Current and Energy Measurement Technology

Transparency Pays Back

Contents

TRANSPARENCY PAYS BACK

WAGO Provides End-to-End Solutions for Current and Energy Measurement Technology

Energy Management Always Pays Off

- By carefully monitoring energy usage, European industrial firms benefited from the following in 2015:
  - Reduced electricity and eco taxes as revenue peak adjustment
  - Exemption from the "German Renewable Energy Act" levy (EEG apportionment) for energy-intensive companies that invest more than 14% of their gross value in energy
- Transparency via energy data
- Energy cost reduction
- Lowered company greenhouse gas emissions and carbon footprint

From Evaluation to Visualization

Complementary energy data management solutions maximize transparency and cost savings. WAGO provides the right product for every link in the energy measurement chain.

Measuring –
Systematically Record Energy Consumption

Anywhere high currents are measured and processed, make WAGO's 855 Series Plug-In Current Transformers your first choice. If existing systems will be retrofitted, save time by using 855 Series Rogowski Coils to avoid disassembling cables or interrupting processes.

JUMPFLEX® Signal Conditioners

JUMPFLEX®-ToGo Configuration App

Visualizing & Configuring

Evaluating

WAGO-I/O-*CHECK*

Evaluating –
Identifying and Planning Energy Use

Three different 3-Phase Power Measurement Modules are available for evaluating actual energy consumption via the WAGO-I/O-SYSTEM 750. Depending on the application or customer preference, the energy data can also be converted to an analog standard signal using the 857 and 2857 Series *JUMPFLEX*® Current and Rogowski Signal Conditioners.

Visualizing and Configuring –
Energy Characteristics per DIN EN ISO 50001

WAGO offers the free *JUMPFLEX*®-ToGo Configuration App for smartphones and tablets, in addition to PC-based software. WAGO-I/O-SYSTEM 750 configuration is performed via WAGO-I/O-*CHECK*, an easy-to-use Windows application for operating and displaying nodes.

CURRENT TRANSFORMERS SELECTION GUIDE

855 Series Current Transformers	Split-Core Current Transformers	Plug-In Current Transformers with CAGE CLAMP® Connection Technology
		
Applications	Retrofits	New systems
Coil bobbin	Separable	Closed
Connection technology	Connection cable (color coded)	CAGE CLAMP®
Assembly	Round cable (insulated), copper current bar (insulated)	Round cable, copper current bar, carrier rail, mounting plate
Compatibility with other WAGO components	750-493, (750-493/000-001) 750-494, (750-494/000-001) 750-495, (750-495/000-001) 857-550	
Primary rated current	60 A to 1000 A	50 A to 2500 A
Secondary rated current	1 A / 5 A	1 A / 5 A
Accuracy class	0.5; 1 or 3	1 or 3
Ambient operating temperature	–10 … + 55 °C	–5 … + 50 °C
Standards	EN 61869-2	EN 61869-2
Approvals	–	c UL us
Connection examples		

*In the measurement range 0.8 … 32 A and in combination with WAGO's 3-Phase Power Measurement Modules, the accuracy class 0.5 is met per EN 61869-2.

Plug-In Current Transformers with a *picoMAX*® Pluggable Connector		Rogowski Coils RT500/RT2000	Rogowski Coils RC 70 / RC 125 / RC 175
			
New systems		Retrofits	Retrofits
Closed		Separable	Bayonet connector, separable
picoMAX®		Connection cable	Connection cable
Round cable, carrier rail, mounting plate		Round cable (insulated), copper current bar (insulated)	Round cable, copper current bar
750-493 750-494 750-495 857-550		750-495/000-002 857-552 789-652 / 789-654	750-495/000-002 857-552
32 A	35 / 64 A	Up to 2000 A	Up to 4000 A
320 mA	1 A	(up to 40.02 mV)	22.5 mV / kA
0.5*	1	–	–
–10 … + 55 °C		–40 … +80 °C	–40 … +80 °C
EN 61869-2		IEC 61010-1	IEC 61010-1 / EN 61869-2
–	c UL us	c UL us	UL pending
			

POWER AND ENERGY MEASUREMENT

Using 3-Phase Power Measurement Modules

We Reduce Your Energy Costs!

The WAGO-I/O-SYSTEM 750 offers a comprehensive range of perfectly tuned solutions for your energy measurement applications. The 3-phase Power Measurement Modules detect and process all relevant variables in a 3-phase supply network. They provide system operators with increased insight into energy consumption by specific machines and systems, as well as the ability to perform comprehensive network analysis.

We Protect Your Machines!

Additionally, collected metrics allow the operator to optimize the supply to a drive or machine, protecting the system from damage and failure. To achieve this, WAGO's 3-Phase Power Measurement modules can be easily integrated into existing systems for intelligent and economical machine protection.

- Measure machine and system energy consumption values
- Measure and process all relevant measured variables
- Comprehensive network analysis
- Connect to the WAGO-I/O-SYSTEM: fieldbus-independent, compact and flexible
- Compatible with the dark gray modules from the robust WAGO-I/O-SYSTEM 750 XTR Series – perfect for monitoring harsh applications in eXTReme environments:
  – eXTReme temperature resistance from –40 to +70 °C
  – eXTReme isolation up to 5 kV of impulse voltage
  – eXTReme vibration resistance to 5g of acceleration

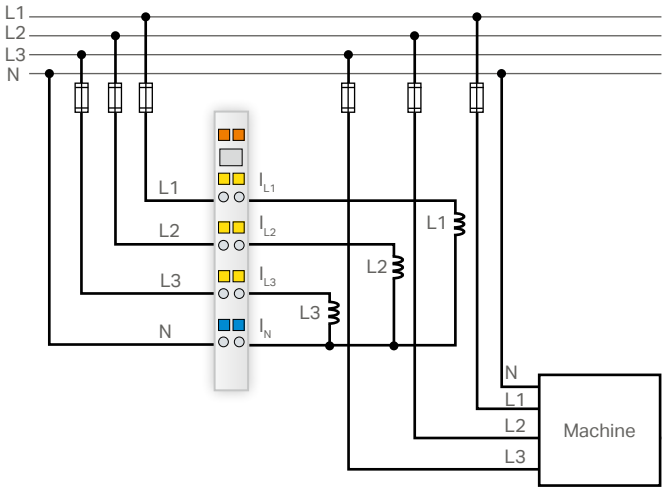
	750-493	750-494	750-495
Energy consumption	✓	✓	✓
Voltage	3~ 480 V	3~ 480 V	3~ 480 V/690 V
Current	1 A (750-493) 5 A (750-493/000-001)	1 A (750-494) 5 A (750-494/000-001)	1 A (750-495) 5 A (750-495/000-001) Rogowski coil: (750-495/000-002)
Active power/energy	✓	✓	✓
Phase position	✓	✓	✓
Reactive power/energy	via function block	✓	✓
Apparent power/energy	via function block	✓	✓
Rotary field detection		✓	✓
Power factor	(✓)	✓	✓
Frequency measurement	✓	✓	✓
Four-quadrant operation (inductive, capacitive, consumer, generator)		✓	✓
Harmonic analysis (up to the 41st harmonic)		✓	✓
Neutral conductor measurement			✓
Other product variants		Extended temperature range: –20 … +60 °C: 750-494/025-000 (1 A), 750-494/025-001 (5 A)	750 XTR: 750-495/040-000 (1 A), 750-495/040-001 (5 A), 750-495/040-002 (Rogowski coil)
Housing width	12 mm	12 mm	24 mm

POWER AND ENERGY MEASUREMENT

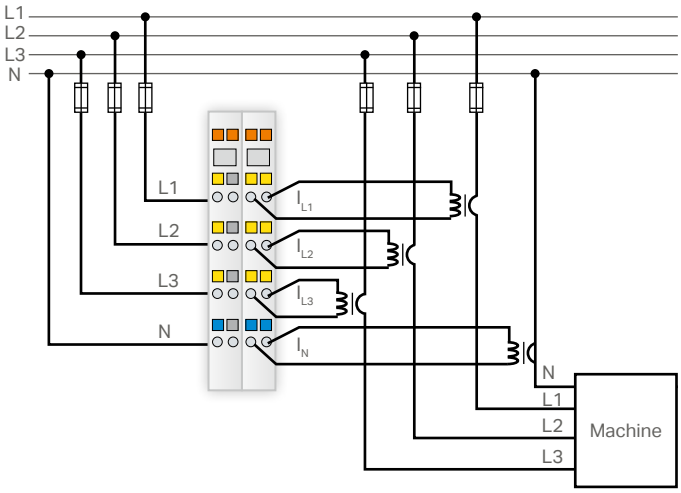
Using 3-Phase Power Measurement Modules

General Configurations:

Power and energy measurement of a machine in a 480 VAC mains network via 750-493, 750-494 3-Phase Power Measurement Modules

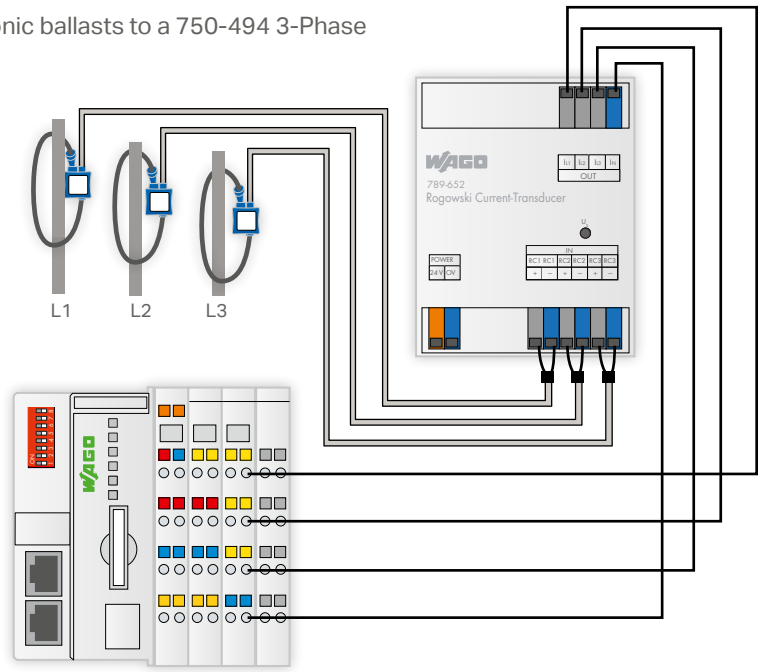


Power, energy and N-conductor measurement of machine in a 480/690 VAC mains network via 750-495 3-Phase Power Measurement Modules

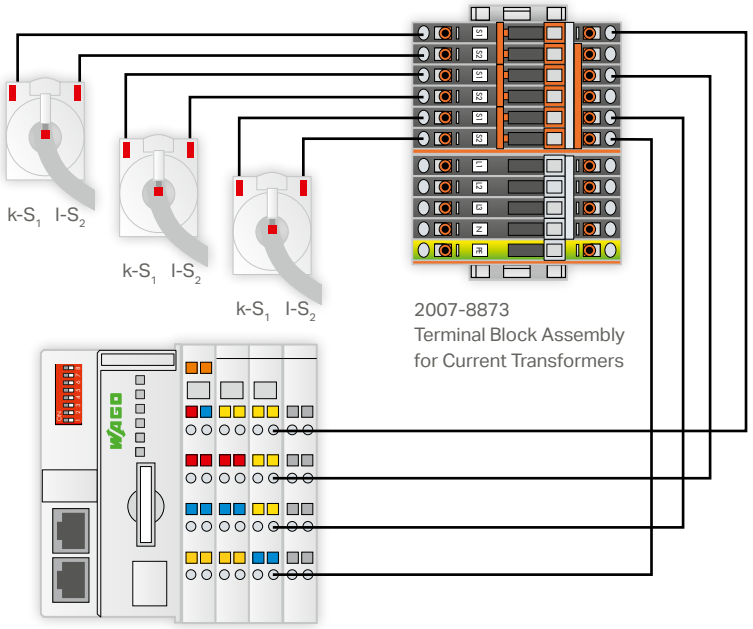


General Configurations:

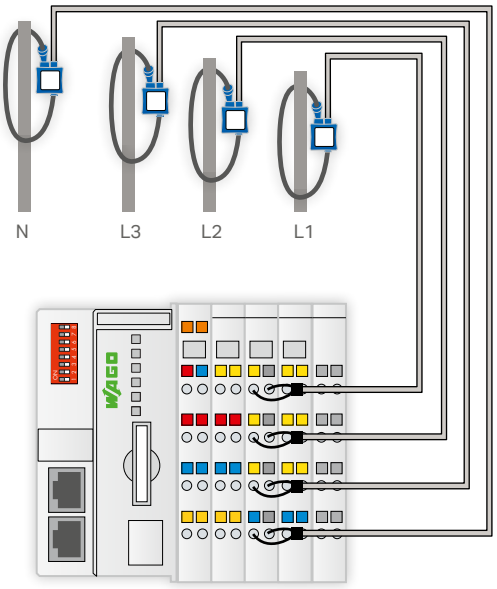
Connecting Rogowski coils with electronic ballasts to a 750-494 3-Phase Power Measurement Module



Applications:
Connecting current transformers to the 3-phase power measurement modules



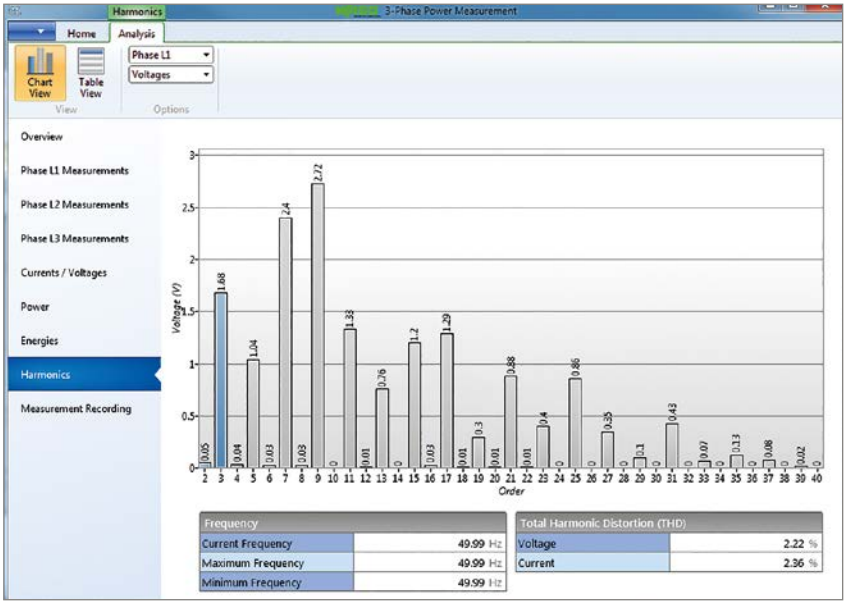
Applications:
Connecting Rogowski coils directly to the 750-495/000-002 3-Phase Power Measurement Module



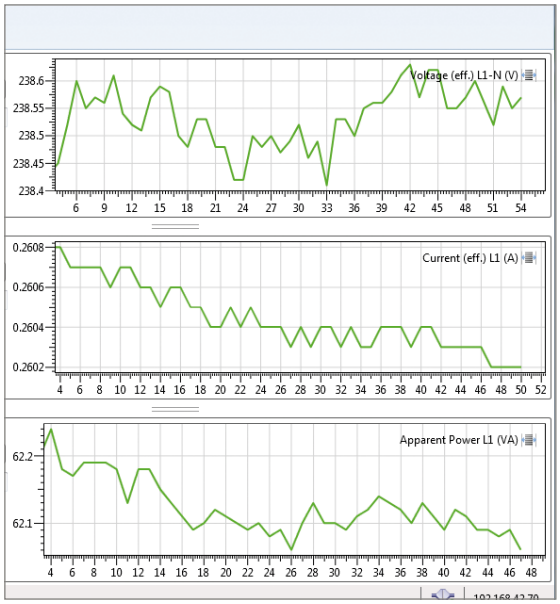
POWER AND ENERGY MEASUREMENT

Comprehensive Network Analysis via WAGO-I/O-*CHECK*

Measured value configuration is also possible via function block.



Harmonic diagram

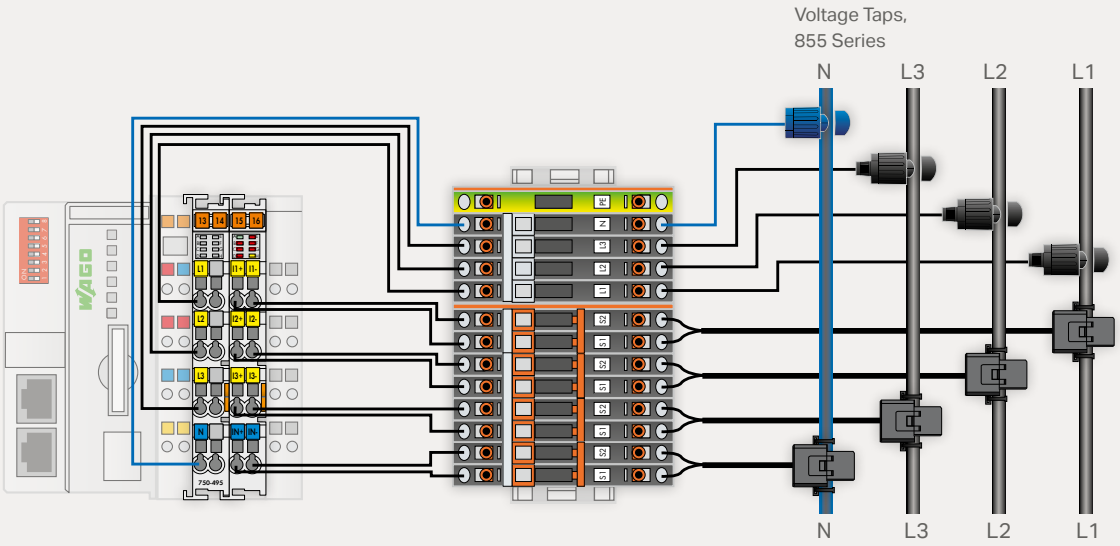


Measured value chart

Configurating and Visualizating Measured Values:

- Graphical display of bus nodes
- Clear display of all measured values
- Extensive power measurement module settings
- Integrated diagnostic indication
- Graphical 4-square representation
- Historical display of measured values
- Record and export measured values (chart recorder function)
- Switchable harmonic view
- Configure and visualize measured values directly from the controller via function blocks

Application Example: The Complete Retrofit Solution



3-Phase Power Measurement Module, 750-495

Terminal Block Assembly, 2007-8874

Split-Core Current Transformers, 855 Series

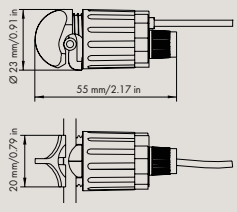
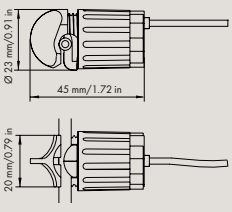
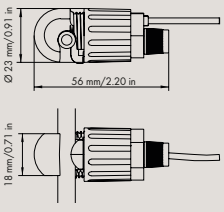
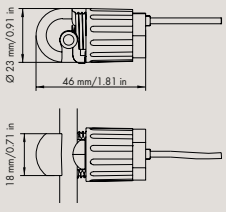
VOLTAGE TAPS

Retrofit Existing Systems

The 855 Series Voltage Taps easily and safely tap the measurement voltage in existing systems.

- Safely tap the measurement voltage with just one turn
- Tool-free assembly
- Conductor contact via IDC connection
- Secure mounting
- 855-8001 and 855-8003 Voltage Taps, including 5 x 25 mm 2 A fuse
- For insulated conductors up to 16 mm² (6 AWG)

Quick and easy mounting!

	855-8001	855-8002	855-8003	855-8004
	 	 	 	 
Conductor range	2.5 … 6 mm²	2.5 … 6 mm²	10 … 16 mm²	10 … 16 mm²
Feedthrough for measurement conductor	3 … 5 mm Ø	3 … 5 mm Ø	5 … 7 mm Ø	5 … 7 mm Ø
Fuse	2 A, 450 V, F, 70 kA	–	2 A, 450 V, F, 70 kA	–
Nominal voltage	400 VAC	400 VAC	400 VAC	400 VAC
Max. permissible continuous current	2 A	2 A	2 A	2 A
Cable length	3 m	3 m	3 m	3 m
Ambient operating temperature	–5 … +55 °C	–5 … +55 °C	–5 … +55 °C	–5 … +55 °C

PLUG-IN CURRENT TRANSFORMERS

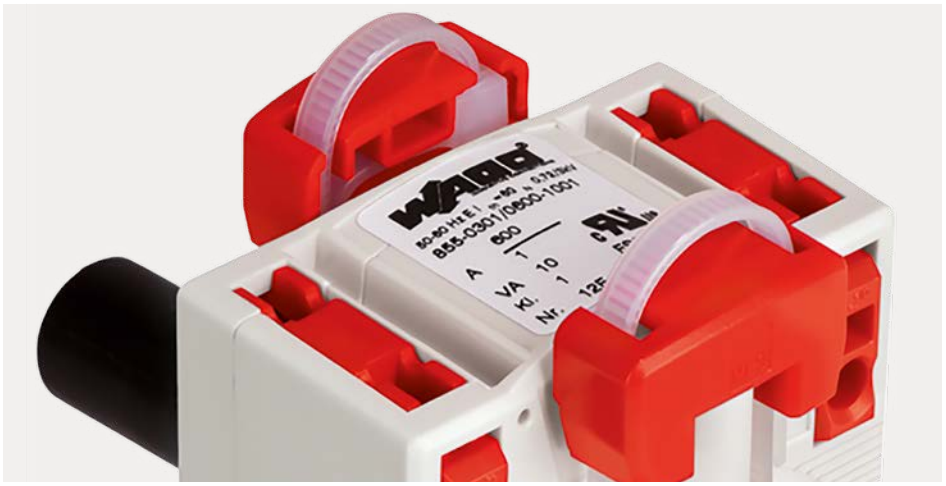
With CAGE CLAMP® Connection Technology

Plug-in current transformers are ideal anywhere high currents are measured and processed. WAGO's 855 Series Current Transformers convert primary rated currents into electrically isolated secondary currents of 1 A or 5 A. They can be used in temperatures ranging from −5 to +50 °C and may be permanently loaded with up to 120 % of the nominal current. The 855 Series components are UL recognized and suitable for 230 V, 400 V and 690 V low-voltage applications. The plug-in current transformers are inductive, single-conductor current transformers. Their key feature is the screwless, shock- and vibration-resistant CAGE CLAMP® connection technology for conductors ranging from 0.08 … 4 mm² (28 … 12 AWG). The 855 Series' plastic housing is extremely robust and can be mounted in four different ways on: round cables, copper current bars, mounting plates and – depending on the version – carrier rails.

iStock.com/IanChrisGraham

WAGO Plug-in Current Transformers – Time-Saving Installation

CAGE CLAMP® connection

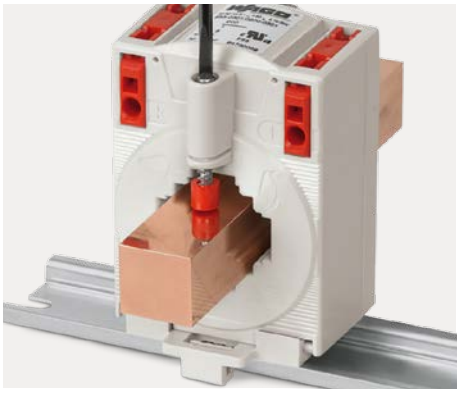


Quick-Mount Kit, 855-9910

Mounting on round cable

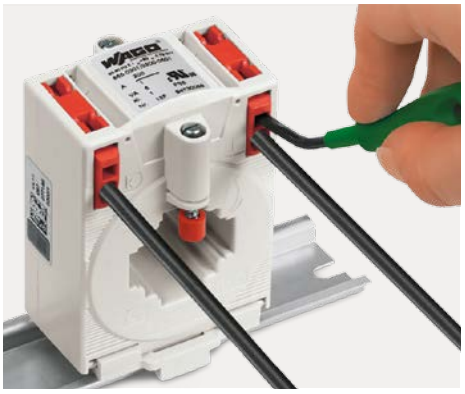
Mounting on carrier rail via carrier rail adapter

Quick-Mount Kit, 855-9910



Mounting on copper carrier rail

Secured to mounting plate

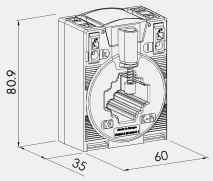
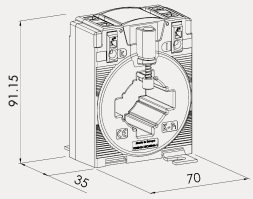


Conductor termination

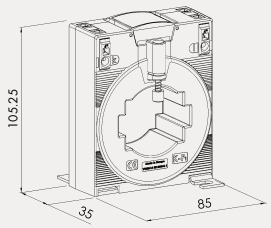
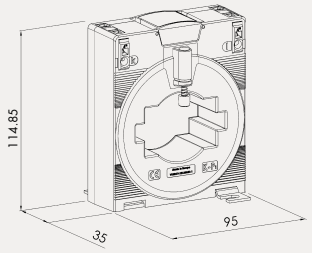
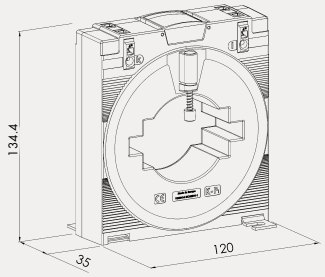
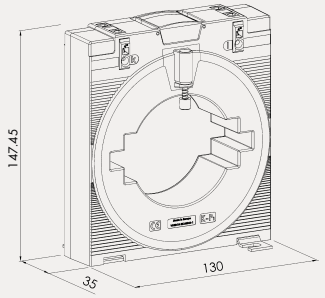
- Continuous overload of 120 % the nominal primary current
- Secondary currents of 1 A or 5 A and primary ratios of 50 A to 2,500 A
- Screwless CAGE CLAMP® connection technology
- Tool-free installation via quick-mount kit
- Low-voltage current transformer for max. operating voltages up to 1.2 kV
- UL certified (Certificate No. E356480)
- EN 61869-1/EN 61869-2

PLUG-IN CURRENT TRANSFORMERS

With CAGE CLAMP® Connection Technology

	Item Number	Primary Rated Current	Secondary Rated Current	Rated Power	Accuracy Class
 Busbar 1: 30 x 10 mm Busbar 2: 25 x 12 mm Busbar 3: 20 x 20 mm **Round cable: 26 mm**	**855-301/050-103**	50 A	1 A	1.25 VA	3
	855-305/050-103	50 A	5 A	1.25 VA	3
	855-301/060-101	60 A	1 A	1.25 VA	1
	855-305/060-101	60 A	5 A	1.25 VA	1
	855-301/075-201	75 A	1 A	2.5 VA	1
	855-305/075-201	75 A	5 A	2.5 VA	1
	855-301/100-201	100 A	1 A	2.5 VA	1
	855-305/100-201	100 A	5 A	2.5 VA	1
	855-301/150-501	150 A	1 A	5 VA	1
	855-305/150-501	150 A	5 A	5 VA	1
	855-301/200-501	200 A	1 A	5 VA	1
	855-305/200-501	200 A	5 A	5 VA	1
	855-301/250-501	250 A	1 A	5 VA	1
	855-305/250-501	250 A	5 A	5 VA	1
	855-305/300-501	300 A	5 A	5 VA	1
	855-301/400-1001	400 A	1 A	10 VA	1
	855-305/400-1001	400 A	5 A	10 VA	1
	855-301/600-1001	600 A	1 A	10 VA	1
	855-305/600-1001	600 A	5 A	10 VA	1
 Busbar 1: 40 x 10 mm Busbar 2: 30 x 15 mm **Round cable: 32 mm**	**855-401/250-501**	250 A	1 A	5 VA	1
	855-405/250-501	250 A	5 A	5 VA	1
	855-401/400-501	400 A	1 A	5 VA	1
	855-405/400-501	400 A	5 A	5 VA	1
	855-401/600-501	600 A	1 A	5 VA	1
	855-405/750-501	750 A	5 A	5 VA	1

	Item Number	
	**855-9900**	Carrier Rail Adapter for Plug-In Current Transformers (for 855-3xx/xxxx-xxxx and 855-4xx/xxxx-xxxx)
	**855-9910**	Quick-Mount Kit (2 pieces including cable tie)

	Item Number	Primary Rated Current	Secondary Rated Current	Rated Power	Accuracy Class
 Busbar 1: 50 x 12 mm Busbar 2: 40 x 30 mm **Round cable: 44 mm**	**855-501/400-1001**	400 A	1 A	10 VA	1
	855-505/400-1001	400 A	5 A	10 VA	1
	855-501/600-1001	600 A	1 A	10 VA	1
	855-505/600-1001	600 A	5 A	10 VA	1
	855-501/800-1001	800 A	1 A	10 VA	1
	855-505/800-1001	800 A	5 A	10 VA	1
	855-501/1000-1001	1000 A	1 A	10 VA	1
	855-505/1000-1001	1000 A	5 A	10 VA	1
 Busbar 1: 63 x 10 mm Busbar 2: 50 x 30 mm **Round cable: 44 mm**	**855-601/1500-501**	1500 A	1 A	5 VA	1
	855-605/1500-501	1500 A	5 A	5 VA	1
 Busbar 1: 80 x 10 mm Busbar 2: 60 x 30 mm **Round cable: 55 mm**	**855-801/1000-1001**	1000 A	1 A	10 VA	1
	855-801/2000-1001	2000 A	1 A	10 VA	1
	855-805/2000-1001	2000 A	5 A	10 VA	1
 Busbar 1: 100 x 10 mm Busbar 2: 80 x 30 mm **Round cable: 70 mm**	**855-1001/2500-1001**	2500 A	1 A	10 VA	1
	855-1005/2500-1001	2500 A	5 A	10 VA	1

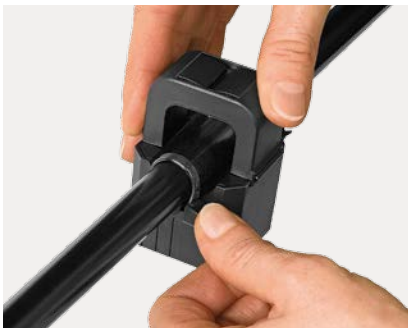
SPLIT-CORE CURRENT TRANSFORMERS

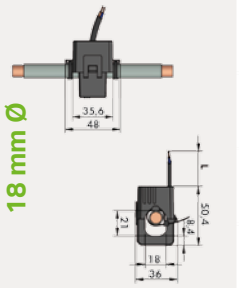
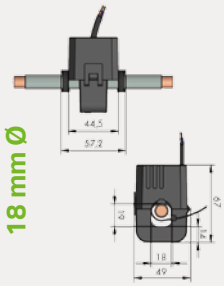
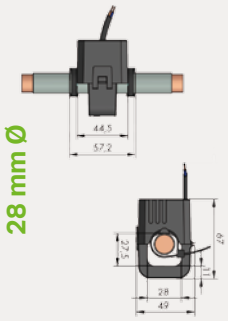
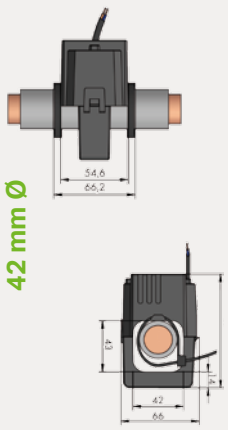
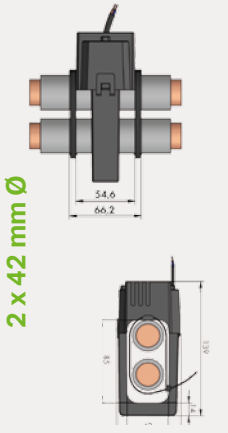
Retrofit Existing Systems

WAGO's compact split-core current transformers are ideal for retroftting existing systems. They are perfect for applications that do not require current path interruption. The transformer's accuracy permits extremely precise current measurements. The split-core current transformers are capable of supplying the specified rated power at the end of the secondary cable. All transformers are supplied with color-coded cables. Two UV-resistant cable ties are also included for secure and easy mounting. All split-core current transformers comply with EN 61869-1/EN 61869-2.

Simple termination!

Quick and easy mounting!



	Item Number	Primary Rated Current	Secondary Rated Current	Rated Power	Accuracy Class	Cable Length
 18 mm Ø	855-3001/060-003	60 A	1 A	0.2 VA	3	3 m
	855-3001/100-003	100 A	1 A	0.2 VA	3	3 m
	855-3001/200-001	200 A	1 A	0.2 VA	1	3 m
	855-3001/250-001	250 A	1 A	0.2 VA	1	3 m
 18 mm Ø	855-4001/100-001	100 A	1 A	0.2 VA	1	3 m
	855-4001/150-001	150 A	1 A	0.2 VA	1	3 m
	855-4005/150-101	150 A	5 A	1 VA	1	0.5 m
	855-4001/200-001	200 A	1 A	0.2 VA	0,5	3 m
 28 mm Ø	855-4101/200-001	200 A	1 A	0.2 VA	1	3 m
	855-4101/250-001	250 A	1 A	0.2 VA	1	3 m
	855-4105/250-101	250 A	5 A	1 VA	1	0.5 m
	855-4101/400-001	400 A	1 A	0.2 VA	1	3 m
	855-4105/400-101	400 A	5 A	1 VA	1	0.5 m
 42 mm Ø	855-5001/250-001	250 A	1 A	0.5 VA	1	5 m
	855-5001/400-000	400 A	1 A	0.5 VA	0,5	5 m
	855-5005/400-001	400 A	5 A	0.5 VA	1	3 m
	855-5001/600-000	600 A	1 A	0.5 VA	0,5	5 m
	855-5005/600-000	600 A	5 A	0.5 VA	0,5	3 m
	855-5001/1000-000	1000 A	1 A	0.5 VA	0,5	5 m
	855-5005/1000-000	1000 A	5 A	0.5 VA	0,5	3 m
 2 x 42 mm Ø	855-5101/1000-000	1000 A	1 A	0.5 VA	0,5	5 m
	855-5105/1000-000	1000 A	5 A	0.5 VA	0,5	3 m

PLUG-IN CURRENT TRANSFORMERS

With a *picoMAX*® Pluggable Connector

This incredibly compact current transformer allows easy connection to WAGO's 750 Series 3-Phase Power Measurement Module. The plug-in current transformers can be easily interlinked with the side locks for space-saving, direct use via the circuit breaker. The *picoMAX*® Pluggable Connector rounds out this product and allows easy installation of the secondary cables.

WAGO's Plug-In Current Transformers with a *picoMAX*® Pluggable Connector are available in two versions:

1 A Output: c UL us

- Convert 64 A or 35 A to 1 A
- Accuracy class 1 per EN 61869-2
- Mount on DIN-rail or panels via carrier rail adapter
- UL certified (Certificate No. E356480)

Low Power Output:

- First transformer with lower power output
- Specifically designed for converting low currents from 32 A to 320 mA
- Compliance with accuracy class 0.5 per EN 61869-2 in the measurement range 0.8 … 32 A and in combination with WAGO's 3-Phase Power Measurement Module

	Item Number	Primary Rated Current	Secondary Rated Current	Rated Power	Accuracy Class	Conductor Hole
	**855-2701/035-001**	35 A	1 A	0.2 VA	1	7.5 mm Ø
	855-2701/064-001	64 A	1 A	0.2 VA	1	7.5 mm Ø
	855-9927	Carrier Rail Adapter				
	**855-1700/032-000**	32 A*	320 mA	0.1 Ω	0.5**	5.0 mm Ø

*Measurement range: 0.8 … 32 A in combination with the 750-493/494/495 3-Phase Power Measurement Modules
**Testing adheres to EN 61869-2 with a conversion ratio of 16 A/0.16 A (accuracy class: 0.5) and an extended primary current of 200 %

Push-in termination technology for solid conductors or fine-stranded conductors with ferrules

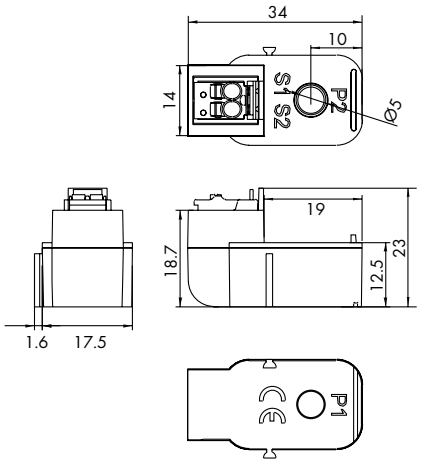
Universal connection: Hands-free wiring for fine-stranded conductors

PLUG-IN CURRENT TRANSFORMERS

With a *picoMAX*® Pluggable Connector

Plug-In Current Transformers/
Low Power Output

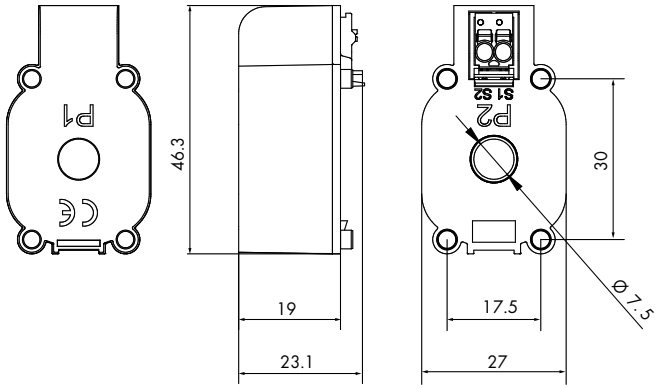
Dimensions:



Assembly:
Plug-in current transformers/low power output – just push together!

Plug-In Current Transformers/
1A Output

Dimensions:



Assembly:
Plug-in current transformers/1A output – just snap them together!

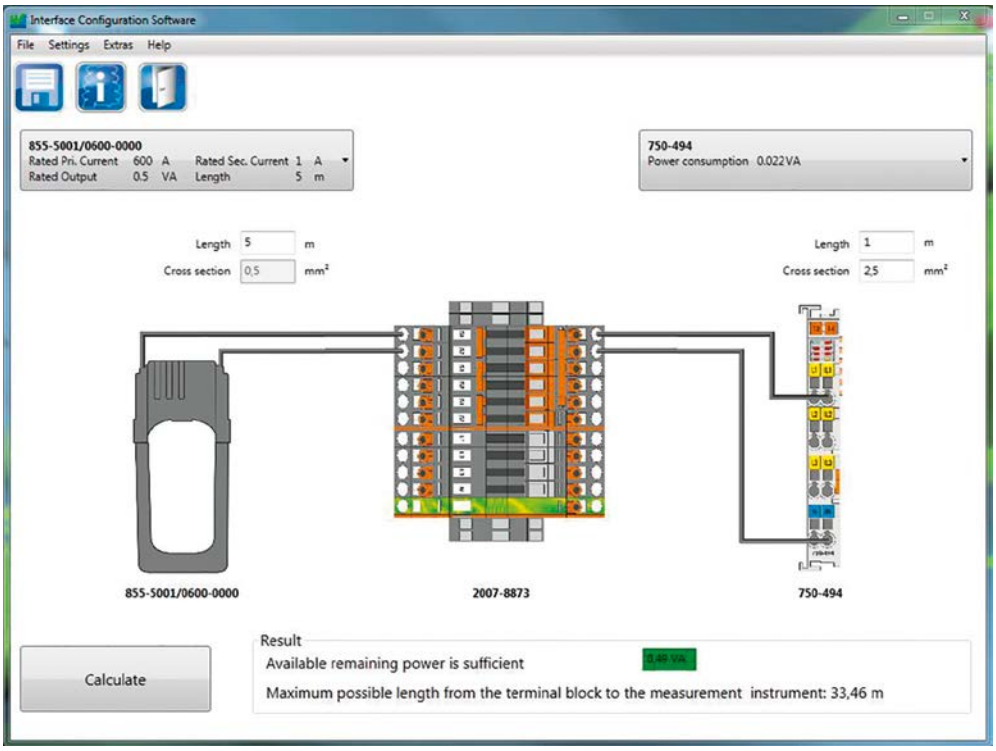
CALCULATING LINE LENGTH FOR CURRENT TRANSFORMERS

WAGO has expanded its configuration tool interface to include a line length calculator.
Calculating line length is quick and easy, with the information being provided for system documentation. All current transformers and power measurement modules can be selected via convenient drop-down menu.

Current Transformer Power Requirements

To determine actual power requirements, both the power requirements of the connected measurement devices and the power losses from the measurement lines connected to the transformer's secondary circuit must be taken into account.

WAGO Interface Configuration Software



Line length calculation using WAGO Interface Configuration Software

Cable length calculator

Configuration report

Project	WAGO
Project number	1582.23.58877
Company	Wago Kontakttechnik GmbH & Co. KG
Author	Michael Meyer
Date	21.08.2015
Stamp	

Transducer	
Item number	855-3001/0060-0003
Rated Pri. Current	60A
Rated Sec. Current	1A
Rated Output	0,221VA
Measurement instrument	
Item number	750-494
Power consumption	0,022VA
Cabel from transducer to terminal block	
Length	3m
Cross section	0.5mm²
Power loss	0,021VA
Cabel from terminal block to measurment instrument	
Length	1m
Cross section	1mm²
Power loss	0,036VA
Result	
Available power	0,221VA
Total power loss	0,057VA
Remaining power	0,164VA
Required power	0,022VA
Result	Available remaining power is sufficient

Simply documented!

Power calculation of copper cable between measurement device and current transformer:

$$P_V = \frac{I_S^2 \times 2 \times l}{A_{CU} \times 56} \text{ VA}$$

I_S = Secondary rated measuring current strength [A]
l = Simple cable length in m
A_{CU} = Cable cross-section in mm²
P_V = Cable power loss

Note: When using a common three-phase return line, the values for P_V are halved.

Example:
A 1 amp or 5 amp current transformer is used, with an ammeter on the secondary circuit, at a distance of 10 m between the transformer and the measurement device.

Current transformer 5 A

$$P_V = \frac{5^2 \times 2 \times 10}{1.5 \times 56} = 5.96 \text{ VA}$$

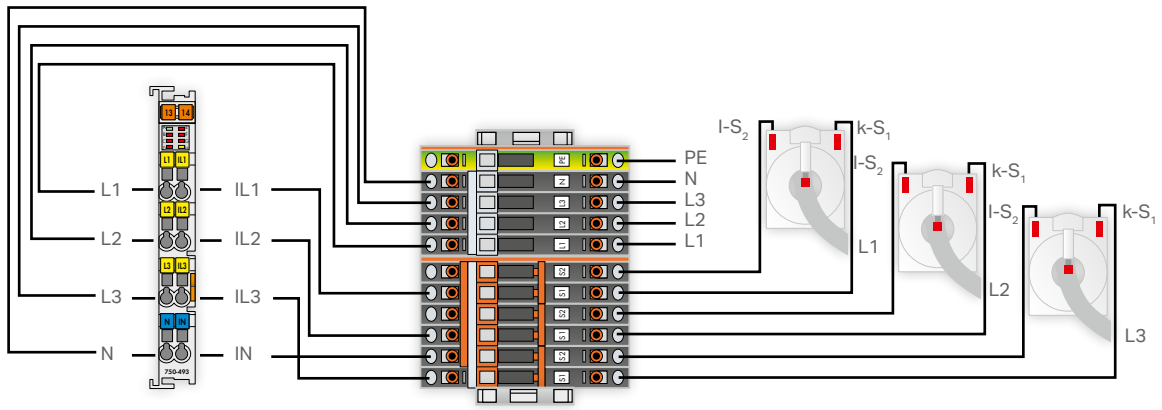
Current transformer 1 A

$$P_V = \frac{1^2 \times 2 \times 10}{1.5 \times 56} \text{ VA} = 0.24 \text{ VA}$$

Free software download:
www.wago.com

TERMINAL BLOCK ASSEMBLY FOR CURRENT AND VOLTAGE TRANSFORMERS

For Fast and Easy Connections

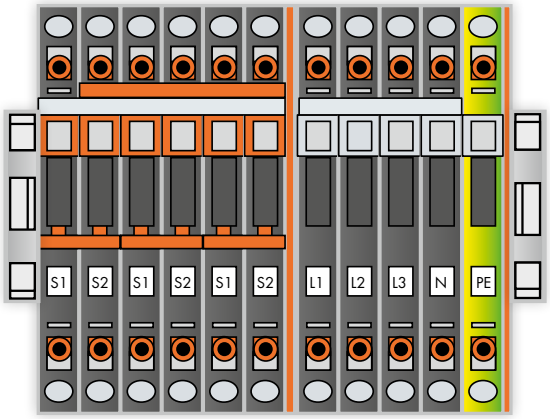


3-Phase Power Measurement Module, 750 Series

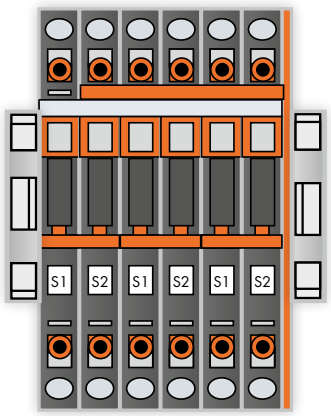
Terminal Block Assembly for Current and Voltage Transformers, 2007 Series

Current Transformers, 855 Series

Pre-assembled terminal block assembly for easy connection and short-circuiting of current transformers, suitable for 750-493 and 750-494 3-Phase Power Measurement Modules

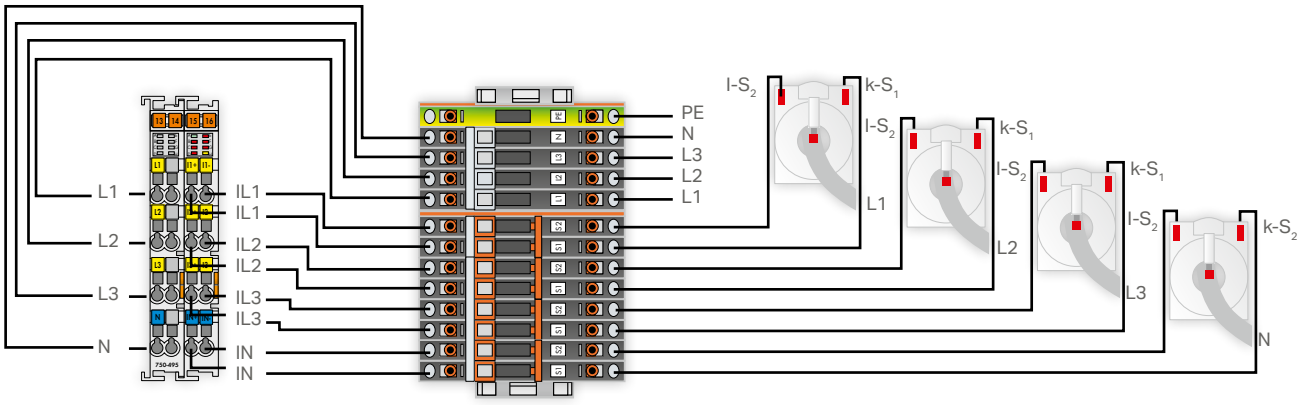


Compact terminal block for current transformer circuit, 2007-8873
Connection option for current and voltage,including 'Y' point jumper



Compact terminal block for current transformer circuit, 2007-8875
Connection option for current, including 'Y' point jumper

- Neutral bridging
- Easy and clear wiring
- Short-circuiting of current transformers
- Test sockets for control measurements

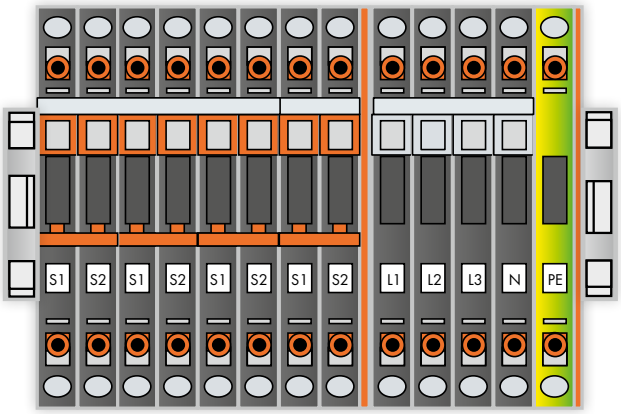


3-Phase Power Measurement Modules, 750 Series

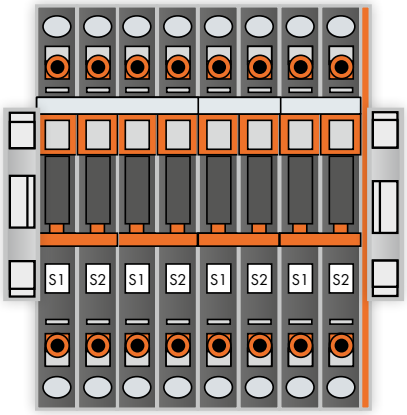
Terminal Block Assembly for Current and Voltage Transformers, 2007 Series

Current Transformers, 855 Series

Pre-assembled terminal block assembly for easy connection and short-circuiting of current transformers, suitable for 750-495 3-Phase Power Measurement Modules



2007-8874: Connection option for current and voltage



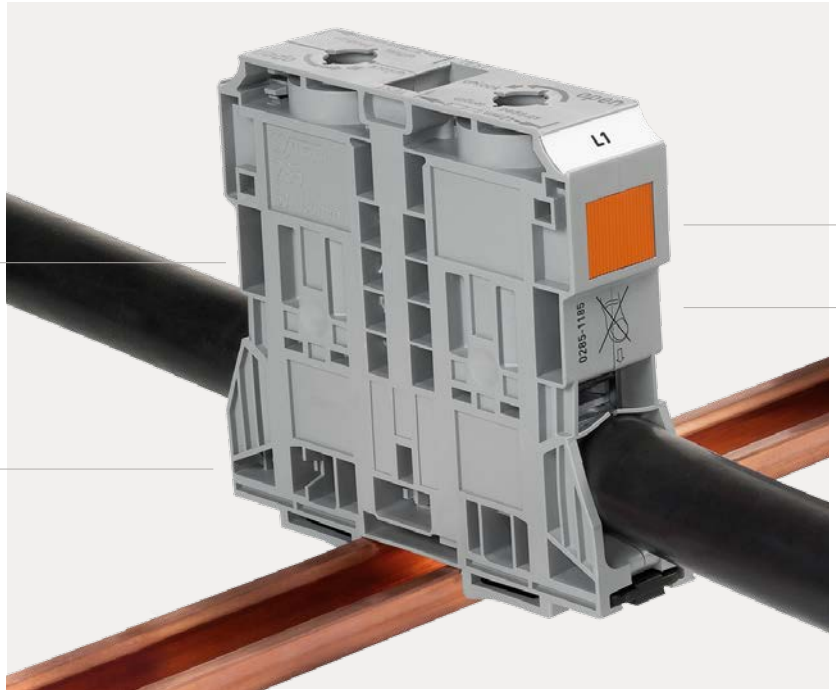
2007-8877: Connection option for current

HIGH-CURRENT, RAIL-MOUNT TERMINAL BLOCKS UP TO 185 mm² (350 KCMIL)

The Ideal Addition to Current Measurement with Plug-In Transformers

Fast Termination
- Eliminate time-consuming preparation – no ring terminals or ferrules required

Easy Termination
- Side-entry design
- Orange locking tab keeps the clamp open for hands-free wiring



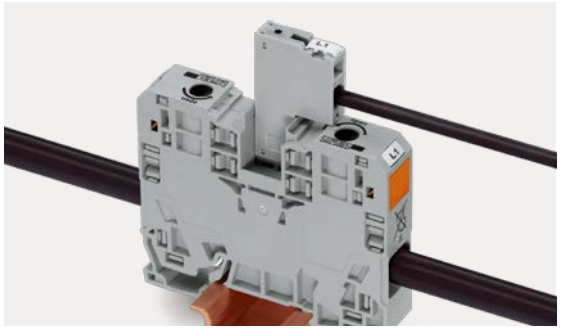
Always Reliable
- Optimum clamping force – independent of operator skill

Suitable for All Applications
- Meet the most stringent requirements, including those specified for railway and marine applications
- Heat- and cold-resistant – even under the heaviest of loads

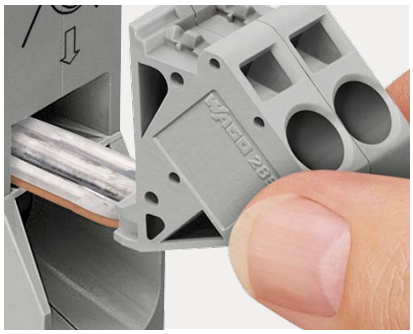
285 Series Item Numbers

Designation	35 mm²	50 mm²	95 mm²	185 mm²
Conductor range	6 … 35 mm² 10 … 2 AWG	10 … 50 (70 "f-st") mm² 8 … 2/0 AWG	25 … 95 mm² 4 … 4/0 AWG	50 … 185 mm² 1/0 AWG … 350 kcmil (ground per standard max. 120 mm² 1/0 AWG … 250 kcmil)
Nominal current I_N	125 A	150 A	232 A	353 A
Rated voltage	1,000 V	1,000 V	1,000 V	AC/DC 1,000 V DC 1,500 V
Through terminal block	285-135	285-150	285-195	285-1185
Through terminal block	285-134	285-154	285-194	285-1184
Ground conductor terminal block	285-137	285-157	285-197	285-1187
Adjacent jumper*	285-435	285-450	285-495	285-1171
Step-down jumper (for TOBJOB® S, 10/16 mm²)*	285-430	-	-	-
Power tap*	285-427	285-447	285-407	285-1175
Three phase set (without DIN-rail and marking accessories)	285-139	285-159	285-199	285-1169
Warning cover	285-420	285-440	285-170	285-1177
Shock protector	285-421	285-441	285-169	285-1178
Marking strip (reel)	2009-110	2009-110	2009-110	2009-110
Marker carrier	285-442	285-442	285-442	-
WMB Inline markers (reel)	2009-115	2009-115	2009-115	2009-115
WMB Multi marking system (for 5 … 5.2 mm)	793-5501	793-5501	793-5501	793-5501

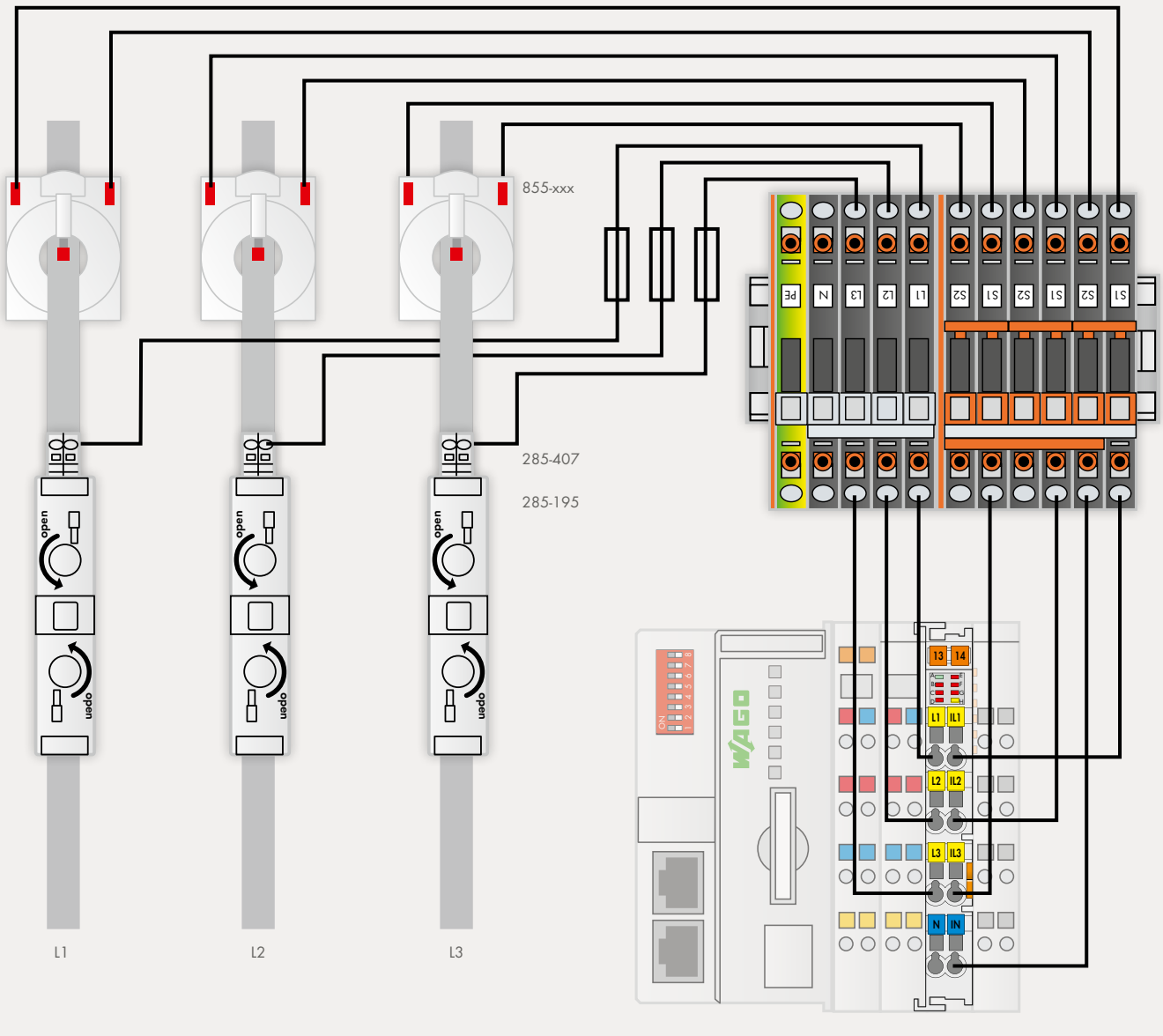
*For more technical data, see Full Line Catalog Volume 1 or http://eshop.wago.com



The power tap is inserted into the jumper contact slot. It can be fitted with a strain relief plate (for 35 mm² high-current rail-mounted terminal blocks).



Power tap provides safe and easy power distribution to additional loads. The tap is inserted when the spring is retracted (for 50 … 185 mm² high-current rail-mounted terminal blocks).



POWER AND VOLTAGE TAPS

The 2-in-1 Solution

This combination of 95 mm² high-current through terminal block with POWER CAGE CLAMP and the new power and voltage tap form the optimum base for successful energy management.

Current and voltage are required wherever electrical power is to be measured. The current and voltage tap is a combination of current transformer and voltage tap and can be quickly and easily mounted into the jumper slot of the 95 mm² high-current through terminal block (285–195).

- Power data can be directly tapped into the power supply
- Easy installation – simply insert the tap into the jumper slot of the 95 mm² high-current through terminal block with POWER CAGE CLAMP
- Integrated 250 A/ 1 A current transformer
- Meets all specifications for accuracy class 0.5 per EN 61869-2 for exact measuring results
- Fused voltage path protects downstream measurement devices

Output – Voltage
- Redundant design

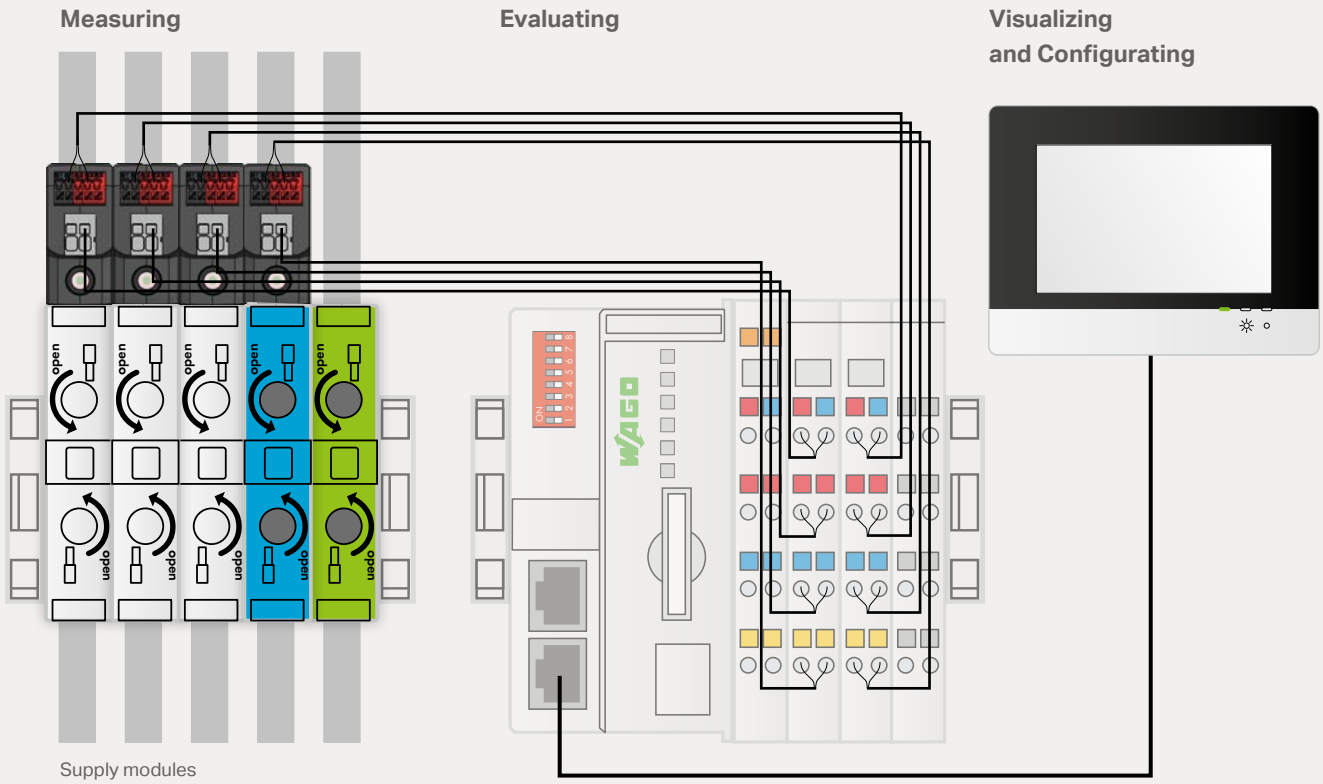
Output – Current
- Energy measurement device connection (1A)
- Short-circuiting the current transformer
- Neutral bridging

Marking Possibility
- TOPJOB®S Marking Strips
- WMB Multi Marking System

Feedthrough for Primary Conductors up to 95 mm²

855-951/250-000

Technical Data for Current and Voltage Taps (855-951/250-000)	
Primary rated current I_{pr}	250 A
Secondary rated current I_{sr}	1 A
Accuracy class	0,5
Rated power S_r	0.2 VA
Nominal voltage	690 VAC
Feedthrough for measurement conductor	16.0 mm Ø



ROGOWSKI COILS

For Quick, Easy Retrofit of Existing Systems

WAGO's Rogowski Coils are closed air coils featuring a non-magnetic split core that can be connected to a 3-Phase Power Measurement Module (750-495/000-002) or a Rogowski Signal Conditioner (857-552).
Easy installation of the Rogowski Coils allows existing systems to be retrofitted without time-consuming installation or process interruption.

- Rated insulation voltage: 1000 V Cat. III / 600 V Cat. IV
- Accuracy class 1 per EN 61869-2
- IP67 protection class
- Ambient operating temperature: −40 … +80 °C
- UL certified

Description		Item Number	Cable Length
Rogowski Coil RC-070		855-9150/2000-0701	1.5 m
		855-9450/2000-0701	4.5 m
Rogowski Coil RC-125		855-9150/2000-1251	1.5 m
		855-9450/2000-1251	4.5 m
Rogowski Coil RC-175		855-9150/2000-1751	1.5 m
		855-9450/2000-1751	4.5 m
Rogowski Coil RT-500		855-9100/500-000	1.5 m
		855-9300/500-000	3.0 m
Rogowski Coil RT-2000		855-9100/2000-000	1.5 m
		855-9300/2000-000	3.0 m

*The specifications for the primary rated current refer to a combination with the WAGO Modules (857-552 and 750-495/000-002). Rogowski technology allows the coils to measure a wide primary current range of up to 10,000 A without loss of accuracy, because there are no saturation effects with this technology.

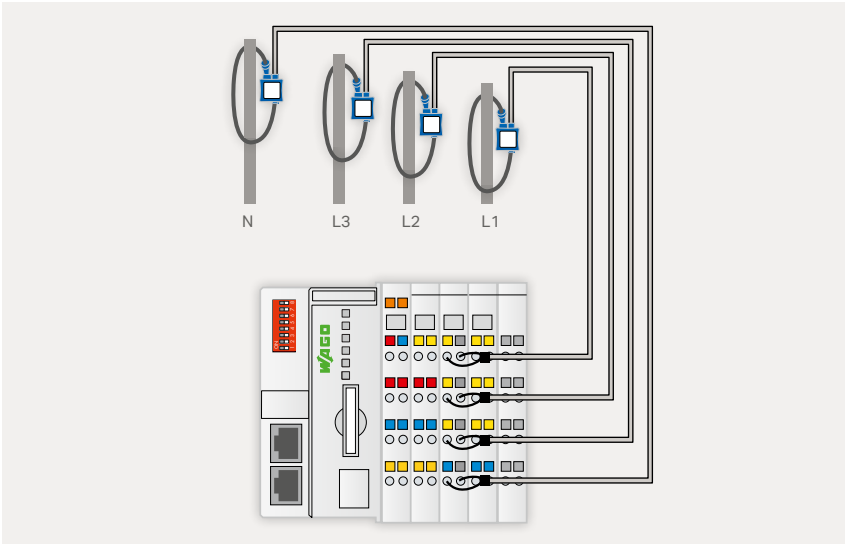
Bayonet connector:
Robust and durable

Fixing lugs:
Quick and easy mounting with cable ties

Lock-out seal option:
More secure thanks to sealable bayonet connector

Easy to Use:

- Rogowski coil diameter: 70, 125 or 175 mm
- Length of signal line: 1.5 m or 4.5 m
- Sealable bayonet connector
- Fixing lugs for cable ties



Connecting Rogowski Coils directly to the 750-495/000-002 3-Phase Power Measurement Module

Feedthrough for Measurement Conductor	Primary Rated Current *	Output Signal	Accuracy Class**
70 mm Ø	4000 AAC	22.5 mV / kA at 50 Hz	1
125 mm Ø	4000 AAC	22.5 mV / kA at 50 Hz	1
175 mm Ø	4000 AAC	22.5 mV / kA at 50 Hz	1
55 mm Ø	500 AAC	10.05 mV / 500 A at 50 Hz	-
125 mm Ø	2000 AAC	40.2 mV /2000 A at 50 Hz	-

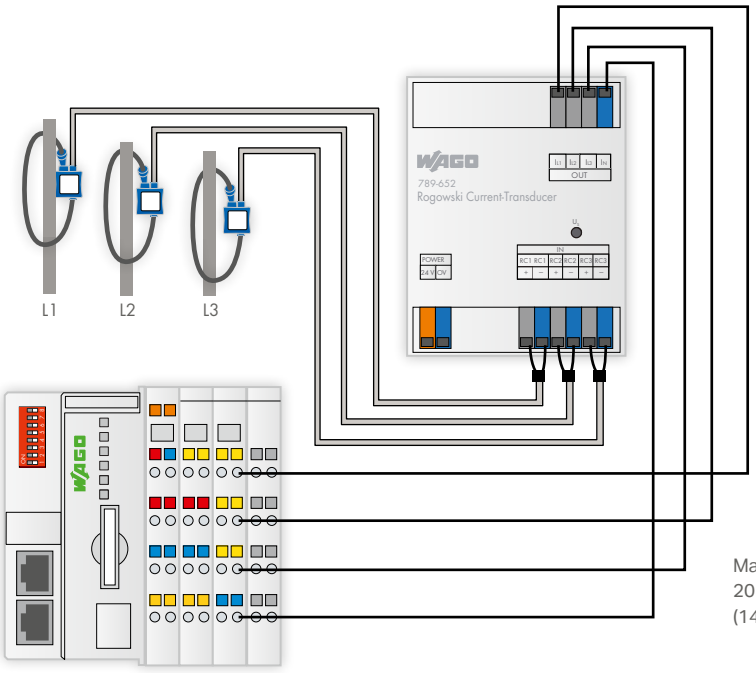
** per EN 61869-2

SIGNAL CONDITIONERS FOR ROGOWSKI COILS

For Long Cable Runs

WAGO's Rogowski Signal Conditioners record 5 … 2000 A alternating currents in a three-phase system. The magnetic field generated around each conductor is detected via three non-contact Rogowski coils and provided as a proportional voltage signal to the signal conditioner. These signal conditioners adjust the phase for each of the three voltage signals, converting them into 100 mA AC current signals; these are are then transmitted to the 3-Phase Power Measurement Modules. Easy installation of Rogowski coils also allows existing systems to be retrofitted without process interruption.

- Record AC currents up to 2,000 A
- Provide in-phase conversion of the three voltage signals
- Convert Rogowski signals into 3 x 100 mA



Maximum cable length up to
20 m for conductors up to 2.5 mm²
(14 AWG)

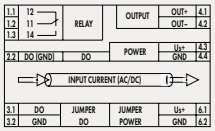
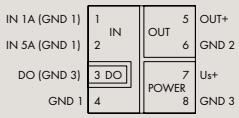
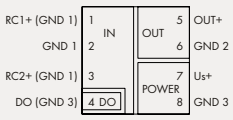
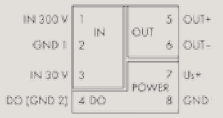
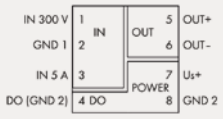
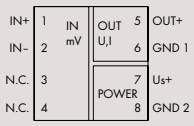
Connecting Rogowski Coils with electronic ballasts to a 750-494
3-Phase Power Measurement Module

	Item Number	Input Signal	Output Signal	Overcurrent	Sensitivity
	**789-652**	3 x RT 500 (500 A)	3 x 100 mAAC	750 A	10.05 mV; 50 Hz, sinusoidal
	**789-654**	3 x RT 2000 (2000 A)	3 x 100 mAAC	3000 A	40.2 mV; 50 Hz, sinusoidal
	**750-494**	see page 7			
	**855-9100/500-000**	see pages 34–35			
	855-9300/500-000	see pages 34–35			
	855-9100/2000-000	see pages 34–35			
	855-9300/2000-000	see pages 34–35			

Only possible in combination with the specified coils!

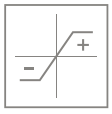
Signal Conditioners and Isolation Amplifiers

Current and Voltage Signal Conditioners

	Description	Item No.	Image	Circuit Diagram	Input		
Current and Voltage Signal Conditioners	Current and Voltage Signal Conditioners				A	V	±
	Current Signal Conditioner with Through-Hole	2857-550			AC/DC 100 A		
	Current Signal Conditioner	857-550			1 A AC/DC 5 A AC/DC		
	Rogowski Current Signal Conditioner	857-552			Rogowski Coils 500 AAC 2000 AAC 4000 AAC		
	Voltage Signal Conditioner	857-560			AC/DC 300 V		
	Power Signal Conditioner	857-569			AC/DC 300 V (5 A)		
	Millivolt Signal Conditioner	857-819				0 … 200 mV 0 … 1000 mV	± 100 mV

Current

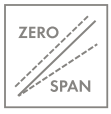
Voltage



Bipolar signals
current and voltage

Digital output (DO)

Clipping capability



Zero/span adjustment

Output			Special Functions				Configuration				Power
A	V		DO		ZERO SPAN	S	ON				
0 ... 10 mA 2 ... 10 mA 0 ... 20 mA 4 ... 20 mA	0 ... 5 V 1 ... 5 V 0 ... 10 V 2 ... 10 V	±10 mA ±20 mA ±5 V ±10 V	x	x	x	x	x	x	x	x	24 VDC
0 ... 10 mA 2 ... 10 mA 0 ... 20 mA 4 ... 20 mA	0 ... 5 V 1 ... 5 V 0 ... 10 V 2 ... 10 V		x	x			x	x	x		24 VDC
0 ... 10 mA 2 ... 10 mA 0 ... 20 mA 4 ... 20 mA	0 ... 5 V 1 ... 5 V 0 ... 10 V 2 ... 10 V		x	x			x	x	x		24 VDC
0 ... 10 mA 2 ... 10 mA 0 ... 20 mA 4 ... 20 mA	0 ... 5 V 1 ... 5 V 0 ... 10 V 2 ... 10 V		x	x			x	x	x		24 VDC
0 ... 10 mA 2 ... 10 mA 0 ... 20 mA 4 ... 20 mA	0 ... 5 V 1 ... 5 V 0 ... 10 V 2 ... 10 V		x	x			x	x	x		24 VDC
0 ... 10 mA 2 ... 10 mA 0 ... 20 mA 4 ... 20 mA	0 ... 5 V 1 ... 5 V 0 ... 10 V 2 ... 10 V			x			x	x	x		24 VDC

Simulation

Interface configuration app

DIP switch

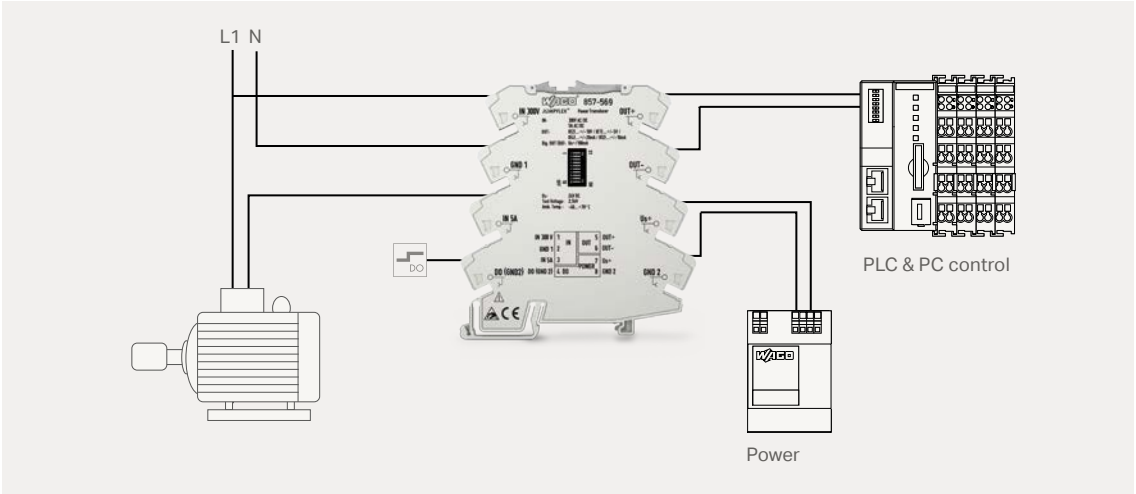
Interface configuration display

Interface configuration software

Supply voltage

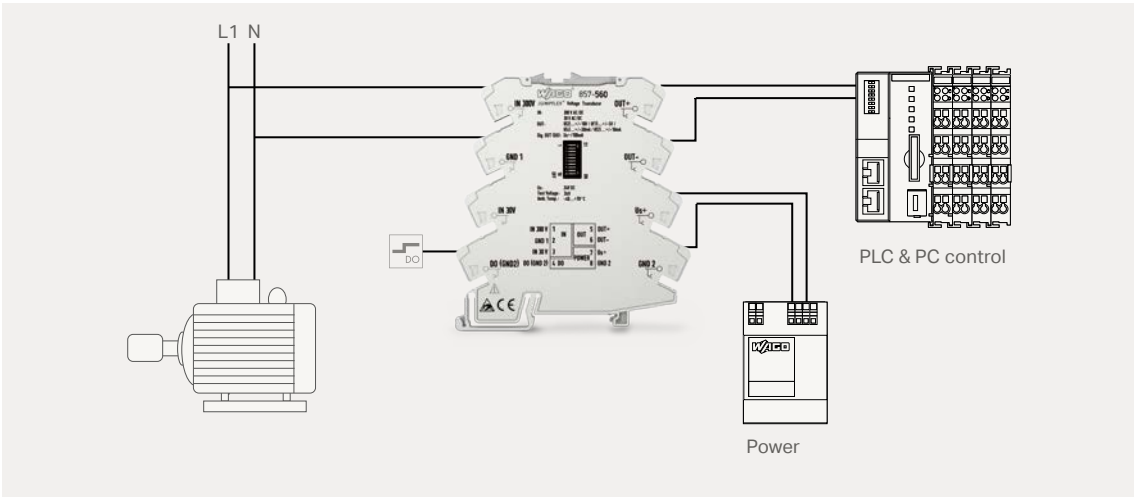
Signal Conditioners and Isolation Amplifiers

Current and Voltage Signal Conditioners



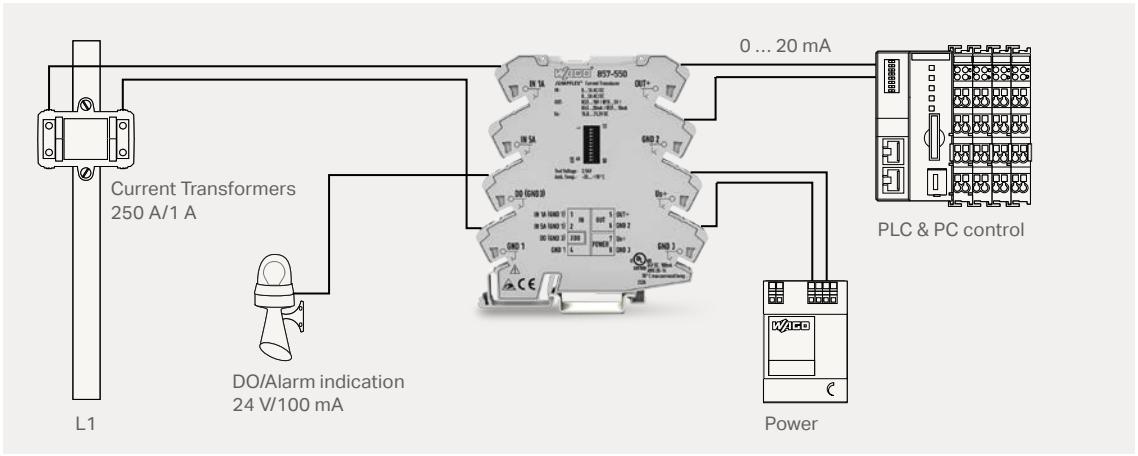
Power Signal Conditioner, 857-569

1-phase power measurement



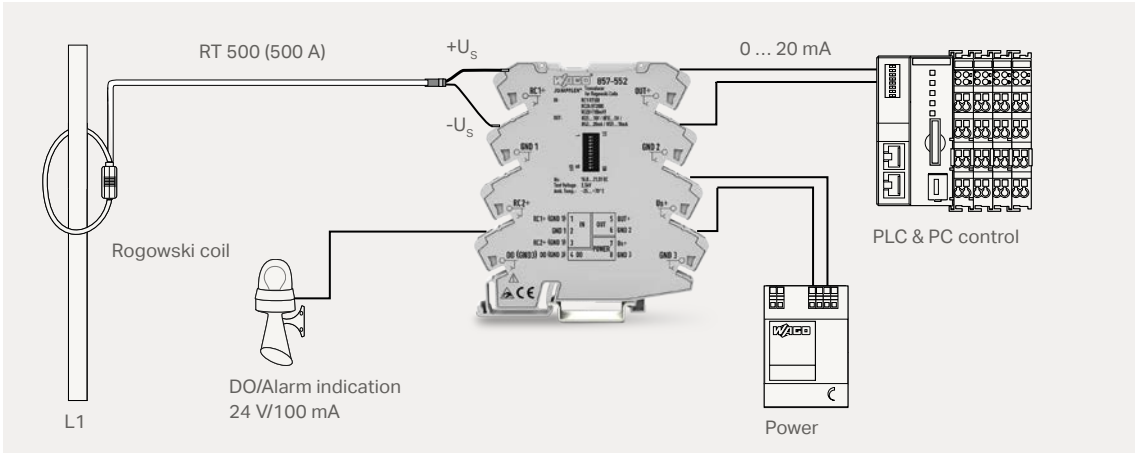
Voltage Signal Conditioner, 857-560

Voltage measurement



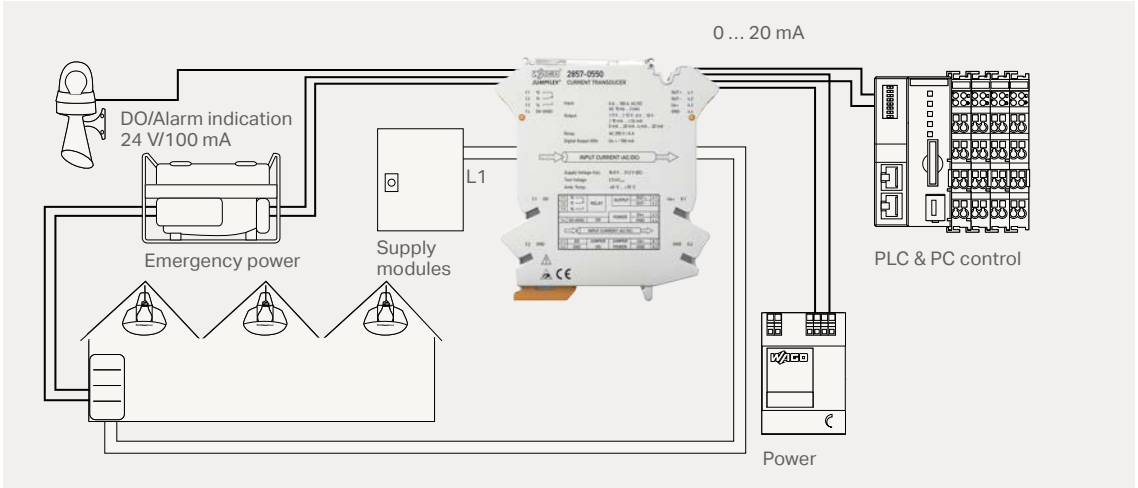
Current Signal Conditioner, 857-550

Current measurement via plug-in current transformer



Rogowski Signal Conditioner, 857-552

Current measurement via Rogowski coil



Current Signal Conditioner, 2857-550

Light monitoring

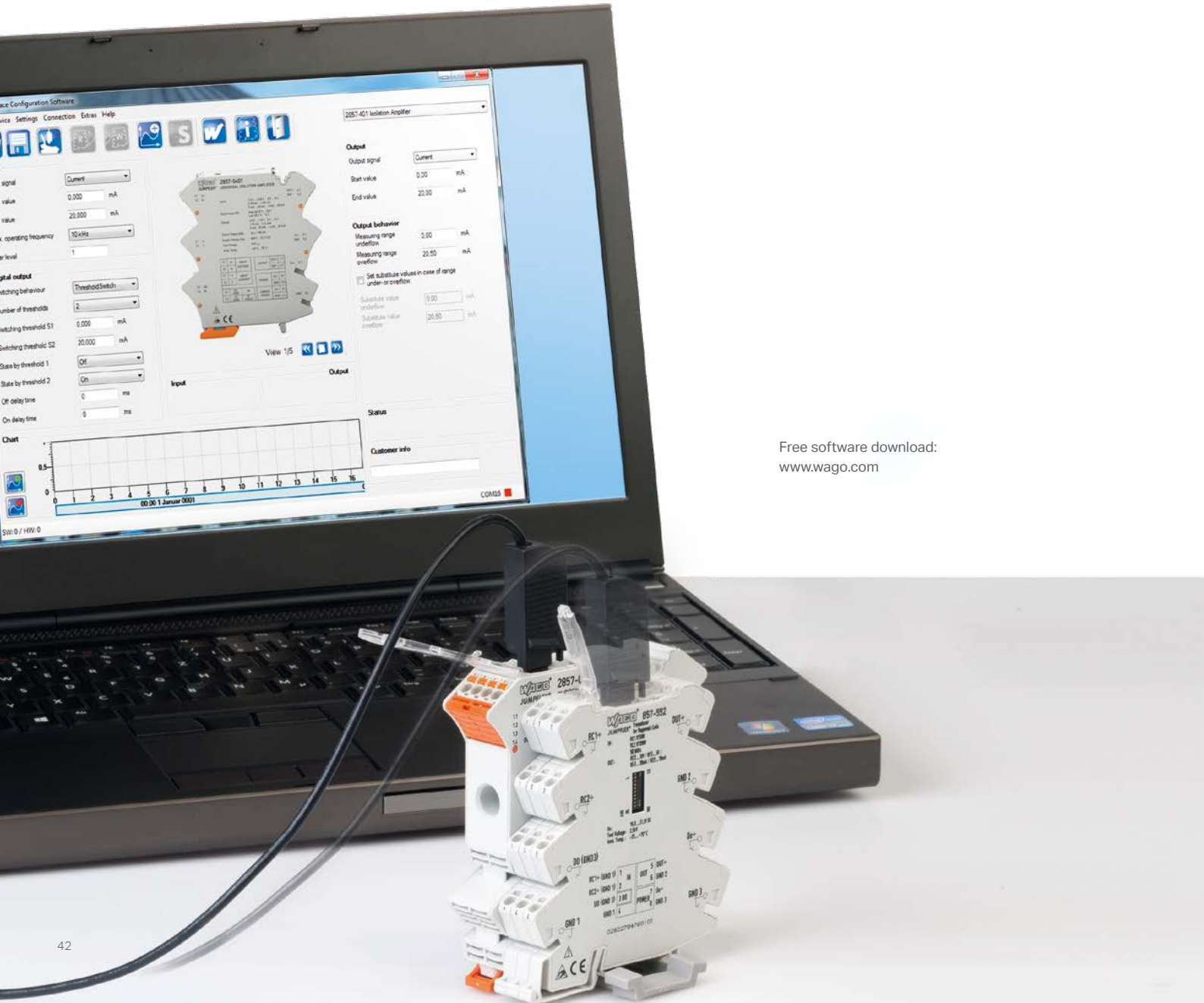
JUMPFLEX® CONFIGURATION

Interface Configuration Software

Configure all signal conditioners with the user-friendly interface configuration software.

Software Features:

- Simulate input and output parameters (2857 Series)
- Detect modules automatically
- Configure and visualize process values
- Parameterize the digital switch output (threshold functionality)
- Communicate via 750-923 WAGO USB Service Cable or WAGO 750-921 *Bluetooth*® Adapter



Free software download:
www.wago.com

JUMPFLEX®-ToGo Configuration App

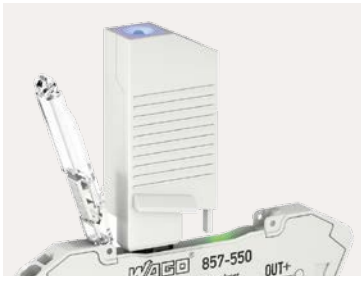
(Android smartphone)

The free *JUMPFLEX*®-ToGo App brings the power of PC-based configuration software to your smart-phone or tablet with Android compatibility.

App Features:

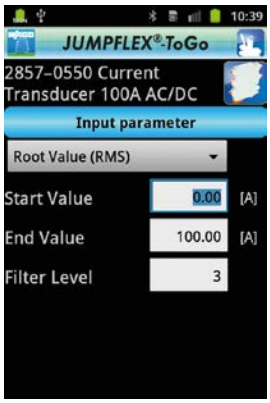
- Configure input and output parameters with a stroke of the finger
- Easily display configuration data and current measurement values
- Communicate via WAGO *Bluetooth*® Adapter

Free download from Google Play



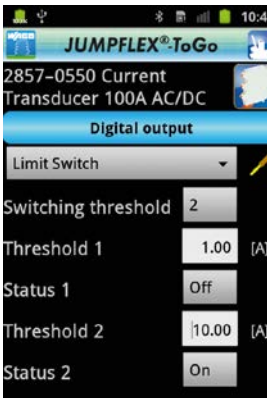
Bluetooth® Adapter 750-921

Device Information

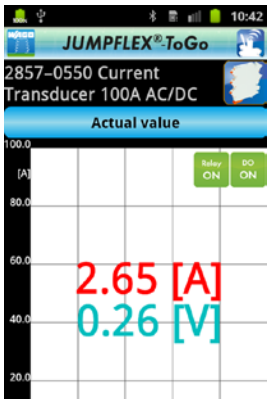


Input Parameter

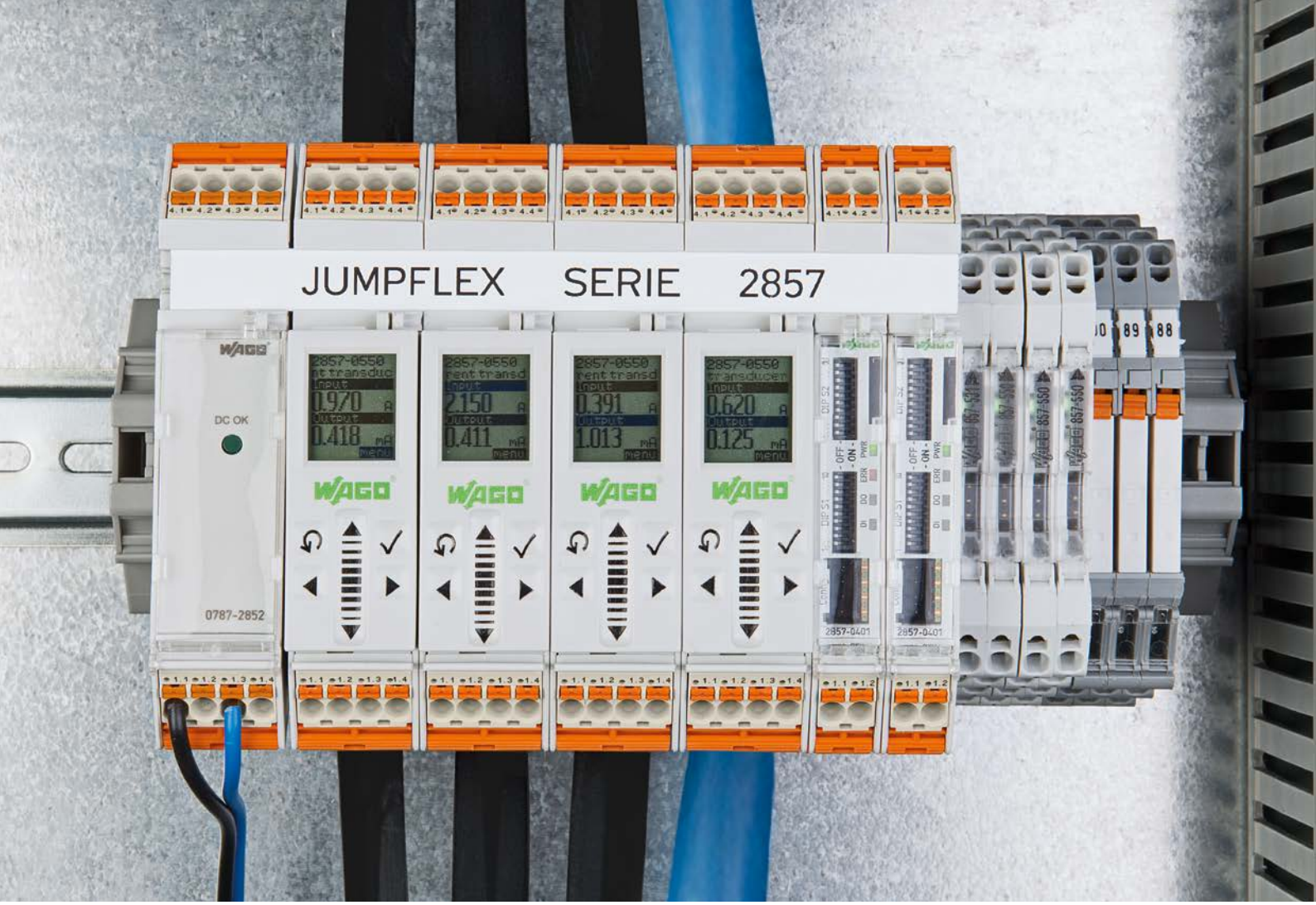
Output Parameter



Digital Output



Actual Value



The pocket-sized configuration option

JUMPFLEX® CONFIGURATION

Configuration Display for 2857 Series

Flexibility at its Finest!

The removable display can be quickly and easily attached to the housing. This unique feature carries an innovative capacitive touch panel for intuitively configuring devices.
The multicolor display changes between orange, red, green or white depending on the device's current status.

Integrated capabilities, such as the copy function, can transmit stored configuration data from one device to another of the same type. Passwords for protecting configured data may be assigned to prevent unauthorized access or changes.

Configuration display
(2857-900)

Suitable for 12.5 and 22.5 mm wide housings

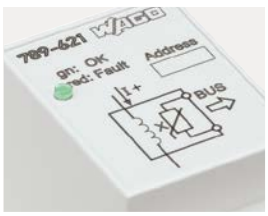
- Easily plug into signal conditioners
- Touch functionality via control panel
- Detect modules automatically
- Configure and visualize process values
- Copy configuration data from device to device

INTELLIGENT CURRENT SENSORS

Monitor Solar Plants via MODBUS Communication

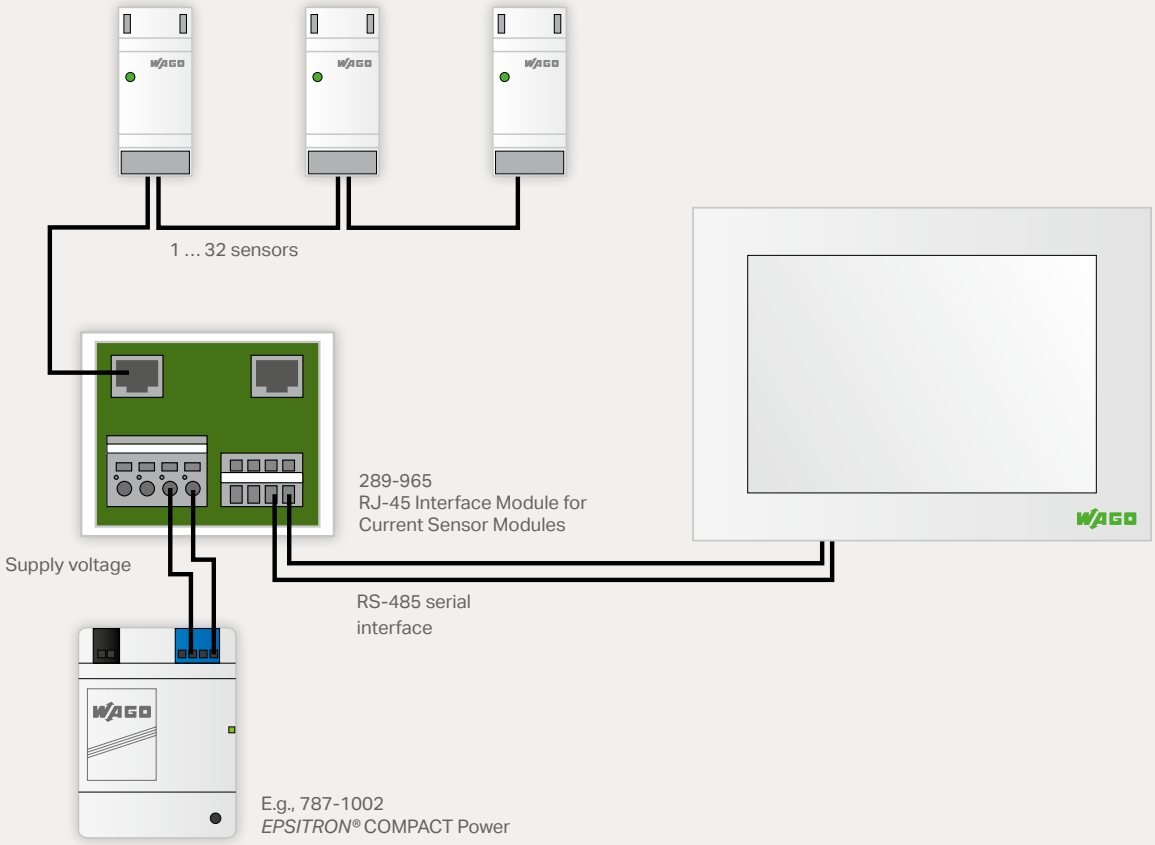
Intelligent current sensors monitor solar plants or inverters for DC measurements within a large current measurement range.

Addressing



Status indicator

Connection to a *PERSPECTO*® Control Panel



	789-620	789-621	789-622
			
Measurement range	0 … 80 ADC	0 … 140 ADC	0 … 50 A_{rms} (AC)
Transmission error	≤ 0.5 % of upper-range value	≤ 0.5 % of upper-range value	≤ 0.5 % of upper-range value
Voltage supply	12 … 34 V (via RJ-45)	12 … 34 V (via RJ-45)	12 … 34 V (via RJ-45)
Feedthrough	15 mm (for electrical lines)	15 mm (for electrical lines)	15 mm (for electrical lines)
Interface	RS-485	RS-485	RS-485
Protocol	MODBUS over serial line	MODBUS over serial line	MODBUS over serial line
Addressing	1 … 32	1 … 32	1 … 32
Max. bus length	≤ 1200 m	≤ 1200 m	≤ 1200 m

ENERGY MANAGEMENT SYSTEM

DIN EN ISO 50001

For certification, energy management systems must meet standardized requirements. While required actions vary from company-to-company, the goal is the same: Reducing energy costs, greenhouse gases and other environmental impacts.

To be certified according to DIN 50001, a company/organization must …

… introduce and document an energy management system that complies with DIN 50001,

… define, document, implement and maintain the application range and the limits of its energy management system,

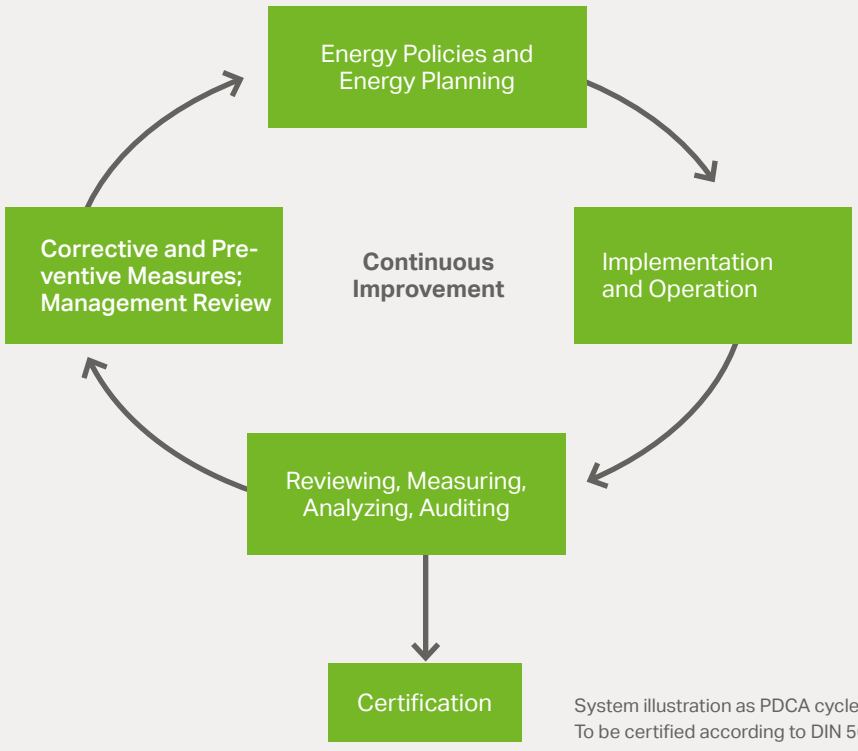
… determine and document how it fulfills the requirements of DIN 50001 with a view toward consistently improving energy efficiency.

For certification, the three following pillars are required:

Energy Team
Energy management representative + team
Established by top management (defining responsibilities)

Energy Policy
Appropriate to the nature and extent of the energy consumed
- Commitment to continuous improvement
- Availability of required information and resources
- Compliance with legal and other requirements (defining objectives)

Energy Planning
- Determination and evaluation of both past and current energy use/consumption
- Estimation of future energy use and consumption
- Identification of the major energy consumers, prioritization of potential improvements (from preliminary to detailed)



System illustration as PDCA cycle per ISO 50001:
To be certified according to DIN 50001.

SYSTEM IMPLEMENTATION

WAGO's Energy Management System

At WAGO, energy management is not just a corporate jargon – we live it by actively conserving resources and saving energy. All organizational and technical measures serve the goal of using as little energy as possible in the construction and operation of every WAGO facility worldwide.

Environmental stewardship has been a long-standing cornerstone of our company policy. In 2012, WAGO successfully passed the DIN EN ISO 50001 energy management certification, making it the heart of our day-to-day operations worldwide.


ZERTIFIKAT ◆ CERTIFICATE ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Management Service

ZERTIFIKAT

Die Zertifizierungsstelle
der TÜV SÜD Management Service GmbH
bescheinigt, dass das Unternehmen

WAGO Kontakttechnik GmbH
(nach Schweizer Recht) & Co. KG
Hansastraße 27 • 32423 Minden • Deutschland
Waldstraße 1 • 99706 Sondershausen • Deutschland

für den Geltungsbereich

ELECTRICAL INTERCONNECTIONS
Entwicklung und Produktion von Klemmen, Klemmleisten und Steckverbindern mit Federklemmtechnik für die Elektrotechnik und Elektronik sowie Vertrieb am Standort Minden

AUTOMATION
Entwicklung und Produktion von Komponenten & Subsystemen für die Automatisierung von Maschinen, Anlagen und Gebäuden auf der Basis von Feldbussystemen, steckbaren und schienenmontierbaren Interface Bausteinen sowie Vertrieb am Standort Minden

ein Energiemanagementsystem
eingeführt hat und anwendet.
Durch ein Audit, Bericht-Nr. 70024958,
wurde der Nachweis erbracht, dass die Forderungen der

ISO 50001:2011

erfüllt sind. Dieses Zertifikat ist gültig vom 2013-09-17 bis 2016-09-16
Zertifikat-Registrier-Nr. 12 340 16077 TMS

Product Compliance Management
München, 2013-09-18

DAkkS Deutsche Akkreditierungsstelle D-ZM-14143-01-02

TÜV SÜD Management Service GmbH • Zertifizierungsstelle • Ridlerstraße 65 • 80339 München • Germany

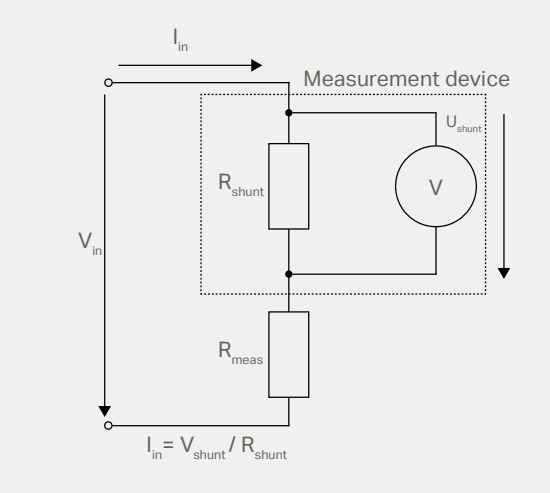
"In 2012, WAGO was one of the very first companies to be certified!"

To achieve such efficiency, we rely heavily on the following pillars:

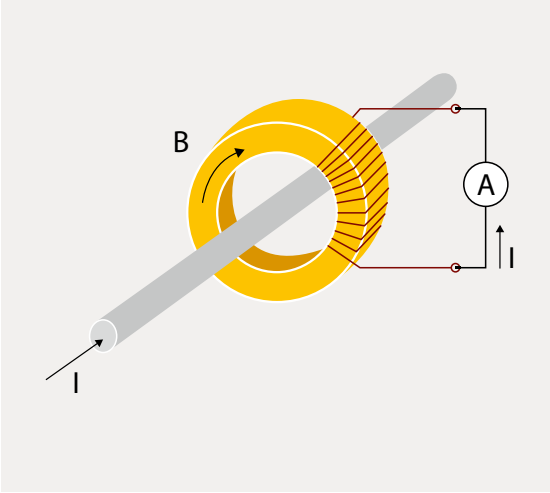
- Systematic installation and evaluation of energy meters (using our own products)
- Expansion of software-supported power data management
- Formation of figures and comparative values (accounting for variables such as production performance or the weather's impact on heating and ventilation)
- Cross-departmental cooperation between Facility Maintenance and other areas – especially Production and Maintenance, as well as Purchasing and Controlling
- Systematically evaluating energy usage when purchasing machines and systems or during the construction and renovation of our facilities
- Implementation of internal audits
- Staff education and training on energy issues

Certification according to DIN EN ISO 50001 is provided from various agencies. Since sustainability and conservation have always been parts of our company mission, WAGO was one of the first companies to be certified in 2012.

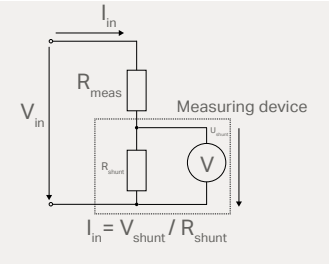
MEASUREMENT METHODS



High-Side Method



Transformer Principle

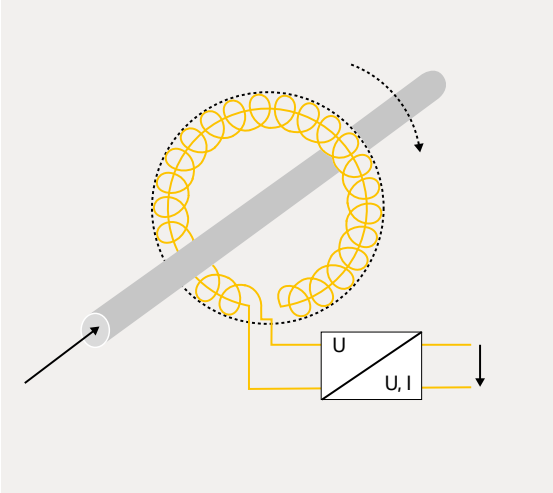


Low-Side Method

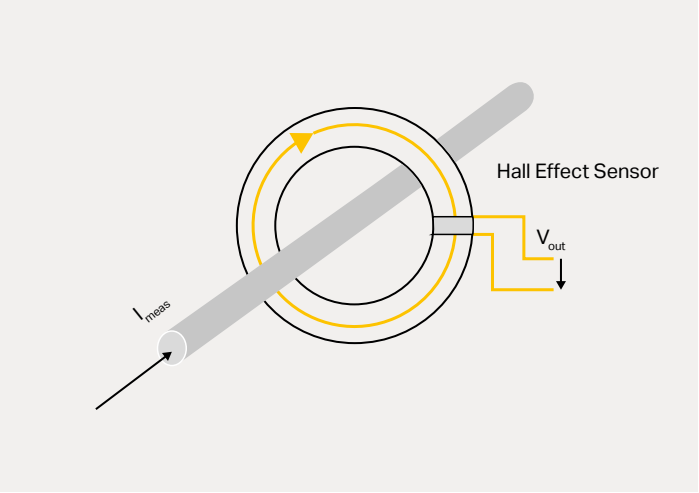
Shunt Measurement (AC/DC)
Current measurement is performed using a low-ohm resistor (shunt), which is connected in parallel to a voltmeter. The current is proportional to the current measured at the shunt resistor, I = U/R.

The shunt can be located upstream or downstream of the load (high-side/low-side method). WAGO products are equipped for both methods, giving users the freedom to decide where the conductor section should be disconnected. In addition to DC and AC currents, shunt measurements are also suitable for measuring superimposed signals (DC + AC). Accuracies of 0.1 % and greater can be achieved. WAGO's 855 Series Plug-In Current Transformers with a predefined division ratio can be used to expand the measurement range for pure AC measurements.

Shunt Measurement in Combination with Plug-In Current Transformer (AC)
Plug-In Current Transformers are used at higher measurement currents. They function based on the transformer principle and expand the range of an existing measurement system (usually a shunt transformer). The number of secondary windings mirrors the fixed setting of the division ratio. The electrically isolated output AC is proportional and in phase with the input AC. The measuring error typically lies below 1 %.



Rogowski Coil



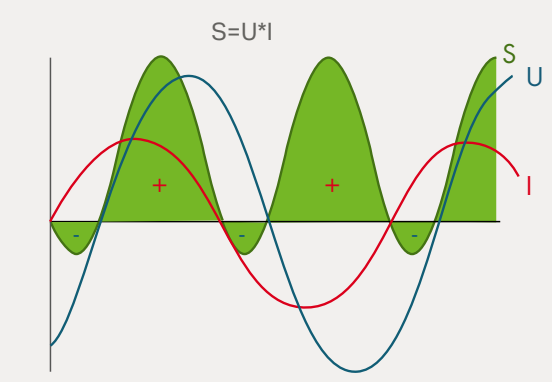
Hall Effect Sensor

Rogowski Coil (AC)
A closed-air coil, i.e., coil without iron core, is applied around the conductor that will be measured. The AC current flowing through the conductor induces a proportional voltage in the Rogowski coil. The output voltage is amplified and conditioned. A measurement error of less than 2 % and a response threshold of only a few amps guarantee straightforward measurement of high to very high AC currents.

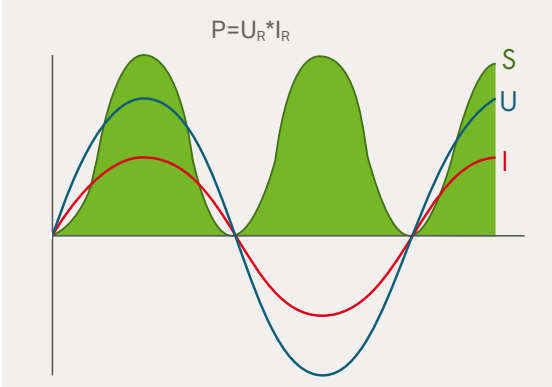
Hall Effect Sensors (AC/DC)
A soft-magnetic core is wrapped around the conductor. The core has a small air gap in which the Hall effect sensor is located. A magnetic flux is generated in the ring-shaped core by the current flowing through the conductor. The magnetic flux also flows through the Hall effect sensor, which outputs a voltage signal proportional to the current measured. This signal is prepared and forwarded for processing. Using the Hall method, different signals (AC/DC) and measurement ranges can be mapped, depending on the design. Measurement accuracy lies between 0.5 % and 1 %.

Measurement Method	Advantages	Application Areas
Shunt	• Very high accuracy • Suitable for DC and AC currents	• Integration into control and regulation systems • Process and energy technology
Shunt + Current transformer	• Suitable for higher AC currents • Potential-free measurement	• Installations and systems technology • Network monitoring and analysis
Hall effect	• Potential-free measurement • For higher currents • DC and AC versions	• PV systems and general energy technology • Control processing of several individual systems

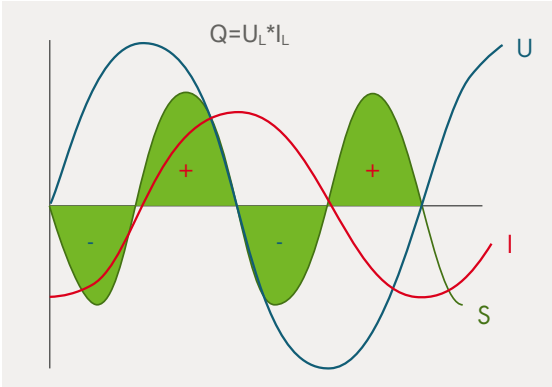
GLOSSARY



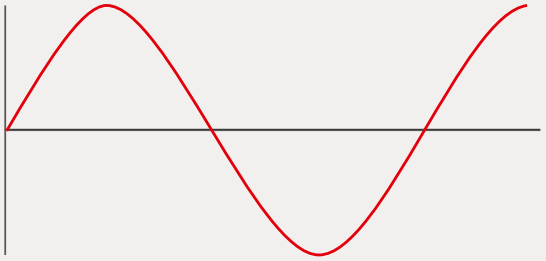
Apparent Power S
Apparent power (S) is the total power of a transmission network. It is composed of active power (P) and reactive power (Q). Positive apparent power, which is in the interest of the consumer, means that the power is drawn from the grid. Negative apparent power, however, means that power is fed back into the grid.



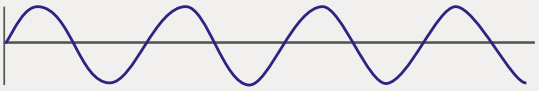
Active Power P
The active power (P) is the power actually consumed. It has no phase shift between current and voltage and relates to a resistive load. For an alternating voltage, the active power results from the multiplication of the RMS values for current and voltage.



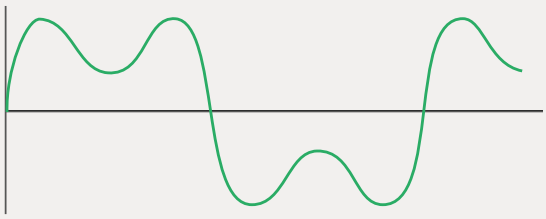
Reactive Power Q
Reactive power (Q) refers to a load on the power grid, which acts against the power flowing from the producer to the consumer. Reactive power is the product of voltage and current flowing through a reactance. Reactive power is generated by any device that is connected to an AC grid. All electrical equipment generates an electromagnetic field when voltage is applied. The magnetic field is constantly being built up and then dismantled by the alternating voltage. The energy created when the field is being dismantled is fed back into the power grid, increasing the resistance to the current flow.



Fundamental frequency (50 Hz)



Third harmonic (150 Hz)



Addition creates a non-sinusoidal wave form.

Harmonics

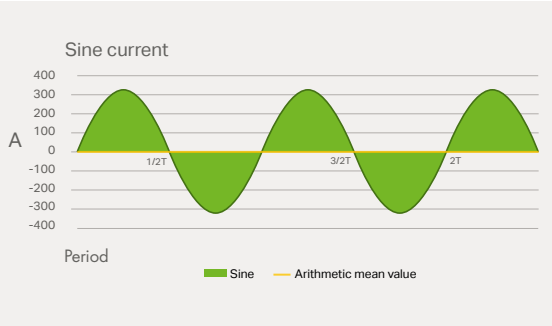
Harmonics are currents having frequencies that are multiples of the 50 Hz fundamental frequency. The harmonic degree is defined as the relationship between harmonic and fundamental frequency. Harmonics are created by devices with non-linear characteristic curves (e.g., transformers, rectifiers, televisions, computers, halogen lighting). The non-sinusoidal currents of these devices result in a voltage drop in the network impedance, which distorts the network nominal voltage and affects operation.

The impacts of harmonics contamination include: failure of protective devices, thermal overload and premature aging of electrical equipment, loss of mechanical stability, performance loss, measurement errors, higher noise level, hard drive failures, system crashes, operational breakdowns and more.

If many devices are operated within a network generating the third harmonic, it may result in a very high current load of the neutral conductor. Neutral conductor currents caused by harmonics in TN-C power networks travel within the entire equipotential bonding system via water/heating pipes, grounding systems, shields of data lines, video lines and communication systems. This can lead to increased corrosion or pitting on piping systems.

Therefore, continuous harmonics and neutral conductor analysis are required for guaranteeing both power supply and overvoltage protection, as well as fire safety.

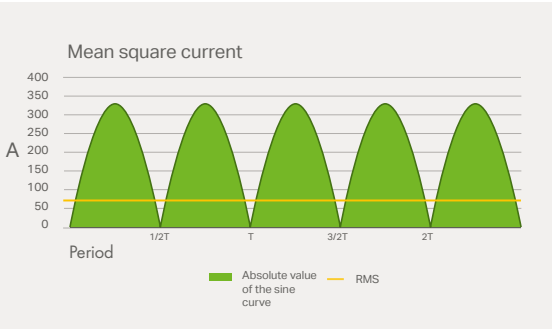
GLOSSARY



Arithmetic Mean Value

The arithmetic mean value (also average) is the sum of all measured values detected and divided by the number of measured values.

For periodic variables (e.g., sine waves), the arithmetic mean is zero. For this reason, it is not meaningful for use with periodic variables, or it only provides information about a possibly present constant. For DC variables, the arithmetic mean value corresponds to the average measured value viewed over time.



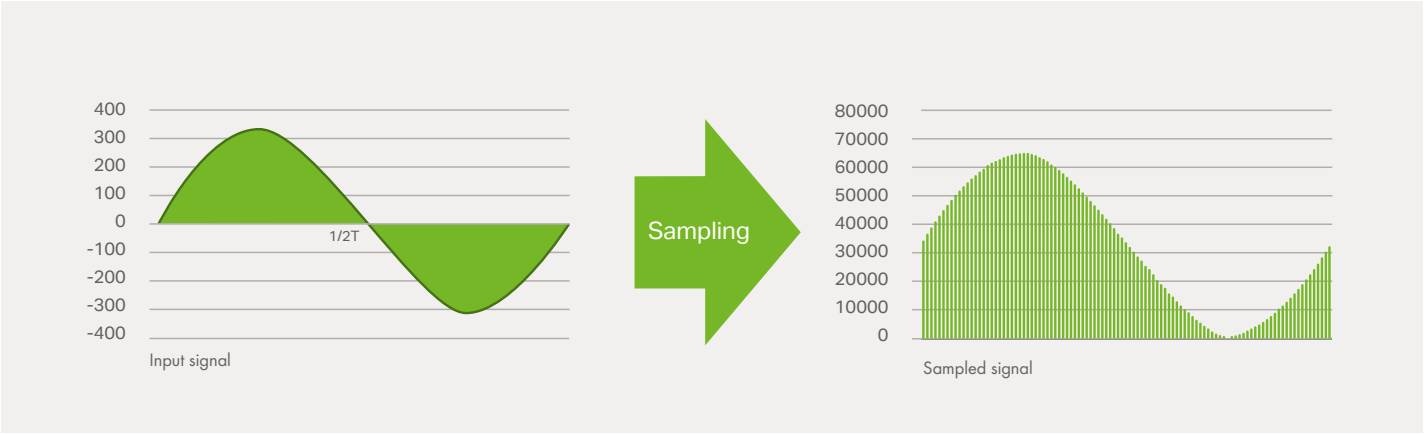
$$I_{rms} \approx \sqrt{\frac{1}{n}\sum_{i=1}^{n} x_i^2}$$

Mean Square Value

The mean square value – RMS (root-mean-square), also the TRMS (true root-mean-square) – is the square root of the quotient of the sum of squares for the measured values and number of measured values (square root of the average of the measured value).

In electrical engineering, the effective value of a periodic quantity corresponds to the effective value of the DC variable. It is characteristic of the power transformed in the consumer.

The RMS and TRMS terms are frequently differentiated. This is based on historical context, so that newer measuring procedures are preferred over form factor based methods. In principle, WAGO measures according to the TRMS method. However, no special differentiation is made, as both terms describe the same mathematical equation, and one merely indicates the specific accuracy of the measurement.



Digital Processing
During digital processing, the signal is sampled in defined, very short time intervals (digitized). The sampled values are processed and, e.g., converted into an analog standard signal.

Digital processes are becoming increasingly common, since high reproducibility and signal-authentic mapping can be guaranteed due to high sampling rates. In addition, further processing or transmission of the digitized information is easier, less susceptible to interference and more flexible, due to the software.

Analog Processing
During analog processing, the input signal is fed directly to a processing unit and prepared according to a fixed transfer function. The processing occurs using an operational amplifier (OpAmp) and a few passive components.

WE INNOVATE!

0888-0599/0204-6901 – MEASUREMENT TECHNOLOGY BROCHURE 2.4 US – 11/2016-00 – Printed in Germany – Subject to design changes

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