	
Number of integrated connections	4
Currents per connection	3
Connection	Connector 6P6C
Extensibility (local bus)	Up to 5 × current extension module 37100 (connection 8P8C)
Max. number of connections	20
Max. number of currents	60

Current input option	**„X/333mV“**
INOM (IB) – Rated current	xxx AAC => 333 mV
Crest factor at INOM (IB)	1.9
Measuring range	0.0025 ÷ 1.2 xxx AAC

Meas. uncertainty (tA=23 ±2 °C)	+/- 0.1% of rdg ± +/- 0.05 % of rng
Temperature drift	+/- 0.03 % of rdg ± +/- 0.01 % of rng / 10 °C
Measurement category	Depending on the CT
Continuous overload	2 x INOM, 666 mVAC
Peak overload	10 × INOM (1 second max, repetition period > 5 minutes)
Burden power (impedance)	< 5 µVA (Ri = 39 kΩ)

Current unbalance	
Measuring range	0 ÷ 100 %
Measurement uncertainty	± 1 % of rdg or ± 0.5

THDI	
Measuring range	0 ÷ 200 %
Measurement uncertainty (for harmonics > 25th order)	THDI <= 100 %:
	THDI > 100 %: ± 1 % of rdg.

3.3 Measured values (power, power factor, energy)

Active / reactive power, power factor (PF), cos φ (PNOM = UNOM x INOM)	
Reference condition "A": **Ambient temperature (tA)** **U, I** **for active power, PF, cos φ** **for reactive power**	 23 ± 2 °C U = 80 ÷ 120 % UNOM, I = 1 ÷ 120 % INOM PF = 1.00 PF = 0.00
Active/reactive power uncertainty	± 0.5 % of rdg ± 0.01 % PNOM
PF & cos φ uncertainty	± 0.01
Reference condition "B": **Ambient temperature (tA)** **U, I** **for active power, PF, cos φ** **for reactive power**	 23 ± 2 °C U = 80 ÷ 120 % UNOM, I = 2 ÷ 120 % INOM PF >= 0.5 PF <= 0.87
Active/reactive power uncertainty	± 1 % of rdg ± 0.01 % PNOM
PF & cos φ uncertainty	± 0.01
Temperature drift of the outputs	± 0.05 % of rdg ± 0.02 % PNOM / 10 °C

Energy	
Measuring range	Corresponds to the U and I measuring ranges four-quadrant energy meters for active and reactive energies
Active power uncertainty	Class 1 according to EN 62053 - 21
Reactive power uncertainty	Class 2 according to EN 62053 - 23

Device characteristics according to IEC 61557-12: Power Quality Assessment Function	
Classification according to ch. 4.3 **Direct measurement of the voltage** **Voltage measurement via VT**	SD SS
Temperature according to 4.5.2.2	K55
Air humidity + altitude acc. to 4.5.2.3	< 95 % - non-condensation conditions < 2000 m
Power class Active power / energy	1

Functional features according to IEC 61557-12

Model "X/333 mV" with "xxx/333-mV" CTs, , I_{nom} = xxx A, U_{nom} = 230 V

Symbol	Function	Class	Measuring range	Notes
P	Total active power	1	0 - (993.6 * I_{nom}) W	
Qa, Qv	Total reactive power	2	0 - (993.6 * Inom) VAr	
Sa, Sv	Total apparent power	1	0 - (993.6 * Inom) VA	
Ea	Total active energy	1	0 - (993.6 * Inom) Wh	
ErA, ErV	Total reactive energy	2	0 - (993.6 * Inom) VArh	
EapA, EapV	Total apparent energy	1	0 - (993.6 * I_{nom}) VAh	
f	Frequency	0.02	40 – 70 Hz	
I	Phase current	0.5	0.1 – 1.2* I_{nom} A AC	
In	Meas. neutral cond. current	-	-	
Inc	Calc. neutral cond. current	0.5	0.1 – 1.2* Inom A AC	
Uln	Outer conductor-neutral conductor voltage	0.05	40 - 280 V AC	
Ull	Phase-to-phase voltage	0.05	70 - 480 V AC	
PFa, PFv	Power factor	0.5	0 – 1	
Pst, Pit	Flicker	-	-	

Udip	Voltage dips	-	-	
Uswl	Voltage swells	-	-	
Utr	Transient overvoltage	-	-	
Uint	Voltage interruption	-	-	
Unba	Voltage unbalance (ampl.)	0.5	0 – 10 %	
Unb	Voltage unbalance (ph. and ampl.)	0.5	0 – 10 %	
Uh	Voltage harmonics	1	up to the 25th order	1)
THDu	Total voltage distortion factor (rel. to fundamental mode)	1	0 – 20 %	1)
THD-Ru	Total voltage distortion factor (relative to rms value)	1	0 – 20 %	1)
Ih	Current harmonics	-	-	1)
THDi	Total current distortion factor (rel. to fundamental mode)	5	0 ÷ 200 %	1)
THD-Ri	Total current distortion factor (relative to rms value)	5	0 ÷ 200 %	1)
Msv	Mains signal voltage	Not yet determined		1, 2)

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