Smart Energy & Power Quality Solutions

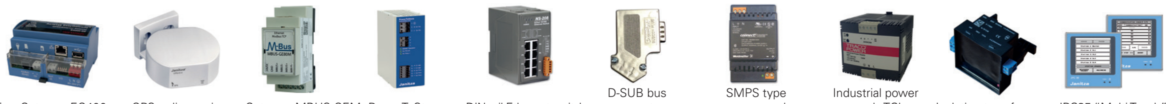
Catalogue 2017 | Issue July

POWER – SIMPLY SAVE

3in1

- Energy management (according to DIN EN ISO 50001)
- Power quality monitoring and analysis
- Residual current monitoring (RCM)

Janitza®



Future with tradition – made in Germany

In the Hessian city of Lahnau between Wetzlar and Gießen we manufacture products that are always a little ahead of their time. For more than half a century now.

Eugen Janitza GmbH was founded in 1961 and in 1986 it brought an independent daughter into the word: Janitza electronics GmbH, with Markus Janitza as managing director. Just two years later Janitza presented the world's first electronic power factor controller with harmonic limit values and automatic step switching.

We introduce new technologies and combine existing applications to form convincing, intelligent products. This has brought us worldwide recognition. From class A power quality monitoring devices with EN-50160 analysis through to complete energy data management systems: We continuously set standards for the entire industry.

M. Janitza

Markus Janitza
Company founder and managing director

The most important thing first: The product portfolio

Your secure, sustainable and efficient handling of electrical energy is our top priority.

This is why we supply our energy measurement technology, class A power quality monitoring devices, GridVis® system software, energy data management systems, digital integrated measurement equipment, power factor power factor controllers, harmonics filters and correction systems throughout the world.

Our customers appreciate our complete system solutions for up-to-date energy data management (e.g ISO 50001) and power quality solutions. Thanks to the scalability of our products and solutions you can also introduce our energy data management system step-by-step.

We will support you from the development of the conceptual solution through to commissioning. We will also help you with the maintenance and support - and training your personnel for the secure operation of the energy systems.

For all your energy and PQ monitoring needs from a single source

Measurement technology under the microscope: Complete solutions for EnMS and PQMS

We offer you one of the most comprehensive ranges of energy and power quality measurement products in the world. With this we can tailor-make an individual solution to suit your requirements - and optimally match the software and hardware components to one another. Our measurement devices and components for measurement systems off all sizes have distinguished themselves in countless applications and installations. Our customers have been measuring and managing their electrical energy with Janitza for almost thirty years! Because we guarantee reliable, technical and commercially attractive solutions from a single source.

- Flexible and scalable system architecture
- Simple integration of non-communications capable meters via digital inputs
- Acquisition of all media with electrical power, gas, water or steam consumption
- Utilisation of your existing infrastructure – or our simple expandable system architecture (thanks to the master-slave concept)

With Janitza measurement technology you have everything from the same source -from current transformers through measurement devices, from communications devices through the IT environment and on to databases and analysis software.

From planning to commissioning

After we have developed your technical solution, executed it and commissioned it, we continue to support you further:

Data analysis	Analyse measurement data
Maintenance	Maintenance and support of the systems
Trainings	Regular training for safe handling of the energy management system, Power quality as well as our products and system solutions

Global projects and local support

In over 60 countries throughout the world we provide on-site support to our local partners.
Global projects in all important market segments verify our market leading position.

1) Germany, European central bank – Building automation and data centre applications
2) Turkey, Bosch and Siemens domestic appliances – Industry
3) Hungary, Palace of the Arts – Building market
4) Singapore, Garden of the Bay – Infrastructure
5) Germany – Automotive industry
6) Switzerland, Laax ski arena
7) Austria, Hotel Petersboden – Building market
8) New Zealand, Otago university – Building market

Quality management and certification

- All our energy data management systems fulfil ISO 50001 – as a basis for efficient use of energy.

- In addition, our "GridVis®" software for energy management systems is also TÜV approved.

- In order to guarantee secure communication with our measurement devices (UMGs), they are tested and certified by independent institutes (also for the most diverse protocols such as Profibus, Modbus or BACnet).

- The PQM standard IEC 61000-4-30 is fulfilled by all of our corresponding class A devices; these are some of the most innovative, compact and competitive devices on the market.

  We want to systematically plan, implement, coordinate and monitor our quality.

  For that reason we have used a documented management system for many years and this is constantly undergoing further development and improvement.

  With this we fulfil the requirements for a quality management system per DIN EN ISO 9001.

To be able to guarantee your reliable energy supply, the power quality (PQ) is of the utmost importance. Various different standards around the world define different aspects of the "Power quality". We help you to monitor your power quality on an almost worldwide scale:

- With our products and solutions you can monitor the power quality per standards EN 50160, EN 610002-4, IEEE519 or ITIC / CBEMA.

- Our GridVis® system software enables you to create PQ reports in accordance with freely-defined time schedules. Thus you have your energy supply automatically within sight and can identify any need for correction in good time.

- We offer country-specific certification such as UL, in particular for the North American market, but also for the regions of China and Russia (e.g. Ghost).

Everything is possible: Open communication architecture

Thanks to our open communications architecture with numerous interfaces and protocols - Modbus, Profibus, M-Bus, Ethernet, BACnet etc.:

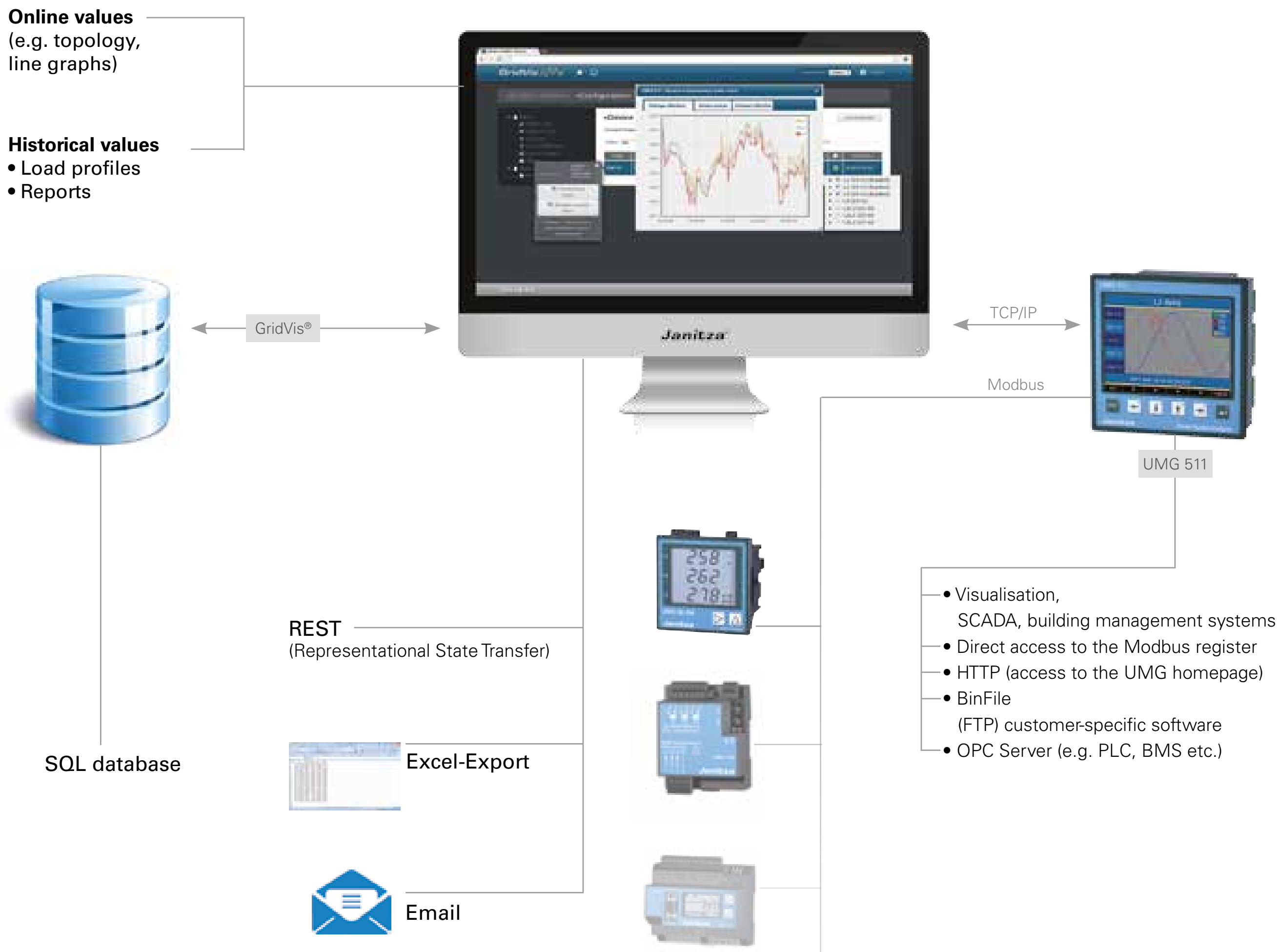
- We can secure every kind of system tie-in (energy management systems, PLC, SCADA, BMS (centralised building control system).
- We simplify the connection considerably. You can therefore access the Modbus addresses directly, e.g. with PLC, BMS or SCADA software. Or, the UMGs can be incorporated into a PLC environment via Profibus.

Measurement data is automatically read out via a field bus and is then available on a central data server for further use in your WEB application.

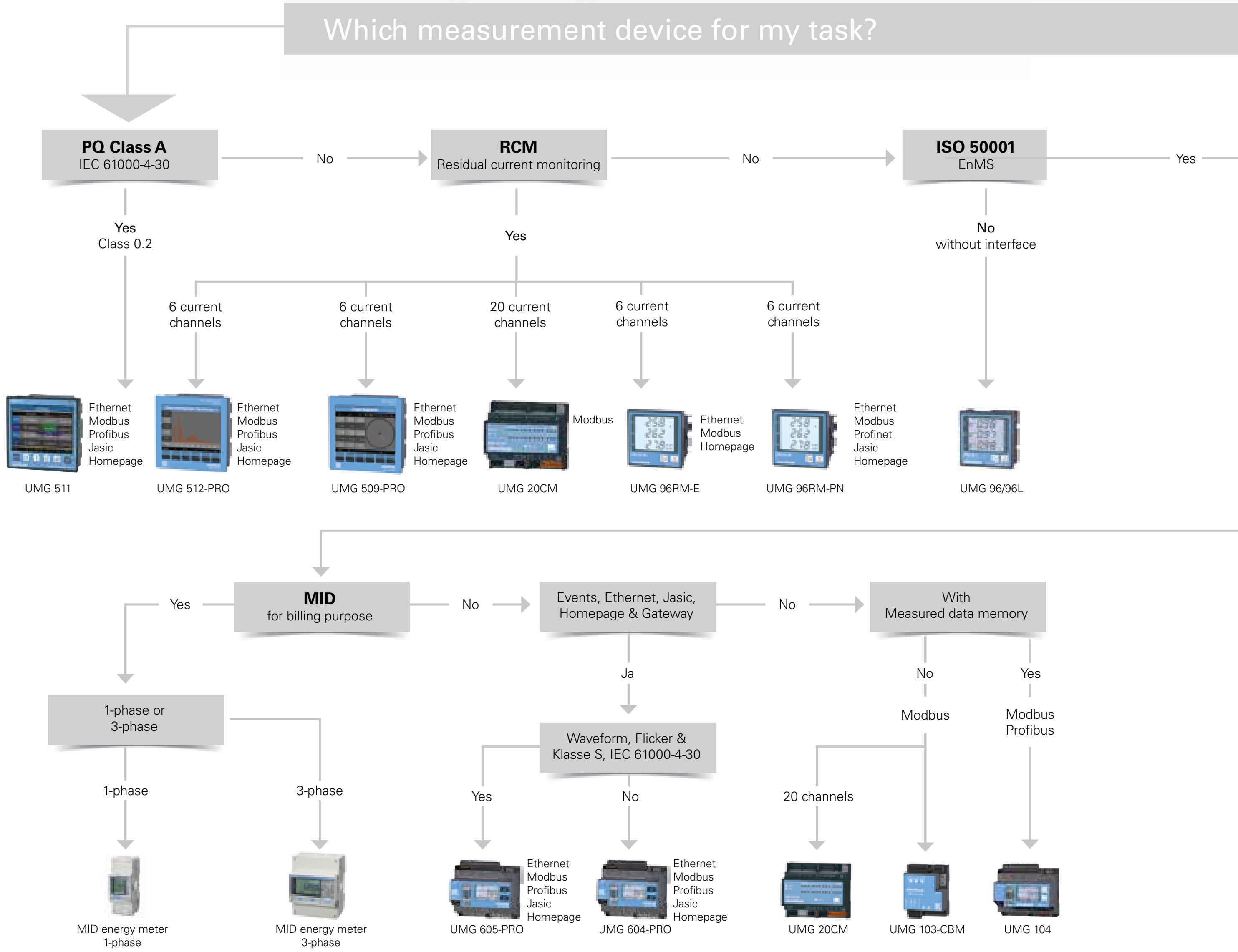
To keep installation costs low (e.g. peripherals for field buses), we use Ethernet TCP/IP more and more frequently as the backbone of the data communication. Because the connection to an existing Ethernet architecture most often guarantees the fastest, cost-optimised and most reliable communication.

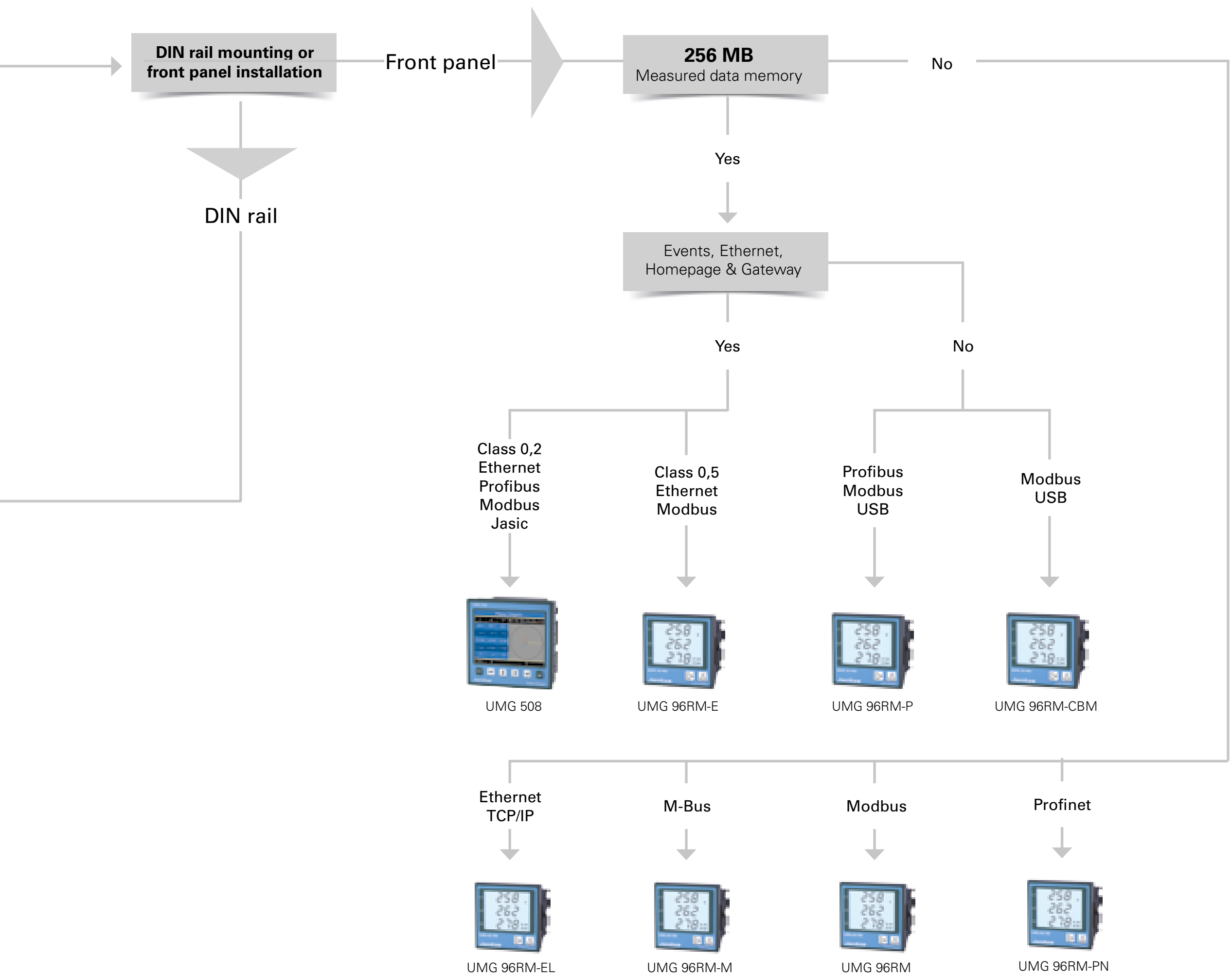
In building automation in particular we use enhanced BACnet. This manufacturer-independent data transfer protocol - for "open communication" with the control and regulation equipment - connects devices in various systems from different manufacturers.

Whilst other manufacturers would like to shackle their customers to themselves with proprietary systems, we would rather impress with quality and use open systems.



UMG selection assistance

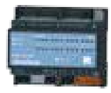
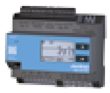
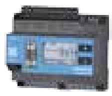



DIN rail mounting or front panel installation
Front panel
DIN rail
256 MB
Measured data memory
No
Yes
Events, Ethernet, Homepage & Gateway
Yes
No
Class 0,2
Ethernet
Profibus
Modbus
Jasic
Class 0,5
Ethernet
Modbus
Profibus
Modbus
USB
Modbus
USB
UMG 508
UMG 96RM-E
UMG 96RM-P
UMG 96RM-CBM
Ethernet
TCP/IP
M-Bus
Modbus
Profinet
UMG 96RM-EL
UMG 96RM-M
UMG 96RM
UMG 96RM-PN

02 Energy and power quality measurement products

Energy and power quality measurement products




Type	UMG 103-CBM	UMG 104		UMG 20CM	UMG 604-PRO		UMG 605-PRO	UMG 96L
			P		E	EP		
Item number	52.28.001	52.20.201	52.20.202	14.01.625	52.16.202	52.16.201	52.16.227	52.14.001
Network voltages								
Rated voltage L-N, AC	277 V	277 V		277 V	277 V		277 V	255 V*2
Rated voltage L-L, AC	480 V	480 V		480 V	480 V		480 V	442 V*2
Overvoltage category	300 V CAT III	300 V CAT III		300 V CAT III	300 V CAT III		300 V CAT III	300 V CAT III
Operating voltage L-N, AC	115 – 277 V	-		-	-		-	196 – 255 V*4
Power supply voltage	-	95 – 240 V AC; 135 – 340 V DC*1		90 – 264 V AC; 120 – 350 V DC	95 – 240 V AC; 135 – 340 V DC*1		95 – 240 V AC; 135 – 340 V DC*1	-
Three wire / four wire (L-N, L-L)	- / •	• / •		- / •	• / •		• / •	- / •
Quadrants	4	4		4	4		4	4*3
Sampling frequency 50/60 Hz Measurement points per second	5,4 kHz 5.400	20 kHz 20.000		20 kHz 20.000	20 kHz 20.000		20 kHz 20.000	2,5 / 3 kHz 50
Uninterrupted measurement	•	•		•	•		•	-
Measurement results per second	5	5		2	5		5	1
Effective value from periods (50 / 60 Hz)	10 / 12	10 / 12		10 / 12	10 / 12		10 / 12	1 / 1
Residual current measurement	-	-		•	-		-	-
Harmonics V/A	1. – 25.	1. – 40.		1. – 63.	1. – 40.		1. – 63.	-
Distortion factor THD-U in %	•	•		•	•		•	-
Distortion factor THD-I in %	•	•		•	•		•	-
Unbalance	-	•		-	•		•	-
Positive / negative / zero sequence component	•	•		-	•		•	-
Present flicker strength	-	-		-	-		•	-
Short-/long-term flicker	-	-		-	-		•	-
Transients	-	-		-	50 µs		50 µs	-
Short-term interruptions, events	-	-		-	•		•	-
Accuracy V / A	0.2 %	0.2 % / 0.25 %		1 %	0.2 % / 0.25 %		0.2 % / 0.25 %	1 %
Effective power class	0,5S (.../5 A)	0,5S (.../5 A)		1	0,5S (.../5 A) / 1 (.../1 A)		0,5S (.../5 A)	2
Operating hours counter	•	•		-	•		•	•
Weekly timer	-	-		-	Jasic®		Jasic®	-
Digital inputs	-	2		-	2		2	-
Digital / pulse output	-	2		2	2		2	-
Current measurement channel	3	4		20	4		4	3
Temperature input	-	1		-	1		1	-
Integrated logic	-	Vergleicher		-	Jasic® (7 Prg.)		Jasic® (7 Prg.)	-
Minimum and maximum values for memory	•	•		•	•		•	•
Memory size for onboard recording	4 MB Flash	4 MB Flash		768 kB	128 MB Flash		128 MB Flash	-
Number of memory values	160 k	156 k		250 k	5.000 k		5.000 k	-
Clock	•	•		•	•		•	-
Bi-metallic function	•	•		-	•		•	•
Error / event recorder function	-	-		-	•		•	-
Peak demand management	-	-		-	•*2		•*2	-
Software for energy management & power quality analysis	GridVis®-Basic	GridVis®-Basic		GridVis®-Basic	GridVis®-Basic		GridVis®-Basic	-
Interfaces								
RS232	-	•	•	-	•		•	-
RS485	•	•	•	•	•		•	-
USB	-	-	-	-	-		-	-
Profibus DP	-	-	•	-	-	•	•	-
M-Bus	-	-	-	-	-		-	-
Ethernet	-	-	-	-	•		•	-
Webserver / email	-	-	-	-	• / •		• / •	-
Protocols								
Modbus RTU	•	•	•	•	•		•	-
Modbus-Gateway	-	-	-	-	•		•	-
Profibus DP V0	-	-	•	-	-	•	•	-
Modbus TCP/IP, Modbus RTU over Ethernet, SNMP	-	-	-	-	•		•	-
BACnet (optional)	-	-	-	-	•*2		•*2	-
Profinet	-	-	-	-	-		-	-
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Comment: For detailed technical information please refer to the respective operation manual and the Modbus address list.

• : Included - : Not included

*1 Other voltages are also available as options
*2 Option
*3 Not for effective energy and reactive energy
*4 In the 230 V version

UMG 96	UMG 96RM						UMG 96RM-PN	UMG 508	UMG 509-PRO	UMG 511	UMG 512-PRO
		P	M	E	CBM	EL					
52.09.001	52.22.061	52.22.064	52.22.069	52.22.062	52.22.066	52.22.068	52.22.090	52.21.001	52.26.001	52.19.001	52.17.011
275 V*2	277 V						277 V	417 V	417 V	417 V	347 V
476 V*2	480 V						480 V	720 V	720 V (3-Leiter 600 V)	720 V	600 V
300 V CAT III	300 V CAT III						300 V CAT III	600 V CAT III	600 V CAT III	600 V CAT III	600 V CAT III
196 – 275 V*2	-						-	-	-	-	-
-	90 – 277 V AC; 90 – 250 V DC						90 – 277 V AC; 90 – 250 V DC	95 – 240 V AC; 80 – 280 V DC*1	95 – 240 V AC; 80 – 300 V DC*1	95 – 240 V AC; 80 – 340 V DC*1	95 – 240 V AC; 80 – 300 V DC*1
- / •	• / •						• / •	• / •	• / •	• / •	• / •
4*3	4						4	4	4	4	4
2,5 / 3 kHz 50	21,33 / 25,6 kHz 21.330 / 25.600						21,33 / 25,6 kHz 21.330 / 25.600	20 kHz 20.000	20 kHz 20.000	20 kHz 20.000	25,6 kHz 25.600
-	•						•	•	•	•	•
1	5						5	5	5	5	5
1 / 1	10 / 12						10 / 12	10 / 12	10 / 12	10 / 12	10 / 12
-	-	-	-	•	-	-	•	-	•	-	•
-	1. – 40.						1. – 40.	1. – 40.	1. – 63.	1. – 63.	1. – 63.
-	•						•	•	•	•	•
-	•						•	•	•	•	•
-	-						-	•	•	•	•
-	•						•	•	•	•	•
-	-						-	-	-	•	•
-	-						-	-	-	•	•
-	-						-	50 µs	50 µs	50 µs	39 µs
-	-	-	-	•	-	-	-	•	•	•	•
1 %	0.2 % / 0.2 %						0.2 % / 0.2 %	0.1 % / 0.2 %	0.1 % / 0.2 %	0.1 % / 0.2 %	0.1 % / 0.1 %
2	0,5S (.../5 A)						0,5S (.../5 A) / 1 (.../1 A)	0,2S (.../5 A)	0,2S (.../5 A)	0,2S (.../5 A)	0,2S (.../5 A)
•	•						•	•	•	•	•
-	-						-	•	•	•	•
-	-	4	-	(3)*5	4	-	(3)*5	8	2	8	2
•	2	6	2	(5)*5	6	-	(5)*5 *8	5	2	5	2
3	3	4	3	4+2	4	3	4+2	4	4+2	4	4+2
-	-	-	-	2*6	-	-	2*6	-	1	-	1
Vergleicher	Vergleicher						Vergleicher	Jasic®	Jasic®	Jasic®	Jasic®
•	•						•	•	•	•	•
-	-	256 MB	-	256 MB	256 MB	-	-	256 MB	256 MB	256 MB	256 MB
-	-	10.000 k	-	10.000 k	10.000 k	-	-	10.000 k	10.000 k	10.000 k	10.000 k
-	-	•	-	•	•	-	-	•	•	•	•
•	•						•	•	•	•	•
-	-						-	•	•	•	•
-	-						-	•*2	-	•*2	-
-	GridVis®-Basic						GridVis®-Basic	GridVis®-Basic	GridVis®-Basic	GridVis®-Basic	GridVis®-Basic
-	-						-	-	-	-	-
-	•	•	-	•	•	-	•	•	•	•	•
-	-	•	-	-	•	-	-	-	-	-	-
-	-	•	-	-	-	-	-	•	•	•	•
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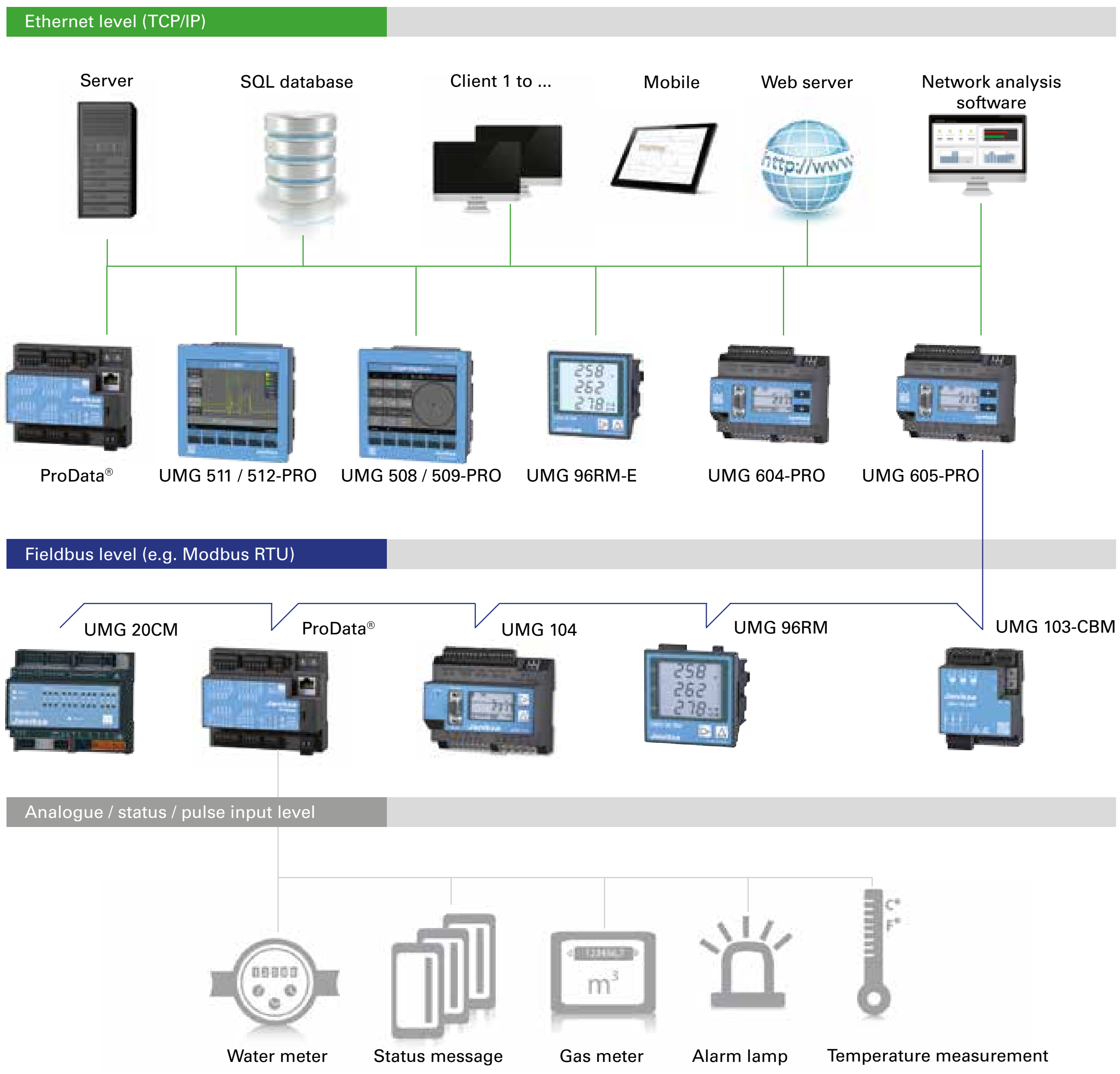
-	-	-	-	•	-	-	-	•	•	•	•
-	-	•	-	-	-	-	-	•	•	•	•
-	-	-	-	•	-	•*7	•*9	•	•	•	•
-	-	-	-	•*2	-	-	-	•*2	•*2	•*2	•*2
-	-	-	-	-	-	-	•	-	-	-	-
53	59						59	75	81	87	97

*5 Combination options for the inputs and outputs: a) 5 Digital outputs; b) 2 Digital outputs and 3 Digital inputs
*6 Combined function: Selectable analogue / temperature / residual current input
*7 No SNMP protocol
*8 2 pulse outputs
*9 SNMP only for internal Profinet communication



UMG 508 / UMG 509-PRO / UMG 604-PRO = Janitza power analyser

UMG 511 / UMG 512-PRO / UMG 605-PRO = Janitza power quality analyser

UMG 96RM / UMG 96RM-E / UMG 103-CBM / UMG 104 = Janitza multifunction energy meters

UMG 20CM = Janitza 20 channel branch circuit monitoring device, for residual current monitoring (RCM) and energy data acquisition

Harmonics

Modbus interface

GridVis®
Analysis software

Measurement accuracy 0.5

UMG 103-CBM – Universal measurement device for DIN rails

Communication
- Protocols: Modbus RTU / Slave

Interface
- RS485

Accuracy of measurement
- Energy: Class 0.5S (… / 5 A)
- Current: 0.5 %
- Voltage: 0.2 %

Power quality
- Harmonics up to 25th order, odd harmonics
- Distortion factor THD-U
- Distortion factor THD-I

Memory
- 4 MB

Networks
- TN, TT networks

Network visualisation software
- Free GridVis®-Basic

Areas of application

- Measurement and checking of electrical characteristics and energy consumption in energy distribution systems
- Cost centre management
- Threshold value monitoring, measured value transducer for building management systems or PLC
- Monitoring of harmonics

Main features

Power quality

- Harmonics analysis up to 25th harmonic, odd harmonics
- Distortion factor THD-U / THD-I
- Minimum and maximum values
- Measurement of positive, negative and zero sequence component

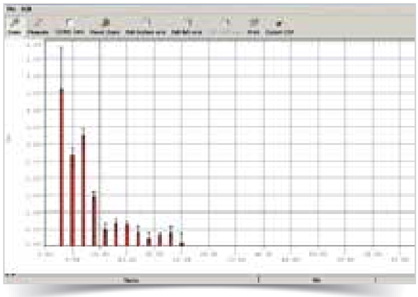


Fig.: GridVis® – Harmonics analysis (FFT)

Features

- 3 Voltage measurement inputs (300 V CATIII)
- 3 Current measurement inputs
- Continuous sampling of voltage and current measurement inputs
- Measurement of the reactive distortion power
- Sampling frequency 5.4 kHz
- Transfer of the measured values via a serial interface
- Supply voltage via measurement voltage L1-N, L2-N and L3-N

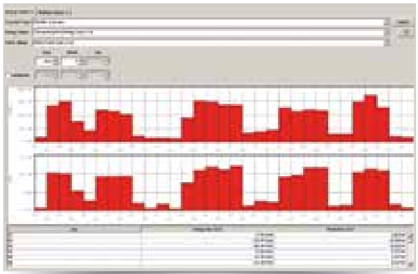
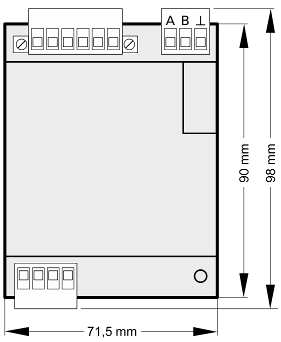


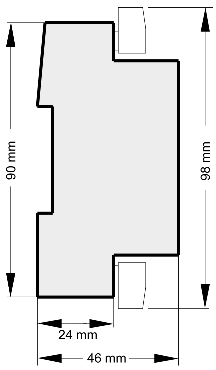
Fig.: GridVis® – Device dashboard with energy analysis

Dimension diagrams

All dimensions in mm

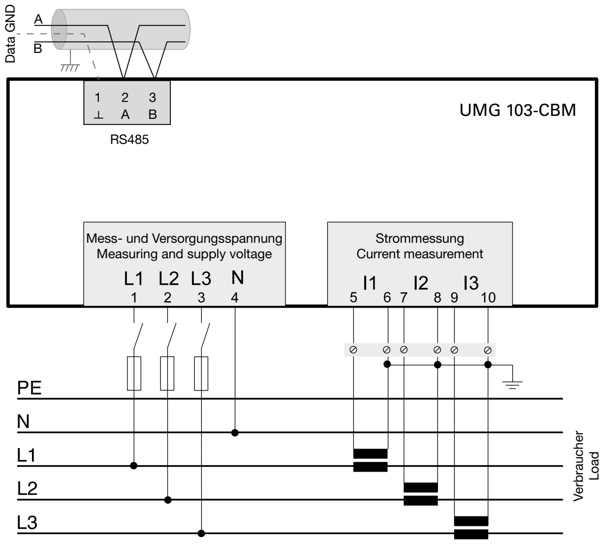


Front view



Side view

Typical connection



Device overview and technical data

	UMG 103-CBM
Item number	**52.28.001**
Measured voltage (L-N/L-L)	277 / 480 V AC
Operating voltage (from 3-phase network)	80 ... 277 V AC
General	
Use in low and medium voltage networks	•
Accuracy voltage measurement	0.2 %
Accuracy current measurement	0.5 %
Accuracy active energy (kWh, .../5 A)	Class 0.5S
Number of measurement points per period	108
Uninterrupted measurement	•
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power / total and per phase	•
Power factor / total and per phase	•
Energy measurement	
Active, reactive and apparent energy [L1,L2,L3, ∑ L1-L3]	•
Number of tariffs	4
Recording of the mean values	
Voltage, current / actual and maximum	•
Active, reactive and apparent power / actual and maximum	•
Frequency / actual and maximum	•
Demand calculation mode (bi-metallic function) / thermal	•

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

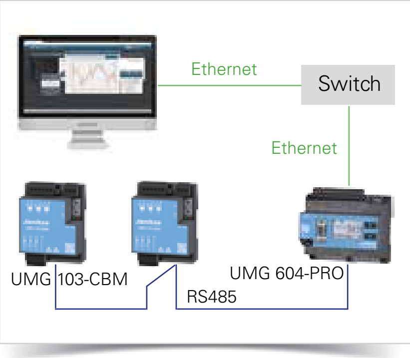


Fig.: Connection of multiple UMG 103-CBMs to a PC via a UMG 604-PRO (with Ethernet option)

	UMG 103-CBM
Other measurements	
Operating hours measurement	•
Power quality measurements	
Harmonics per order / current	1st – 25th
Harmonics per order / voltage	1st – 25th
Distortion factor THD-U in %	•
Distortion factor THD-I in %	•
Current and voltage, positive, zero and negative sequence component	•
Measured data recording	
Current measurement channels	3
Recording time	up to 144 days
Memory (Flash)	4 MB
Battery	BR1632 A
Clock	•
Online readout with GridVis®	•
Average, minimum, maximum values	•
Communication	
Interfaces	
RS485: Autobaud, 9.6 – 115.22 kbps (Screw-type terminal)	•
Protocols	
Modbus RTU	•
Software GridVis®-Basic*2	
Online graphs	•
Databases (Janitza DB, Derby DB)	•
Manual reports (energy, power quality)	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Programming / threshold values / alarm management	
Comparator (2 Groups with 3 comparators each)	•
Technical data	
Type of measurement	Constant true RMS up to 25th harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	277 / 480 V AC (+ 10%)
Measurement in quadrants	4
Networks	TN, TT
Measured voltage input	
Overvoltage category	300 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	80 ... 277 Vrms (± 10%)
Measured range, voltage L-L, AC (without potential transformer)	80 ... 480 Vrms (± 10%)
Resolution	0,01 V
Frequency measuring range	45 ... 65 Hz
Leistungsaufnahme	1,5 VA
Power consumption	4 kV
Sampling frequency	5,4 kHz / Phase
Measured current input	
Rated current	1 / 5 A
Resolution	0,1 mA
Measurement range	0,005 ... 6 Arms
Overvoltage category	300 V CAT III
Measurement surge voltage	2 kV
Power consumption	ca. 0,2 VA (Ri = 5 mOhm)
Overload for 1 sec.	60 A (sinusoidal)
Sampling frequency	5,4 kHz / Phase
Mechanical properties	
Weight	200 g
Device dimensions in mm (H x W x D)	approx. 98 x 71,5 x 46
Protection class per EN 60529	IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	35-mm-DIN rail
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	 0,08 bis 2,5 mm² 1,5 mm²

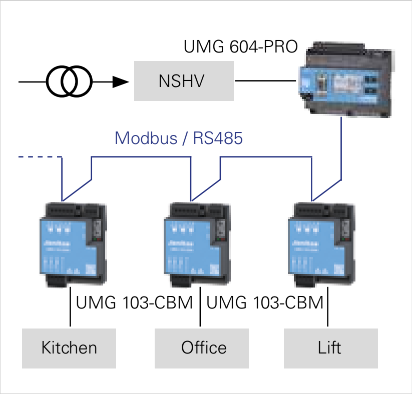


Fig.: Topology example UMG 604-PRO (Master) – UMG 103-CBM (Slave)

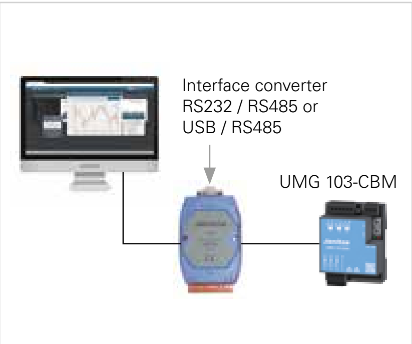


Fig.: Connection of a UMG 103-CBM to a PC via an interface converter

Environmental conditions	
Temperature range	Operation: K55 (-10 ... +55 °C)
Relative humidity	Operation: 5 to 95 % (at 25 °C)
Operating height	0 ... 2,000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class A: Residential environment	IEC/EN 61326-1
RFI Field Strength 30 – 1,000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Safety	
Europe	CE labelling
USA and Canada	UL variants available
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com

*[1] Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.

*[2] UMG 103-CBM UL certification requested

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

Typical application illustration with 2 supplies

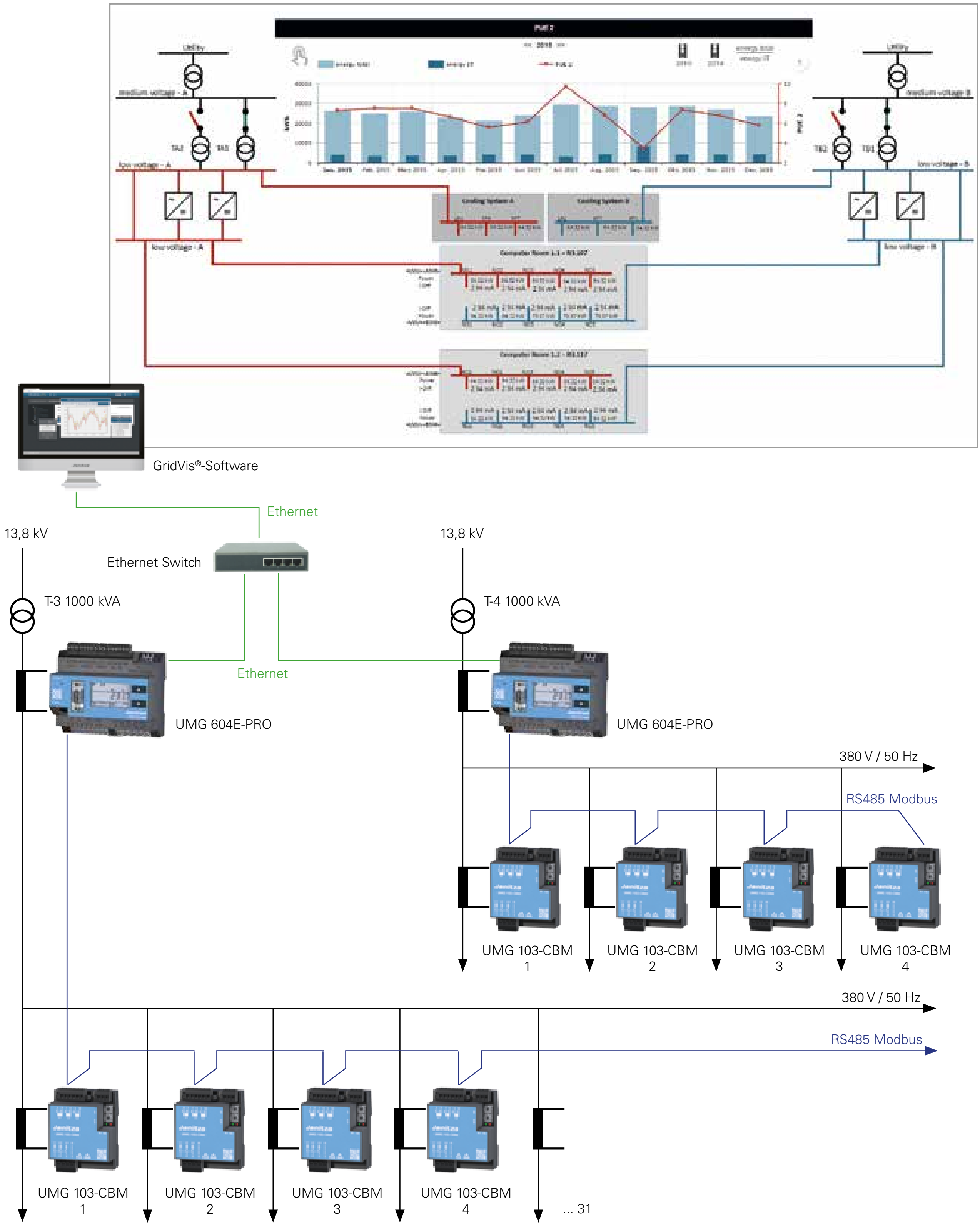


Fig.: Typical application illustration with 2 supplies, UMG 604-PRO as master measurement device in the main power supply and UMG 103-CBM for measuring the low voltage feeder.

Harmonics

Measurement accuracy 0.5

Temperature input

Memory 4 MByte

UMG 104 – Energy measurement device for DIN rails

Communication
- Profibus (DP / V0 – optional)
- Modbus RTU

Interfaces
- RS232
- RS485

Accuracy of measurement
- Energy: Class 0.5S (… / 5 A)
- Current: 0.2 %
- Voltage: 0.2 %

Power quality
- Harmonics up to 40th harmonic
- Unbalance, rotary field indication
- Distortion factor THD-U / THD-I

Networks
- IT, TN, TT networks
- 3 and 4-phase networks
- Up to 4 single-phase networks

Temperature measurement
- PT100, PT1000, KTY83, KTY84

Network visualisation software
- Free GridVis®-Basic

2 digital inputs
- Pulse input
- Signalling input logic
- State monitoring

2 digital outputs
- Pulse output kWh / kvarh
- Switch output
- Threshold value output
- Logic output

Measured data memory
- 4 MByte Flash (156,000 measured values)

Areas of application

- Consumption data acquisition and evaluation (load profiles, load curves)
- Continuous power quality monitoring
- Cost centre accounting of energy costs
- Network protection
- Measured value transducer for building management systems or PLC

Main features

Power quality

- Harmonics analysis up to 40th harmonic
- Unbalance
- Rotary field indication
- Distortion factor THD-U / THD-I
- Measurement of positive, negative and zero sequence component

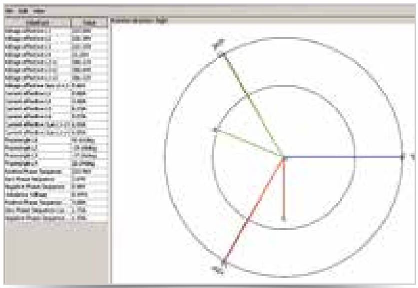


Fig.: GridVis® – Phasor diagram

High-speed Modbus

- Fast and reliable data exchange via RS485 interface
- Speed up to 921.6 kB/s

Secure and rapid communication via Modbus and Profibus

- Rapid, cost-optimised and reliable communication in existing Fieldbus architectures
- Integration in PLC systems and building management systems
- High flexibility due to the use of open standards

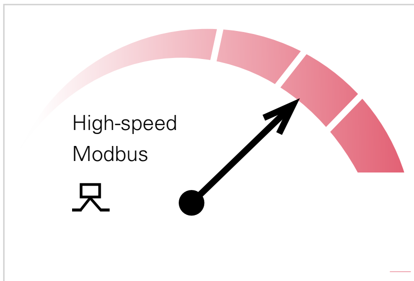


Fig.: High-speed Modbus

Large measurement data memory

- 4 MByte
- 156,000 saved values
- Recording range dependent on the user-defined measurement data memory configuration over a few months
- Recording freely configurable

Added value through additional functions

The UMG 104 goes far beyond the limits of digital multifunction measurement devices thanks to the integration of additional functions:

- Multifunction measurement device
- State monitoring
- Data logger
- Meters (kWh, kvarh)
- Temperature monitoring
- Harmonics analyser

Due to the four current and voltage inputs there are also particular advantages with the monitoring of up to four single-phase outputs, e.g. in data centres, offices or single-phase motor outputs.

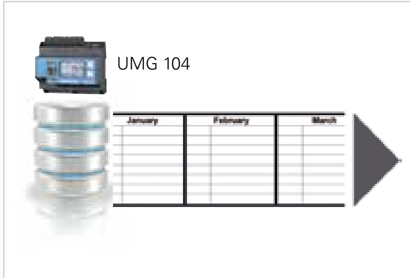
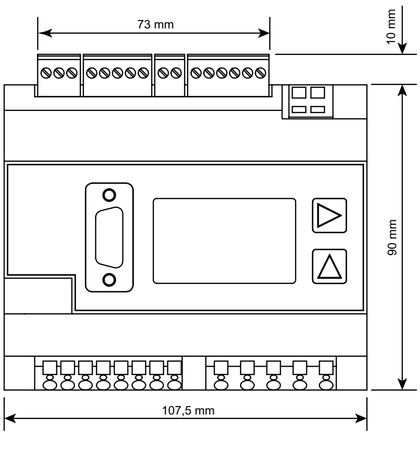


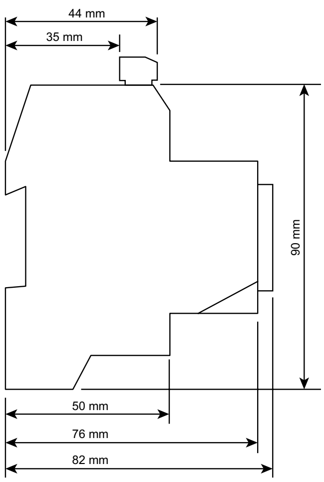
Fig.: Large measurement data memory

Dimension diagrams

All dimensions in mm

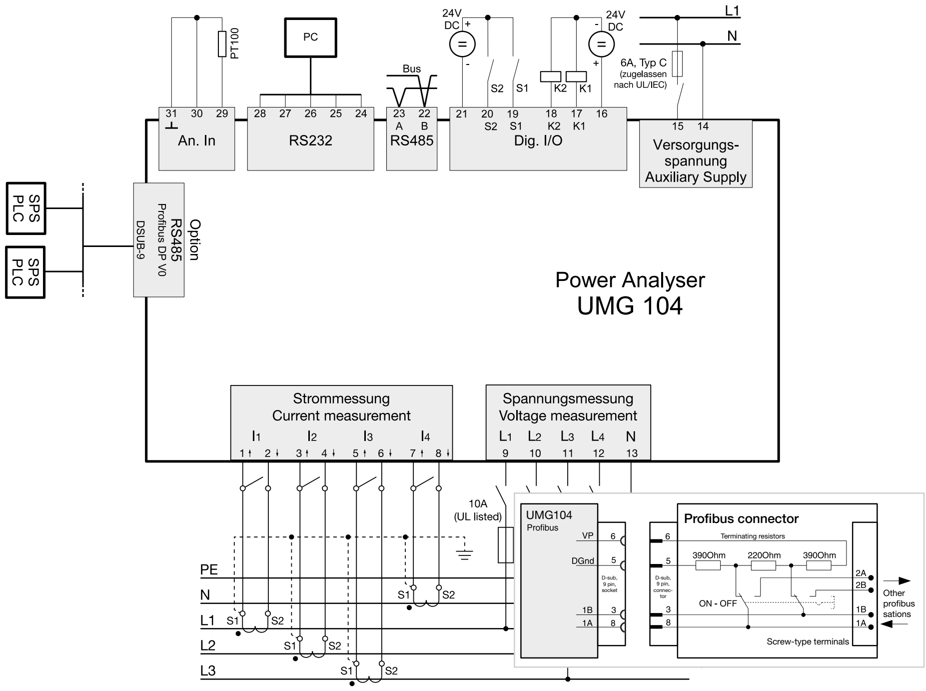


Front view



Side view

Typical connection



Device overview and technical data

	UMG 104			UMG 104P
Item number	52.20.003			
Item number (UL)	52.20.201	-	52.20.205	52.20.202
Supply voltage AC	95 ... 240 V AC	50 ... 110 V AC	20 ... 50 V AC	95 ... 240 V AC
Supply voltage DC	135 ... 340 V DC	50 ... 155 V DC	20 ... 70 V DC	135 ... 340 V DC
Communication				
Interfaces				
RS485: 9.6 – 921.6 kbps (Screw-type terminal)	•	•	•	•
RS232: 9.6 – 115.2 kbps (Screw-type terminal)	•	•	•	•
Profibus DP: Up to 12 Mbps (DSUB-9-socket)	-	-	-	•

General	
Use in low and medium voltage networks	•
Accuracy voltage measurement	0.2 %
Accuracy current measurement	0.25 %
Accuracy active energy (kWh, .../5 A)	Class 0.5S
Number of measurement points per period	400
Uninterrupted measurement	•
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power / total and per phase	•
Power factor / total and per phase	•

Comment: For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

An RS232 connecting cable is not included in the delivery and must be ordered separately as item no. 08.02.427.

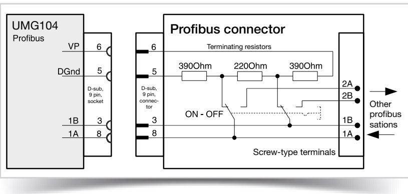


Fig.: Profibus connector, contact allocation

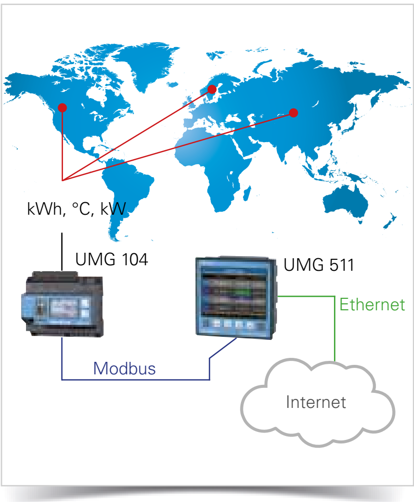


Fig.: Word-wide remote monitoring of the energy consumption and temperature for various different locations

Comment: For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

*1 Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.

Energy measurement	
Active, reactive and apparent energy [L1,L2,L3, L4, ∑ L1–L3, ∑ L1–L4]	•
Recording of the mean values	
Voltage, current / actual and maximum	•
Active, reactive and apparent power / actual and maximum	•
Frequency / actual and maximum	•
Demand calculation mode (bi-metallic function) / thermal	•
Other measurements	
Clock	•
Power quality measurements	
Harmonics per order / current and voltage	1st – 40th
Harmonics per order / active and reactive power	1st – 40th
Distortion factor THD-U in %	•
Distortion factor THD-I in %	•
Voltage unbalance	•
Rotary field indication	•
Current and voltage, positive, zero and negative sequence component	•
Measured data recording	
Memory (Flash)	4 MB
Average, minimum, maximum values	•
Measured data channels	4
Alarm messages	•
Time stamp	•
Time basis average value	freely user-defined
RMS averaging, arithmetic	•
Displays and inputs / outputs	
LCD display	•
Digital inputs	2
Digital outputs (as switch or pulse output)	2
Thermistor input (PT100, PT1000, KTY83, KTY84)	•
Voltage and current inputs	every 4
Password protection	•
Communication	
Protocols	
Modbus RTU	• / •
Profibus DP V0	- / •
Software GridVis®-Basic*1	
Online graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports (energy, power quality)	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Programming / threshold values / alarm management	
Comparator (2 Groups with 4 comparators each)	•
Technical data	
Type of measurement	Constant true RMS Up to 40th harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	277 / 480 V AC
Nominal voltage, three-phase, 3-conductor (L-L)	480 V AC
Measurement in quadrants	4
Networks	TN, TT, IT
Measurement in single-phase / multi-phase networks	1 ph, 2 ph, 3 ph, 4 ph and up to 4 times 1 ph
Measured voltage input	
Overvoltage category	300 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	10 ... 600 Vrms
Measured range, voltage L-L, AC (without potential transformer)	18 ... 1,000 Vrms
Resolution	0.01 V
Impedance	4 MOhm / phase
Frequency measuring range	45 ... 65 Hz
Power consumption	approx. 0.1 VA
Sampling frequency	20 kHz / phase

Measured current input	
Rated current	1 / 5 A
Resolution	1 mA
Measurement range	0.001 ... 8.5 Amps
Overvoltage category	300 V CAT III
Measurement surge voltage	4 kV
Power consumption	approx. 0.2 VA (Ri = 5 MOhm)
Overload for 1 sec.	100 A (sinusoidal)
Sampling frequency	20 kHz
Digital inputs and outputs	
Number of digital inputs	2
Maximum counting frequency	20 Hz
Input signal present	18 ... 28 V DC (typical 4 mA)
Input signal not present	0 ... 5 V DC, current < 0.5 mA
Number of digital outputs	2
Switching voltage	max. 60 V DC, 30 V AC
Switching current	max. 50 mA Eff AC / DC
Pulse output (energy pulse)	max. 20 Hz
Maximum cable length	up to 30 m unscreened, from 30 m screened
Mechanical properties	
Weight	350 g
Device dimensions in mm (H x W x D)	90 x 107.5 x approx. 82
Battery	Type Lithium CR2032, 3 V
Protection class per EN 60529	IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	35-mm DIN rail
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	 0.08 to 2.5 mm² 1.5 mm²
Environmental conditions	
Temperature range	Operation: K55 (-10 ... +55 °C)
Relative humidity	Operation: 5 to 95 % (at 25 °C)
Operating height	0 ... 2,000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class B: Residential environment	IEC/EN 61326-1
Radio disturbanc voltage strength 30 – 1000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Safety	
Europe	CE labelling
USA and Canada	UL variants available
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

RCM

Modbus

GridVis® Analysis software

Harmonics via analysis channel

Alarm management

20 current channels

UMG 20CM – 20 Channel Branch Circuit Monitoring Device with RCM

Interfaces / communication
- RS485
- Modbus RTU

Accuracy of measurement
- Active energy Class 1
- Current: 1 %
- Voltage: 1 %

NEW: Now available with memory
- 768 kB

Power quality
- Harmonics up to 63rd harmonic (analysis channel)
- Crest factor / total harmonic distortion
- Minimum and maximum values for currents with time stamp
- Threshold value for each current channel / limit value bit

- **20 Current measurement channels**
- True RMS measurement
- High sampling rate at 20 kHz
- Operating current and residual current monitoring (RCM)

2 digital outputs (open collector)
- Pulse output kWh / kvarh
- Relay / PLC inputs

Network visualisation software
- Free GridVis®-Basic

Areas of application

- Continuous acquisition of the operating currents
- Permanent residual current monitoring
- Messages in the event of the nominal current being exceeded
- Energy acquisition for complete current distribution
- Cost centre accounting
- Transparency of energy costs
- More effective use of IT infrastructure
- PDUs in data centres
- Increase of high availability power supply

Main features

RCM and energy measurement device in a single unit

- 20 current measurement channels +/- 0.5 %
- 3 voltage measurement channels +/- 0.5 %
- Internal RS485 interface (Modbus as Slave)
- 20 LEDs – One LED for each current channel (Green = o.k., Yellow = Warning; Red = Nominal current exceed)
- Measurement range of operation current with burden up to 63 A with closed or split core current transformers (standard measured values: V, A, kW, kVA, kVar, kWh)

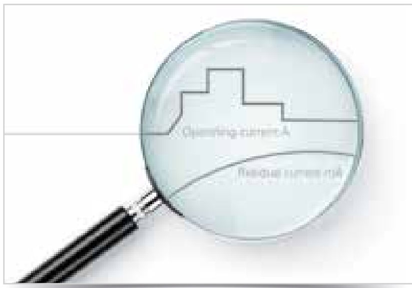


Fig.: Operating current and RCM fault current monitoring

The system for smart people

- Compact nature of the system
- Can be retrofitted to existing systems
- Modbus RTU directly on board
- State indication per channel (LEDs)
- Name stored per channel in the measurement device
- Polarity reversal for the current channels
- Memory function for the messages of the threshold monitoring
- Wide range power adapter (90 – 276 V ... AC / DC)
- Integration in the GridVis® software
- Diverse current transformer variants for the individual application
- Measurement variants:
  - Three-phase and single-phase energy measurement
  - RCM measurement three-phase and single-phase
- High sampling rate 20,000 Hz
- Current transformer connection monitoring (i.e. wire break will be detected)
- Harmonics analysis up to 63rd harmonic via analysis channel
- Saving of minimum and maximum values with time stamp
- Standard measured values: V, A, kW, kVA, kVar, kWh (variable list)
- Scalability of the system

The system

Power supply without drop-outs

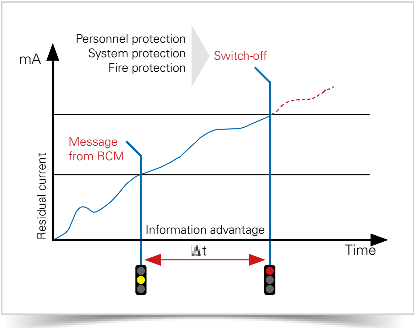


Fig.: Message before shut-down - an objective of residual current monitoring

- Permanent monitoring and logging of processes in TN-S or TN-C-S systems
- Simple parameterisation and operation of the RCM measurement
- Automatic reporting in the event of problems enables a rapid initiation of countermeasures
- Comprehensive diagnostics increase safety and efficiency of a company

Alarms before failures (preventative residual current analysis)

- Faults arising will be detected in good time
- Monitoring, evaluation and reporting of creeping increases in residual currents (e.g. triggered by insulation faults and operating currents for system parts or loads being too high)
- Reduction of downtimes

Sensors for energy management

- Energy data of a large number of loads can be acquired and passed to a database with ease
- Automatic reading out and saving of the measured values and data saved in the measurement devices as well as the exceedance of parameterised threshold values
- Channel-specific measured values of the current monitoring devices can be displayed via the GridVis® software
  - The progression of measured values is visualised graphically
  - Display of warnings or fault messages possible, e.g. via the topology views.
  - Associated message texts can be freely configured for this
  - Automatic sending of an email in the event of operational or fault messages
  - Remote monitoring of the entire system is possible via internet
  - Residual current and operational current monitoring devices can be parameterised via GridVis® (Modbus)
- The evaluation and saving of data in central databases is implemented via the GridVis® software
- The greater the scope of information, the more accurate the determination of savings potentials
- Energy optimisation offers a higher, more economical savings potential (ISO 50001)

Fig.: Read-out, analysis and saving of energy data

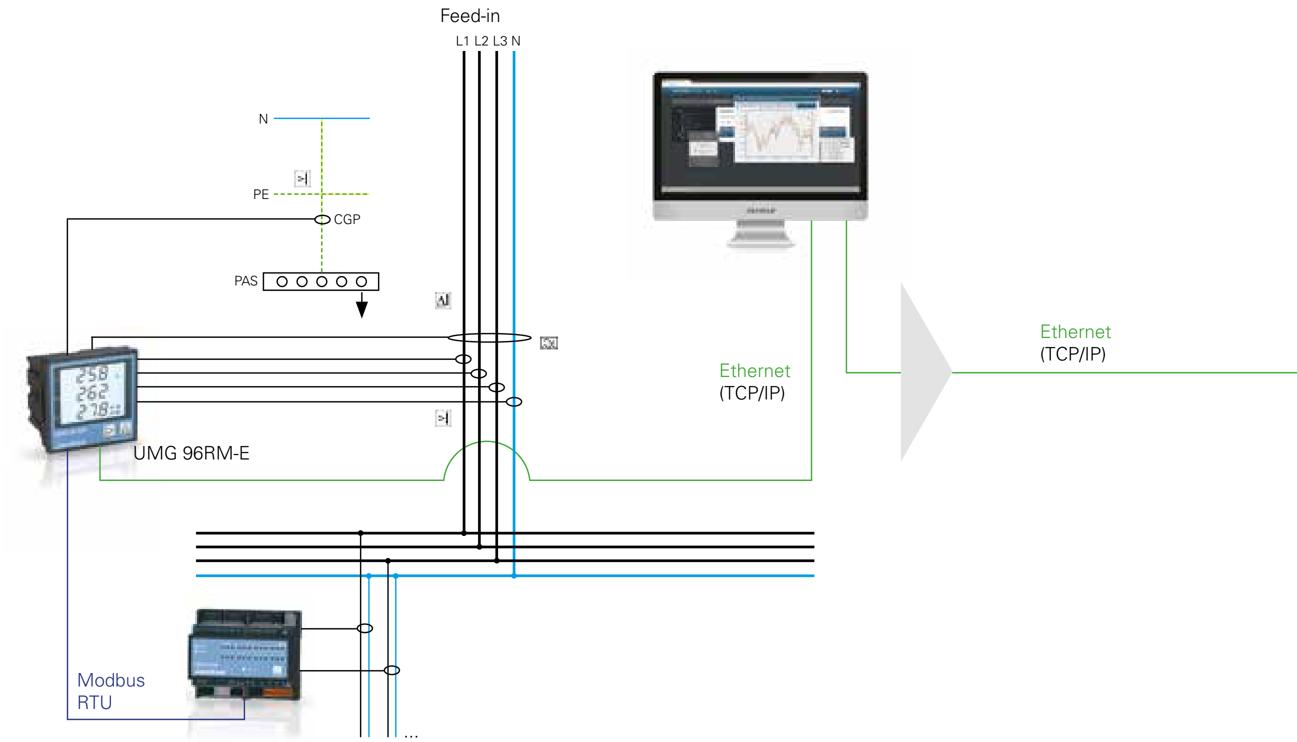


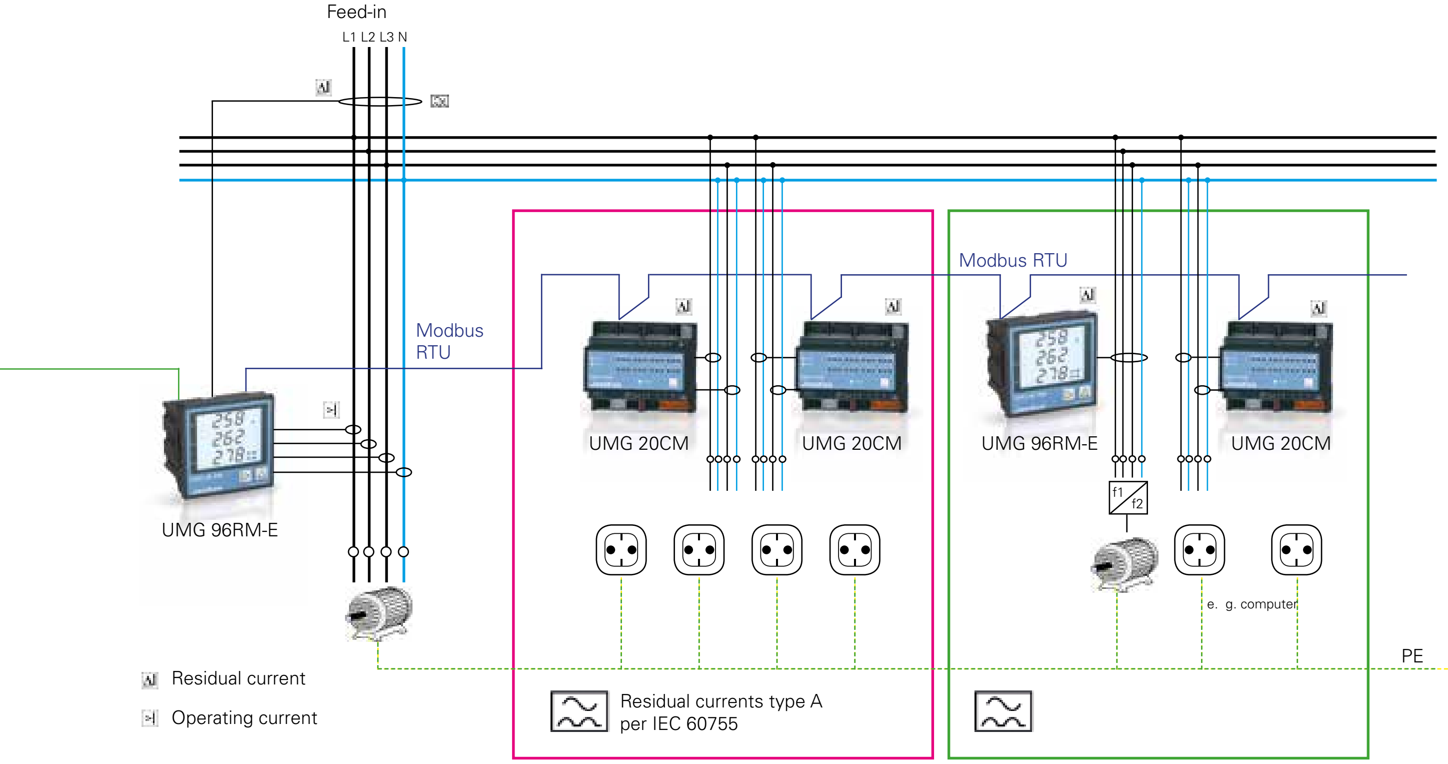
Fig.: The 20 channels of the UMG 20CM can be optionally used for residual current or operational current monitoring by utilising the corresponding current measurement transformer. In the case of residual current monitoring, the residual currents flowing to ground or any other path are acquired.

Your benefits

Fig.: Constant processes and highly sensitive applications such as data centres, are based on RCM monitoring.

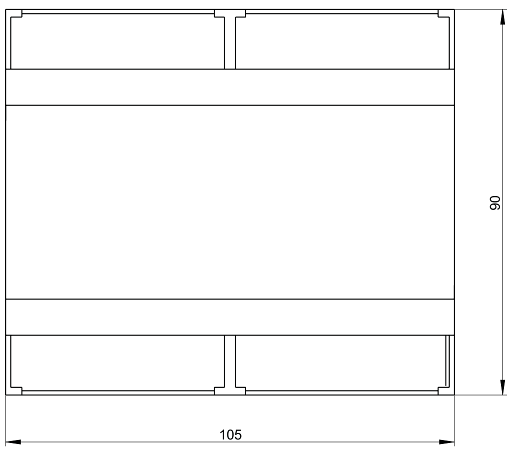
The intelligent system solution

- Early warning with system failures
- Avoidance of costly and hazardous system downtimes; the availability of systems is increased
- Localisation of individual faulty feeders, reduced work when troubleshooting
- Early detection of an overloading of the N conductor and critical residual currents, resulting in increased fire safety
- Through parameterisation of the system in new condition and constant monitoring, all changes to the system state after the point of commissioning can be detected
- Fulfilment of the safety criteria "RCM residual current monitoring" in data centres
- Convenient monitoring and parameterisation solution with GridVis® software
- Operating current acquisition of all relevant consumers as a basis for an energy management system (EnMS)

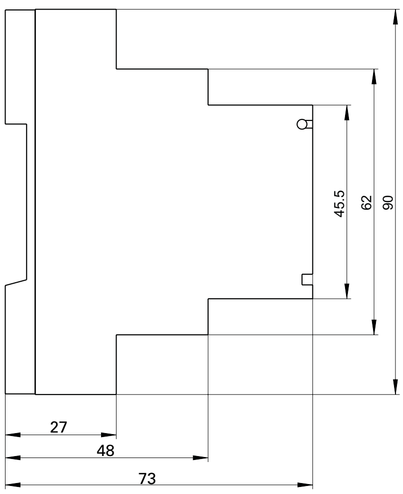


Dimension diagrams

All dimensions in mm

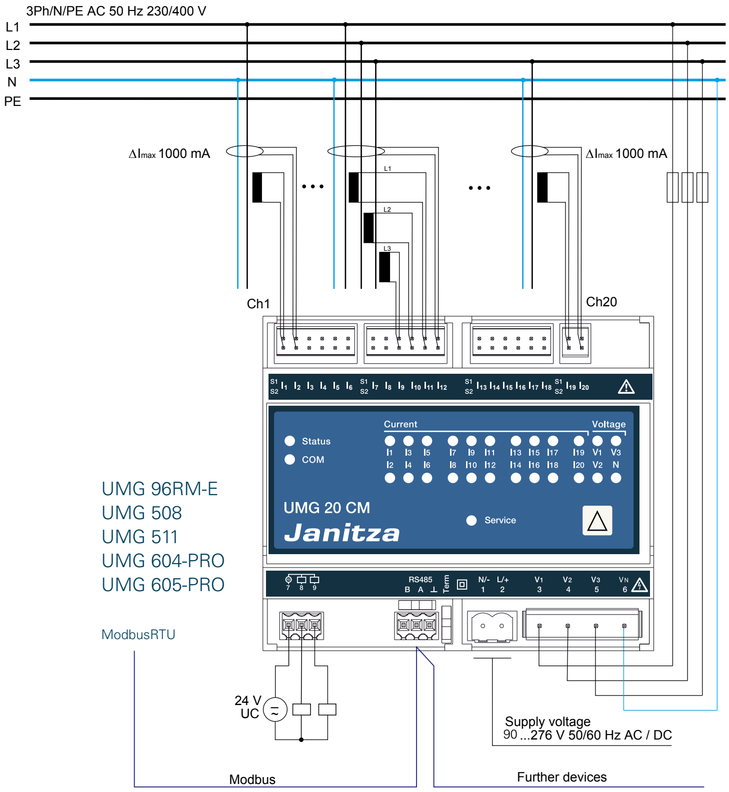


Front view



Side view

Typical connection



Recommendation: The bus should not contain more than 10 devices, type UMG 20CM if several UMG 20CM measuring channels are used. If the APP "20CM-Webmonitor" is used, the number is limited to 5 devices due to the APP management).

Device overview and technical data

	UMG 20CM
Item number	**14.01.625**
Power supply voltage	90 ... 264 V AC / 120 ... 350 V DC
General	
Use in low and medium voltage networks	•
Accuracy voltage measurement	1 %
Accuracy current measurement	1 %
Accuracy active energy (kWh)	Class 1
Number of measurement points per period	400
Uninterrupted measurement	•
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power for each of the 20 current inputs	•
Power factor for each of the 20 current inputs	•
Energy measurement	
Active energy (for each of the 20 current inputs, + 7 aggregating channels)	•
Recording of the mean values	
Current / present, minimum and maximum	•
Active power / present, minimum and maximum	•
Frequency / present	•
Aggregating channels	7

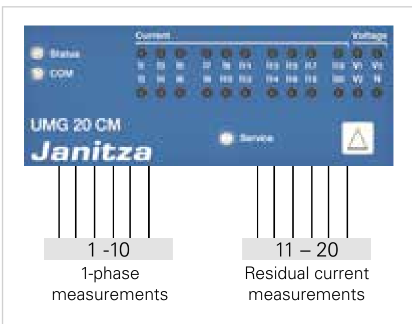


Fig.: 10 single-phase operational current measurements,
10 single-phase residual current measurements,

Comment: For detailed technical information please refer to the operation manual and the Modbus address list.

• = included   - = not included

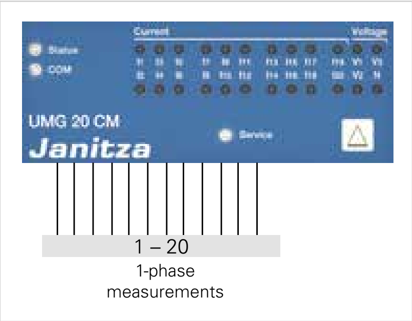


Fig.: 20 single-phase operating current or RCM measurements

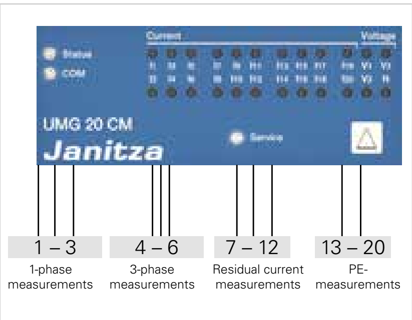


Fig.: 3 single-phase operational current measurements,
1 three-phase operational current measurement,
6 single-phase residual current measurements,
8 single-phase PE measurements

RCM measurement	
Residual current monitoring for all 20 channels (selectable)	•
Current transformer connection monitoring (i.e. wire break will be detected)	•
Power quality measurements	
Harmonics per order / current and voltage (absolute and in %)	1st – 63rd
Distortion factor THD-I in %	•
Under and overcurrent recording	•
Crest factor	•
Measured data recording	
Memory (Flash)	768 kB
Minimum, maximum values	•
Measured data channels	24
Alarm messages	•
Time stamp	•
Displays and inputs / outputs	
LCD display	-
LEDs (3 states each)	27
Digital outputs (as switch or pulse output)	2
Voltage measurement inputs	L1, L2, L3 + N
Current measurement inputs	20
Communication	
Interfaces	
RS485: 9.6 – 115.2 kbps (Screw-type terminal)	•
Protocols	
Modbus RTU (Slave)	•
Software GridVis®-Basic*¹	
Online and historic graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports (energy, power quality)	•
Graphical programming	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Technical data	
Type of measurement	Constant true RMS up to the 63rd harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	230 / 400 V AC
Measurement in quadrants	4
Networks	TN, TT, IT
Measurement in single-phase / multi-phase networks	1 ph, 2 ph, 3 ph, 4 ph and up to 20 times 1 ph
Measured voltage input	
Overvoltage category	300 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	10 ... 300 Vrms
Measured range, voltage L-L, AC (without potential transformer)	18 ... 480 Vrms
Resolution	0.1 V
Impedance	1.3 MOhm / phase
Frequency measuring range	45 ... 65 Hz
Sampling frequency	20 kHz / phase
Measured current input	
Evaluation range of the operating current	0 ... 600 A
Evaluation range of the residual current	10 mA ... 15 A
Resolution	1 mA
Digital inputs and outputs	
Number of digital outputs	2
Switching voltage	max. 60 V DC, 30 V AC
Maximum current	350 mA
Switch-on resistance	2 Ohm
Maximum cable length	up to 30 m unscreened, from 30 m screened

Comment: For detailed technical information please refer to the operation manual and the Modbus address list.

• = included   - = not included

*¹ Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.

Mechanical properties	
Weight	270 g
Device dimensions in mm (H x W x D)	90 x 105 x approx. 73
Protection class per EN 60529	IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	35-mm DIN rail
Environmental conditions	
Temperature range	Operation: K55 (-10 ... +55 °C)
Relative humidity	Operation: 5 to 95 % (at 25 °C)
Operating height	0 ... 2,000 m above sea level
Degree of pollution	3
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Class A: Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class B: Residential environment	IEC/EN 61326-1
RFI Field Strength 30 – 1,000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Safety	
Europe	CE labelling
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com

Fig.: Residual current transformer for the acquisition of residual currents. Different configurations and sizes allow use in almost all applications (see chapter 06, current / voltage transformers and sensors).

Comment: For detailed technical information please refer to the operation manual and the Modbus address list.
Recommendation: The bus should not contain more than 10 devices, type UMG 20CM if several UMG 20CM measuring channels are used. If the APP "20CM-Webmonitor" is used, the number is limited to 5 devices due to the APP management).

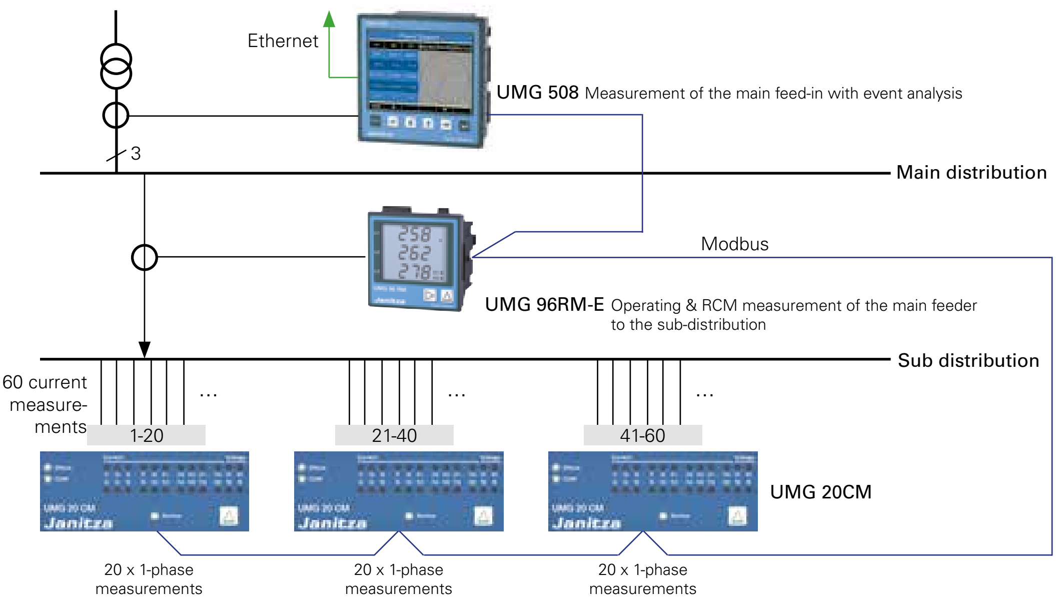


Fig.: Extremely compact solution for complete monitoring via three levels with leading-edge master-slave communication architecture

UMG 604-PRO – Power analyser

Communication
- Profibus (DP/ V0)
- Modbus (RTU, UDP, TCP, Gateway)
- TCP/IP
- BACnet (optional)
- HTTP (configurable homepage)
- FTP (file transfer)
- SNMP
- TFTP
- NTP (time synchronisation)
- SMTP (email function)
- DHCP

Interfaces
- Ethernet
- RS232
- RS485

Accuracy of measurement
- Energy: Class 0.5S (… / 5 A)
- Current: 0.2 %
- Voltage: 0.2 %

Peak demand management (optional)
- Up to 64 switch-off stages

Power quality
- Harmonics up to 40th harmonic
- Short-term interruptions (> 20 ms)
- Transient recorder (> 50 μs)
- Starting currents (> 20 ms)
- Unbalance
- Full wave effective value recording (up to 4.5 min.)

Networks
- IT, TN, TT networks
- 3 and 4-phase networks
- Up to 4 single-phase networks

Measured data memory
- 128 MByte Flash

Programming language
- Jasic®

2 digital inputs
- Pulse input
- Logic input
- State monitoring
- HT / LT switching

2 digital outputs
- Pulse output kWh / kvarh
- Switch output
- Threshold value output
- Logic output

(expandable via external I/O modules, see FBM modules in chapter 05)

Temperature measurement
- PT100, PT1000, KTY83, KTY84

Network visualisation software
- Free GridVis®-Basic

Areas of application

- Master device for energy management systems, (e.g. ISO 50001)
- Measurement, monitoring and checking of electrical characteristics in energy distribution systems
- Consumption data acquisition
- Monitoring of the power quality (harmonics, short-term interruptions, transients, starting currents, etc.)
- Measured value transducer for building management systems or PLC
- Control tasks e.g. depending on measured value or limit values being reached
- Peak demand management
- Ethernet gateway for subordinate measurement points
- Remote monitoring

Main features

Power quality

- Harmonics analysis up to 40th harmonic
- Unbalance
- Distortion factor THD-U / THD-I
- Measurement of positive, negative and zero sequence component
- Short-term interruptions (> 20 ms)
- Logging and storage of transients (> 50 µs)
- Start-up processes
- Fault recorder function
- Rotary field indication

Fig.: DIN rail mounting (6 TE)

DIN mounting rail (6TE):
Simple and cost-optimised installation

- Mounting on a 35 mm DIN rail
- Clear cost advantages in the switch cabinet construction through lower installation and connection effort
- Simple integration into the LVDB, in machinery construction, in installation subdistribution panel for building management systems, in IT and in data centres

Fig.: Modern communication architecture

Modern communications architecture via Ethernet

- Rapid, cost-optimised and reliable communication through integration into an existing Ethernet architecture
- Integration in PLC systems and building management systems
- High flexibility due to the use of open standards
- Simultaneous polling of interfaces possible

Ethernet-Modbus gateway

- Simple integration of Modbus-RTU devices into an Ethernet architecture through the Modbus gateway function
- Integration of devices with identical file formats and matching function codes possible via Modbus RTU interface

High-speed Modbus

- Fast and reliable data exchange via RS485 interface
- Speed up to 921.6 kB/s

Graphical programming

- Comprehensive programming options on the device, 7 programs simultaneously (PLC functionality)
- Jasic® source code programming
- Functional expansions far beyond pure measurement
- Complete APPs from the Janitza library

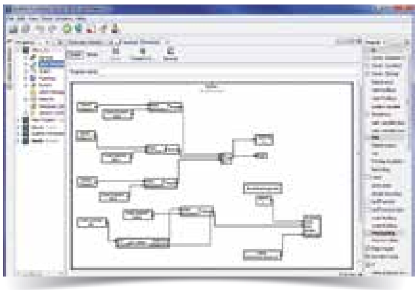


Fig.: Graphical programming

Convenient home page and email functions

- Information can be received conveniently by email and via the device homepage
- Access to powerful device homepage via web browser
- Online data, historical data, graphs, events and much more, is available direct from the homepage

Fig.: Illustration of the online data via the device's own homepage

Large measurement data memory

- 128 MByte
- 5,000,000 saved values
- Recording range up to 2 years
- Recording freely configurable

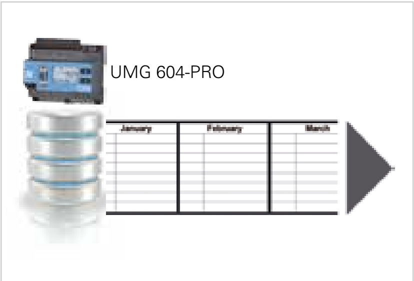
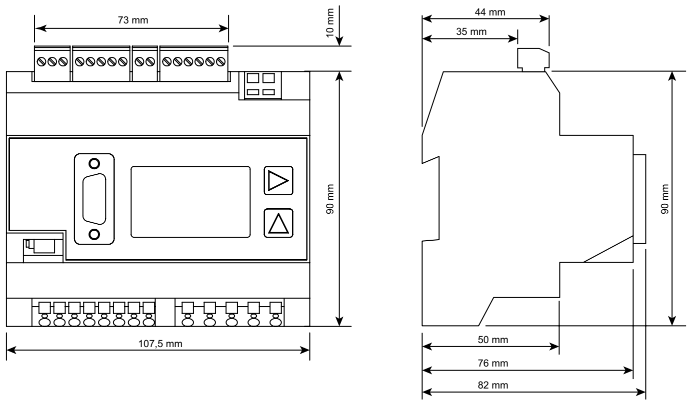


Fig.: Large measurement data memory

Dimension diagrams

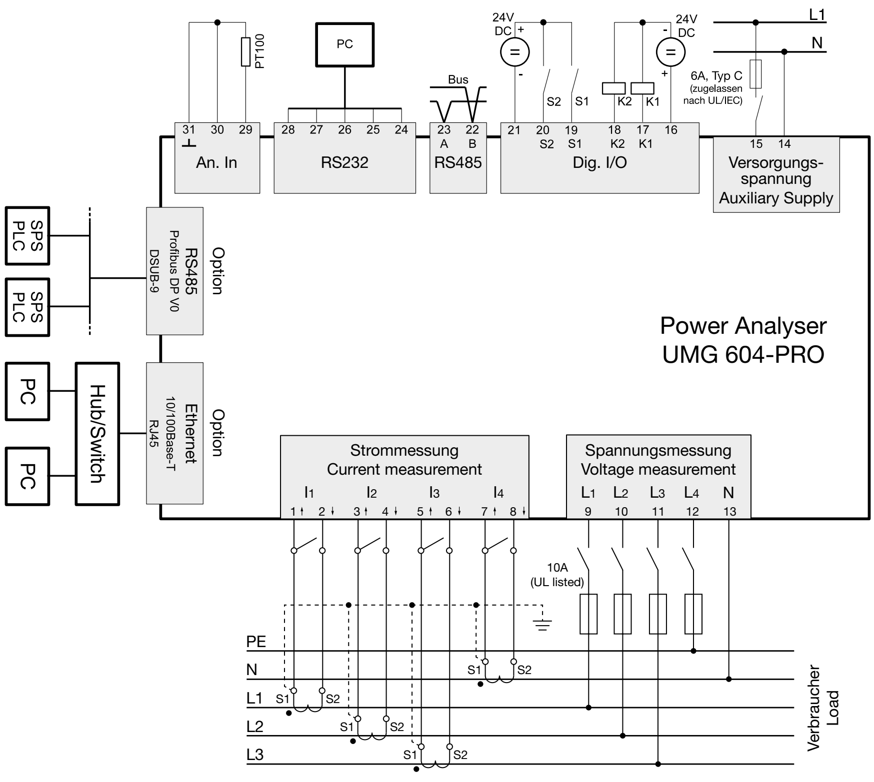
All dimensions in mm



Front view

Side view

Typical connection



Device overview and technical data

	UMG 604E-PRO			UMG 604EP-PRO	
Item number		**52.16.012**			
Item number (UL)	**52.16.202**	**-**	**52.16.222**	**52.16.201**	**52.16.221**
Supply voltage AC	95 ... 240 V AC	50 ... 110 V AC	20 ... 50 V AC	95 ... 240 V AC	20 ... 50 V AC
Supply voltage DC	135 … 340 V DC	50 … 155 V DC	20 … 70 V DC	135 … 340 V DC	20 … 70 V DC
Communication					
Interfaces					
RS485: 9.6 – 921.6 kbps (Screw-type terminal)	•	•	•	•	•
RS232: 9.6 – 115.2 kbps (Screw-type terminal)	•	•	•	•	•
Profibus DP: Up to 12 Mbps (DSUB-9 plug)	-	-	-	•	•
Ethernet 10/100 Base-TX (RJ-45 socket)	•	•	•	•	•
Protocols					
Modbus RTU, Modbus TCP, Modbus RTU over Ethernet	•	•	•	•	•
Modbus Gateway for Master-Slave configuration	•	•	•	•	•
Profibus DP V0	-	-	-	•	•
HTTP (homepage configurable)	•	•	•	•	•
SMTP (email)	•	•	•	•	•
NTP (time synchronisation)	•	•	•	•	•
TFTP	•	•	•	•	•
FTP (File-Transfer)	•	•	•	•	•
SNMP	•	•	•	•	•
DHCP	•	•	•	•	•
TCP/IP	•	•	•	•	•
BACnet (optional)	•	•	•	•	•
ICMP (Ping)	•	•	•	•	•
Device options					
BACnet communication	**52.16.081**	**52.16.081**	**52.16.081**	**52.16.081**	**52.16.081**

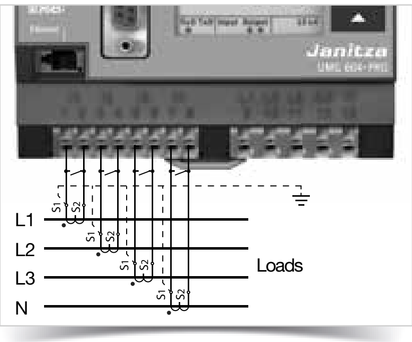


Fig.: Current measurement via current transformers

General	
Use in low and medium voltage networks	•
Accuracy voltage measurement	0.2 %
Accuracy current measurement	0.25 %
Accuracy active energy (kWh, …/5 A)	Class 0.5S
Number of measurement points per period	400
Uninterrupted measurement	•
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power / total and per phase	•
Power factor / total and per phase	•
Energy measurement	
Active, reactive and apparent energy [L1,L2,L3, L4, ∑ L1–L3, ∑ L1–L4]	•
Number of tariffs	8
Recording of the mean values	
Voltage, current / actual and maximum	•
Active, reactive and apparent power / actual and maximum	•
Frequency / actual and maximum	•
Demand calculation mode (bi-metallic function) / thermal	•
Other measurements	
Clock	•
Weekly timer	Jasic®

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

Power quality measurements	
Harmonics per order / current and voltage	1st – 40th
Harmonics per order / active and reactive power	1st – 40th
Distortion factor THD-U in %	•
Distortion factor THD-I in %	•
Voltage unbalance	•
Current and voltage, positive, zero and negative sequence component	•
Transients	50 µs
Error / event recorder function	•
Short-term interruptions	20 ms
Oscillogram function (waveform U and I)	•
Full wave effective values (U, I, P, Q)	•
Under and overvoltage recording	•
Measured data recording	
Memory (Flash)	128 MB
Average, minimum, maximum values	•
Measured data channels	8
Alarm messages	•
Time stamp	•
Time basis average value	freely user-defined
RMS averaging, arithmetic	•
Displays and inputs / outputs	
LCD display	•
Digital inputs	2
Digital outputs (as switch or pulse output)	2
Thermistor input (PT100, PT1000, KTY83, KTY84)	•
Voltage and current inputs	each 4
Password protection	•
Peak load management (optionally 64 channels)	•
Software GridVis®-Basic*1	
Online and historic graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports (energy, power quality)	•
Graphical programming	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Programming / threshold values / alarm management	
Application programs freely programmable	7
Graphical programming	•
Programming via source code Jasic®	•

Technical data	
Type of measurement	Constant true RMS Up to 40th harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	277 / 480 V AC
Nominal voltage, three-phase, 3-conductor (L-L)	480 V AC
Measurement in quadrants	4
Networks	TN, TT, IT
Measurement in single-phase/multi-phase networks	1 ph, 2 ph, 3 ph, 4 ph and up to 4 times 1 ph
Measured voltage input	
Overvoltage category	300 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	10 ... 600 Vrms
Measured range, voltage L-L, AC (without potential transformer)	18 ... 1,000 Vrms
Resolution	0.01 V
Impedance	4 MOhm / phase
Frequency measuring range	45 ... 65 Hz
Power consumption	approx. 0.1 VA
Sampling frequency	20 kHz / phase
Transients	> 50 µs

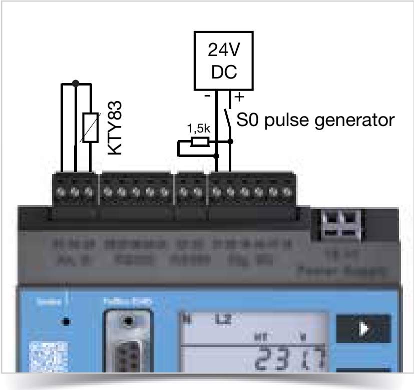


Fig.: Example temperature input (KTY83) and S0 pulse transducer

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

*1 Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.

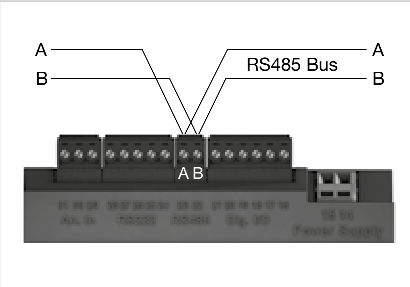
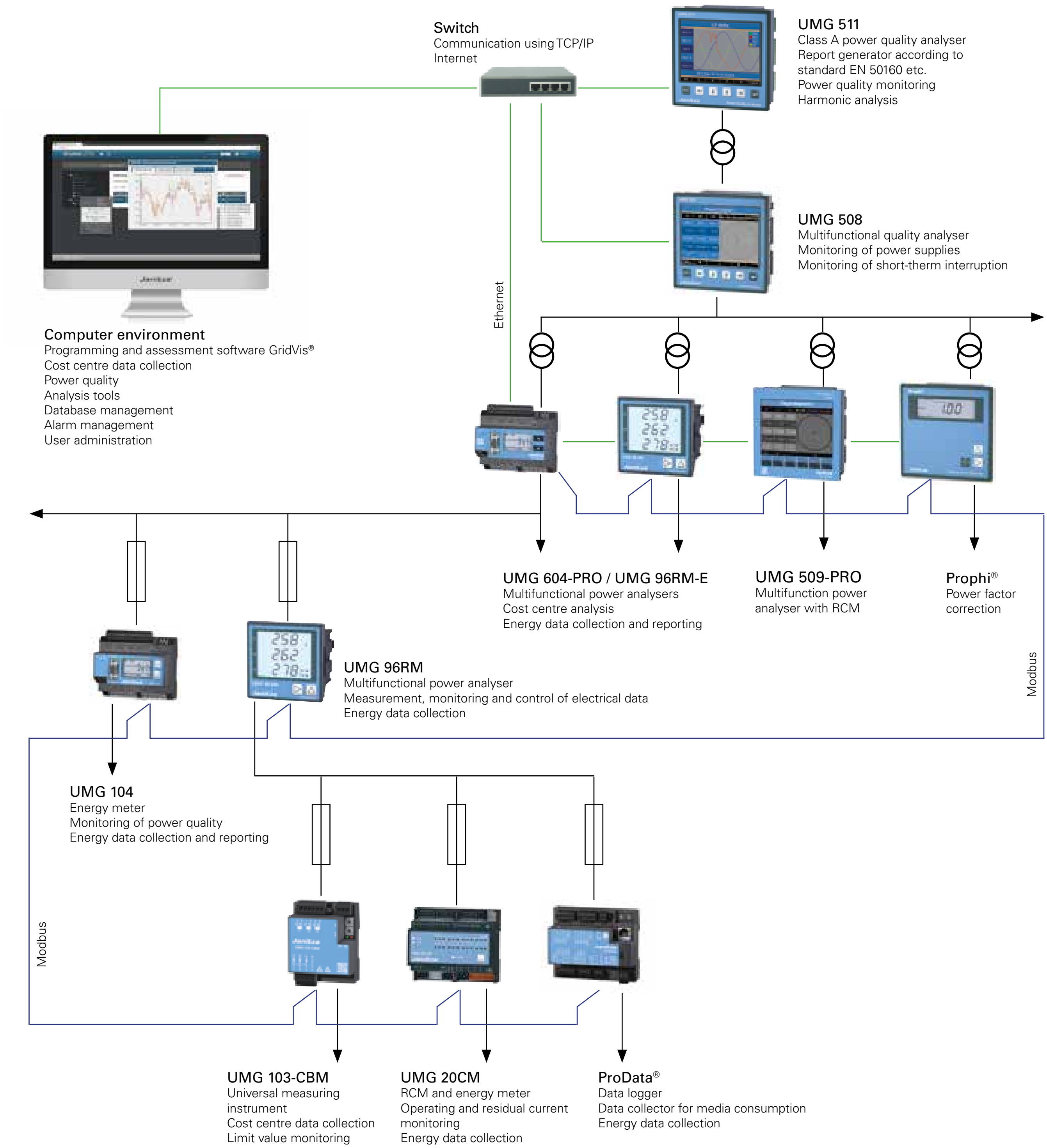


Fig.: RS485 interface, 2 pin plug contact

Measured current input	
Rated current	1 / 5 A
Resolution	1 mA
Measurement range	0.001 ... 8.5 Amps
Overvoltage category	300 V CAT III
Measurement surge voltage	4 kV
Power consumption	approx. 0.2 VA (Ri = 5 MOhm)
Overload for 1 sec.	100 A (sinusoidal)
Sampling frequency	20 kHz
Digital inputs and outputs	
Number of digital inputs	2
Maximum counting frequency	20 Hz
Input signal present	18 ... 28 V DC (typical 4 mA)
Input signal not present	0 ... 5 V DC, current < 0.5 mA
Number of digital outputs	2
Switching voltage	max. 60 V DC, 30 V AC
Switching current	max. 50 mA Eff AC / DC
Output of voltage dips	20 ms
Output of voltage exceedance events	20 ms
Pulse output (energy pulse)	max. 20 Hz
Maximum cable length	up to 30 m unscreened, from 30 m screened
Mechanical properties	
Weight	350 g
Device dimensions in mm (H x W x D)	90 x 107.5 x approx. 82
Battery	Type Lithium CR2032, 3 V
Protection class per EN 60529	IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	35-mm DIN rail
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	 0.08 to 2.5 mm^2 1.5 mm^2
Environmental conditions	
Temperature range	Operation: K55 (-10 ... +55 °C)
Relative humidity	Operation: 5 to 95 % (at 25 °C)
Operating height	0 ... 2,000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class B: Residential environment	IEC/EN 61326-1
RFI Field Strength 30 – 1,000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Safety	
Europe	CE labelling
USA and Canada	UL variants available
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included


Switch
Communication using TCP/IP
Internet
UMG 511
Class A power quality analyser
Report generator according to standard EN 50160 etc.
Power quality monitoring
Harmonic analysis
UMG 508
Multifunctional quality analyser
Monitoring of power supplies
Monitoring of short-therm interruption
Computer environment
Programming and assessment software GridVis®
Cost centre data collection
Power quality
Analysis tools
Database management
Alarm management
User administration
Ethernet
UMG 604-PRO / UMG 96RM-E
Multifunctional power analysers
Cost centre analysis
Energy data collection and reporting
UMG 509-PRO
Multifunction power analyser with RCM
Prophi®
Power factor correction
UMG 96RM
Multifunctional power analyser
Measurement, monitoring and control of electrical data
Energy data collection
Modbus
UMG 104
Energy meter
Monitoring of power quality
Energy data collection and reporting
Modbus
UMG 103-CBM
Universal measuring instrument
Cost centre data collection
Limit value monitoring
UMG 20CM
RCM and energy meter
Operating and residual current monitoring
Energy data collection
ProData®
Data logger
Data collector for media consumption
Energy data collection

UMG 605-PRO – Power quality analysers for DIN rails

Communication
- Profibus (DP / V0)
- Modbus (RTU, UDP, TCP, Gateway)
- TCP/IP
- BACnet (optional)
- HTTP (configurable homepage)
- FTP (file transfer)
- TFTP
- NTP (time synchronisation)
- SMTP (email function)
- DHCP
- SNMP

Interfaces
- Ethernet
- RS232
- RS485 (Modbus)
- RS485 (DSUB9) for Profibus

Accuracy of measurement
- Energy: Class 0.5S (... / 5 A)
- Current: 0.2 %
- Voltage: 0.2 %

Peak demand management (optional)
- Up to 64 switch-off stages

Power quality
- Harmonics up to the 63rd harmonic, direct / indirect
- Flicker measurement
- Short-term interruptions (> 20 ms)
- Transient recorder (> 50 µs)
- Starting currents
- Unbalance
- Half wave RMS recordings (up to 4.5 min.)

Networks
- IT, TN, TT networks
- 3 and 4-phase networks
- Up to 4 single-phase networks

Measured data memory
- 128 MByte Flash

Programming language
- Jasic®

2 digital inputs
- Pulse input
- Logic input
- State monitoring
- HT / LT switching

2 digital outputs
- Pulse output kWh / kvarh
- Switch output
- Threshold value output
- Logic output*

*(expandable via external I/O modules)

Temperature measurement
- PT100, PT1000, KTY83, KTY84

Network visualisation software
- Free GridVis®-Basic

Areas of application

- Power quality monitoring
- Ethernet gateway for subordinate measurement points
- Analysis of electrical disturbances in the event of network problems
- Report generator for various power quality standards
- Control tasks e.g. depending on measured value or limit values being reached
- Measured value transducer for building management systems or PLC

Main features

Power quality

- Continuous power quality monitoring (e.g. EN 50160)
- Harmonics analysis up to the 63rd harmonic, even and odd
- Interharmonics
- Distortion factor THD-U / THD-I
- Measurement of positive, negative and zero sequence component
- Flicker measurement in accordance with DIN EN 61000-4-15
- Logging and storage of transients (> 50 µs)
- Recording of short-term interruptions (> 20 ms)
- Monitoring start-up processes
- Recorder for limit value events

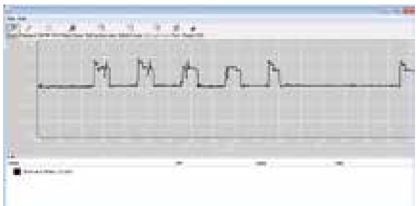


Fig.: GridVis®– Flicker Monitoring

Power

- 4 voltage and 4 current measurement inputs
- Logging and digitalisation of effective values (true RMS) of currents and voltages (15 – 440 Hz)
- Continuous sampling of the voltage and current measurement inputs at 20 kHz
- Recording of over 2,000 measured values per measurement cycle (200 ms)
- Stipulation of nominal current possible for measuring current events
- Fourth current measurement input is suitable for measuring the current in the neutral or PE conductor or for measuring any potential difference between N and PE.
- Large measured data memory (memory range = 5 000 000 measured values)
- Simple remote polling of measured data via the device's own homepage
- All interfaces can be used simultaneously
- Up to 4 ports can be accessed simultaneously

Impressive reporting with GridVis®

- Automatic generation and sending of power quality reports
- Power quality reports per EN 50160, EN 61000-2-4, IEEE519
- Illustration of the ITI-(CBEMA) curve
- Freely definable time planning for the generation of reports

Fig.: Automatic reporting

Modern communications architecture via Ethernet

- Rapid, cost-optimised and reliable communication through integration into an existing Ethernet architecture
- Integration in PLC systems and building management systems
- High flexibility due to the use of open standards
- Simultaneous polling of interfaces possible

Ethernet-Modbus gateway

- Simple integration of Modbus-RTU devices into an Ethernet architecture through the Modbus gateway function
- Integration of devices with identical file formats and matching function codes possible via Modbus RTU interface

Powerful alarm management

- Can be programmed via the graphic programming or Jasic® source code
- All measured values can be used
- Can be arbitrarily, mathematically processed
- Individual forwarding via email sending, switching of digital outputs, writing to Modbus addresses etc.
- Watchdog APP
- Further alarm management functions via GridVis®-Service alarm management

Fig.: Alarm management, alarm list (logbook)

High-speed Modbus

• Fast and reliable data exchange via RS485 interface
• Speed up to 921.6 kB/s

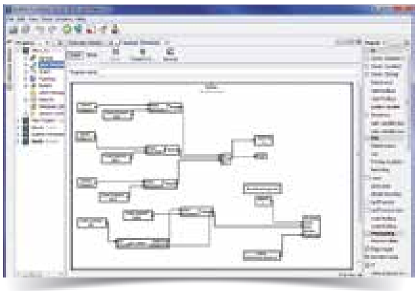


Fig.: Graphical programming

Graphical programming

• Comprehensive programming options on the device, 7 programs simultaneously (PLC functionality)
• Jasic® source code programming
• Functional expansions far beyond pure measurement
• Complete APPs from the Janitza library

Fig.: Illustration of the online data via the device's own homepage

Convenient home page and email functions

• Information can be received conveniently by email and via the device homepage
• Access to powerful device homepage via web browser
• Online data, historical data, graphs, events and much more, is available direct from the homepage

Large measurement data memory

• 128 MByte
• 5,000,000 saved values
• Recording range up to 2 years
• Recording freely configurable by the user

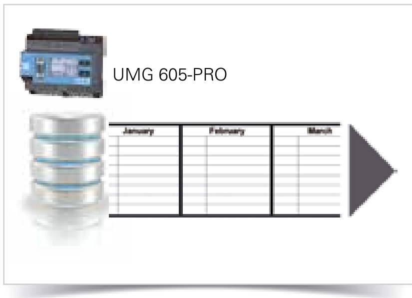


Fig.: Large measurement data memory

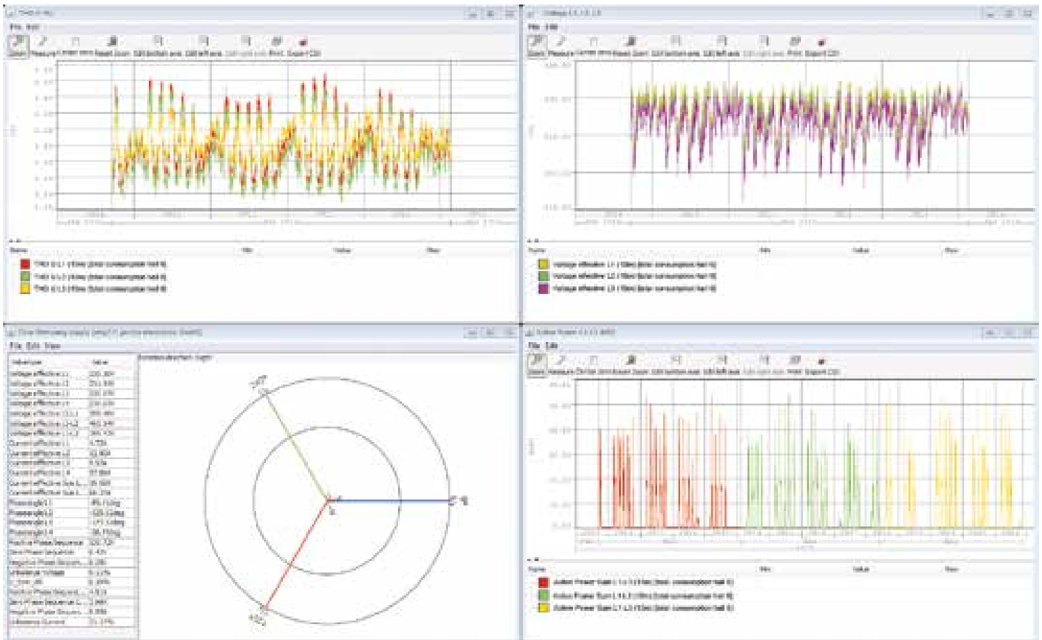
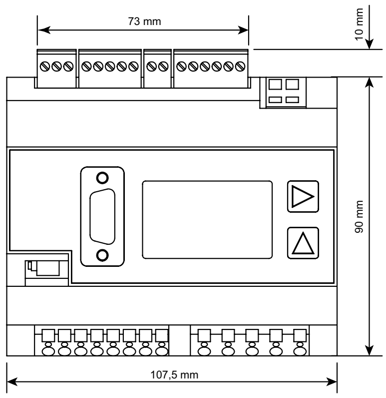


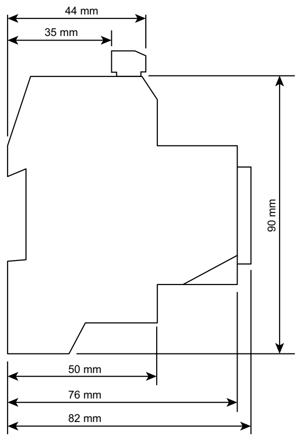
Fig.: GridVis® Graphset with THD-U, voltage, phasor diagram and load profile (kW)

Dimension diagrams

All dimensions in mm

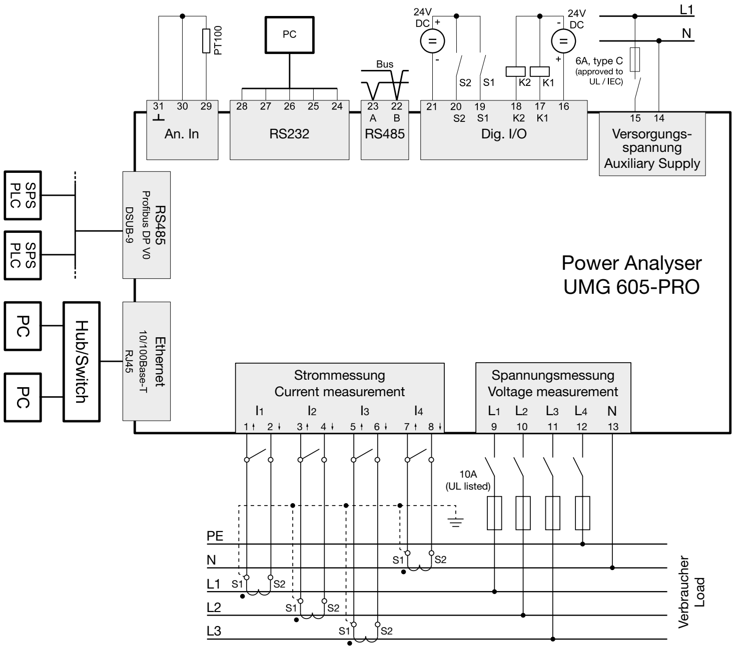


Front view



Side view

Typical connection



Device overview and technical data

	UMG 605-PRO		
Item number		**52.16.028**	
Item number (UL)	**52.16.227**	**-**	**52.16.229**
Supply voltage AC	95 ... 240 V AC	50 ... 110 V AC	20 ... 50 V AC
Supply voltage DC	135 … 340 V DC	50 … 155 V DC	20 … 70 V DC
Device options			
BACnet communication	**52.16.083**	**52.16.083**	**52.16.083**

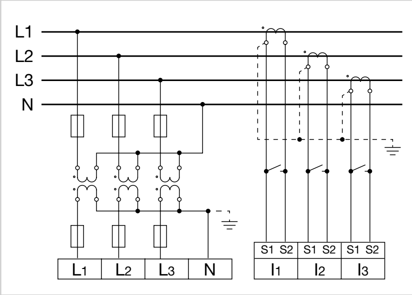


Fig.: Measurement via 3 voltage transformers in a three-phase 4-wire network with asymmetric loading

General	
Use in low and medium voltage networks	•
Accuracy voltage measurement	0.2 %
Accuracy current measurement	0.25 %
Accuracy active energy (kWh, .../5 A)	Class 0.5S
Number of measurement points per period	400
Uninterrupted measurement	•
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power / total and per phase	•
Power factor / total and per phase	•
Energy measurement	
Active, reactive and apparent energy [L1,L2,L3, L4, ∑ L1–L3, ∑ L1–L4]	•
Number of tariffs	8
Recording of the mean values	
Voltage, current / actual and maximum	•
Active, reactive and apparent power / actual and maximum	•
Frequency / actual and maximum	•
Demand calculation mode (bi-metallic function) / thermal	•
Other measurements	
Operating hours measurement	•
Clock	•
Weekly timer	Jasic®
Power quality measurements	
Harmonics per order / current and voltage	1st – 63rd
Harmonics per order / active and reactive power	1st – 63rd
Interharmonics - current / voltage	•
Distortion factor THD-U in %	•
Distortion factor THD-I in %	•
Voltage unbalance	•
Current and voltage, positive, zero and negative sequence component	•
Flicker: Short-term, long-term, present	•
Transients	50 µs
Error / event recorder function	•
Short-term interruptions	> 20 ms
Oscillogram function (waveform U and I)	•
Under and overvoltage recording	•
Measured data recording	
Memory (Flash)	128 MB
Average, minimum, maximum values	•
Measured data channels	8
Alarm messages	•
Time stamp	•
Time basis average value	freely user-defined
RMS averaging, arithmetic	•

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

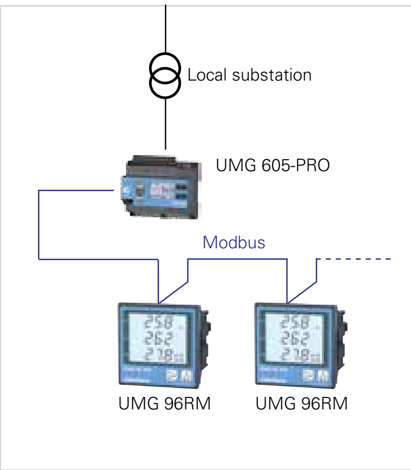


Fig.: Example of a master - slave combination

Displays and inputs / outputs	
LCD display	•
Digital inputs	2
Digital outputs (as switch or pulse output)	2
Thermistor input (PT100, PT1000, KTY83, KTY84)	•
Voltage and current inputs	each 4
Password protection	•
Peak load management (optionally 64 channels)	•
Communication	
Interfaces	
RS485: 9.6 – 921.6 kbps (Screw-type terminal)	•
RS232: 9.6 – 115.2 kbps (Screw-type terminal)	•
Profibus DP: Up to 12 Mbps (DSUB-9 connector)	•
Ethernet 10/100 Base-TX (RJ-45 socket)	•
Protocols	
Modbus RTU, Modbus TCP, Modbus RTU over Ethernet	•
Modbus Gateway for Master-Slave configuration	•
Profibus DP V0	•
HTTP (homepage configurable)	•
SMTP (email)	•
NTP (time synchronisation)	•
TFTP	•
FTP (File-Transfer)	•
SNMP	•
DHCP	•
TCP/IP	•
• BACnet (optional)	•
ICMP (Ping)	•
Software GridVis®-Basic*1	
Online and historic graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports (energy, power quality)	•
Graphical programming	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Programming / threshold values / alarm management	
Application programs freely programmable	7
Graphical programming	•
Programming via source code Jasic®	•

Technical data	
Type of measurement	Constant true RMS up to the 63rd harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	277 / 480 V AC
Nominal voltage, three-phase, 3-conductor (L-L)	480 V AC
Measurement in quadrants	4
Networks	TN, TT, IT
Measurement in single-phase/multi-phase networks	1 ph, 2 ph, 3 ph, 4 ph and up to 4 times 1 ph
Measured voltage input	
Overvoltage category	300 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	10 ... 600 Vrms
Measured range, voltage L-L, AC (without potential transformer)	18 ... 1000 Vrms
Resolution	0.01 V
Impedance	4 MOhm / phase
Frequency measuring range	15 ... 440 Hz
Power consumption	approx. 0.1 VA
Sampling frequency	20 kHz / phase
Transients	> 50 µs

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included   - = not included

*1 Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.

Measured current input	
Rated current	1 / 5 A
Resolution	1 mA
Measurement range	0.001 ... 8.5 Arms
Overvoltage category	300 V CAT III
Measurement surge voltage	4 kV
Power consumption	approx. 0.2 VA (Ri = 5 MOhm)
Overload for 1 sec.	100 A (sinusoidal)
Sampling frequency	20 kHz
Digital inputs and outputs	
Number of digital inputs	2
Maximum counting frequency	20 Hz
Reaction time (Jasic® program)	200 ms
Input signal present	18 ... 28 V DC (typical 4 mA)
Input signal not present	0 ... 5 V DC, current < 0.5 mA
Number of digital outputs	2
Switching voltage	max. 60 V DC, 30 V AC
Switching current	max. 50 mA Eff AC / DC
Reaction time (Jasic® program)	200 ms
Output of voltage dips	20 ms
Pulse output (energy pulse)	max. 20 Hz
Maximum cable length	up to 30 m unscreened, from 30 m screened
Mechanical properties	
Weight	350 g
Device dimensions in mm (H x W x D)	90 x 107.5 x approx. 82
Battery	Type Lithium CR2032, 3 V
Protection class per EN 60529	IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	35 mm DIN mounting rails
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	0.08 to 2.5 mm² 1.5 mm²
Environmental conditions	
Temperature range	Operation: K55 (-10 ... +55 °C)
Relative humidity	Operation: 5 to 95 % (at 25 °C)
Operating height	0 ... 2,000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class A: Industrial environment	IEC/EN 61326-1
RFI Field Strength 30 – 1,000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Safety	
Europe	CE labelling
USA and Canada	UL variants available
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com

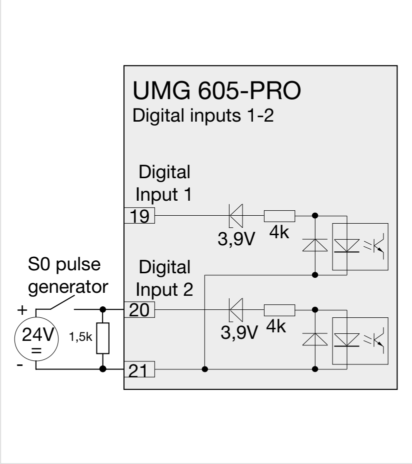
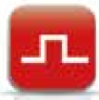


Fig.: Example for the connection of an S0 pulse transducer to digital input 2

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

Threshold value monitoring



Pulse outputs

ISO 50001 – Made in Germany

UMG 96L / UMG 96 – Universal measurement device

Measuring accuracy
- Energy: Class 2
- Current .../1 A, .../5 A
- Voltage L - N: ± 1 %

Networks
- TN-, TT-Networks

2 digital outputs (UMG 96)
- Pulse output kWh / kvarh
- Switch output

Areas of application

- Replaces analogue measurement devices
- Display and checking of electrical characteristics in energy distribution systems
- Limit value monitoring

Main features

Fig.: Effective power, all three phases at a glance

Display selection and automatic display rotation

- Generous LCD display
- All measured values can be called up in factory setting
- Measured values that are not required can be hidden and displayed again

Operating hours counter

- The operating hours counter is active as soon as the device is switched on
- The time is measured with a resolution of 15 minutes
- Display in hours mode

Digital outputs for reactive or active energy

- Transmission of the reactive and active energy via digital outputs
- The active energy should be assigned to output 1 and the reactive energy to output 2

Digital outputs for threshold values (UMG 96)

- Digital outputs also suitable for use as switch outputs
- Programming the digital outputs for threshold monitoring of measurement data
- Assignment of a measured value (threshold value) per switch output
- The associated output reacts in response to the value exceeding or dropping below the threshold value
- Transistor outputs

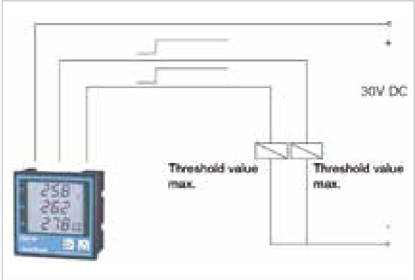


Fig.: Digital output for threshold value monitoring

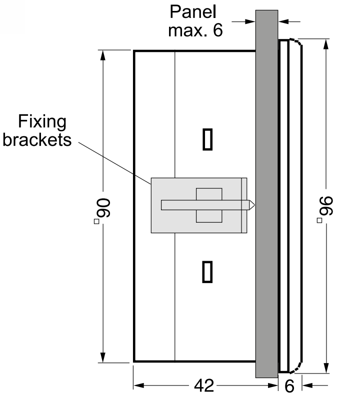
Password

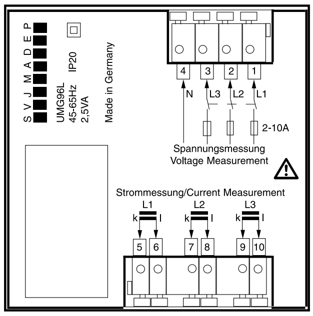
- 3-digit password protects against unauthorised changing of the programming and configurations
- Changes in the following program menus can only be implemented after entering the correct user password
- Password is not factory-programmed

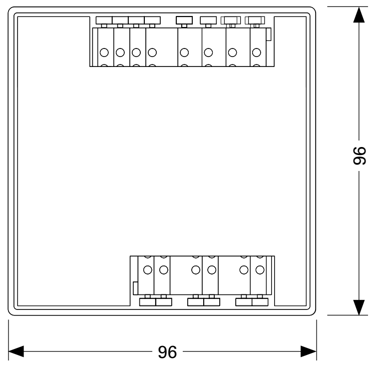
Fig.: Password protection

Dimension diagrams

All dimensions in mm







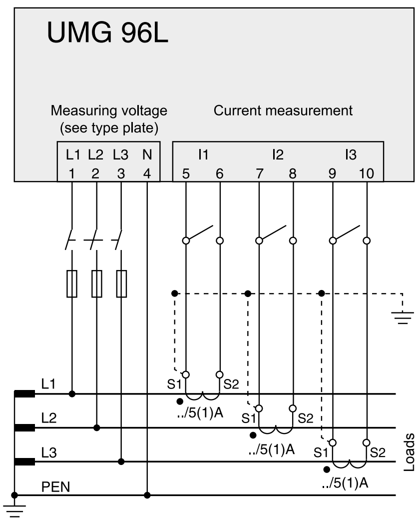
Side view UMG 96L / UMG 96

Rear view UMG 96L

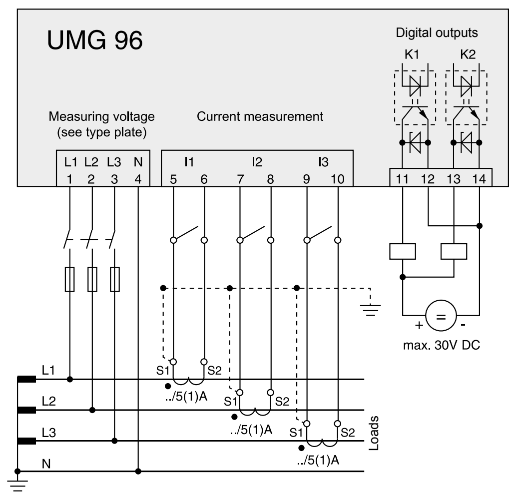
Rear view UMG 96

Cut out: $92^{+0,8}$ x $92^{+0,8}$ mm

Typical connection



UMG 96L



UMG 96 with 2 digital outputs

Device overview and technical data

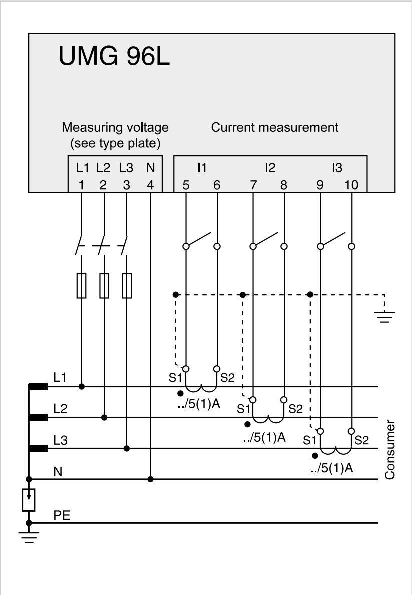


Fig.: Example connection via three current transformers (UMG 96L)

	UMG 96L	UMG 96
Item number	**52.14.001**	**52.09.001**
Measured voltage	230 / 400 V AC	275 / 476 V AC
Operating voltage	196 ... 255 V AC	196 ... 275 V AC
Measured voltage input		
Overvoltage category	300 V CAT III	300 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	50 … 255 V AC	50 … 275 V AC
Measured range, voltage L-L, AC (without potential transformer)	87 … 442 V AC	87 … 476 V AC
Digital outputs		
Number of digital outputs	-	2
General		
Accuracy voltage measurement	1 %	1 %

General	
Use in low and medium voltage networks	•
Accuracy current measurement	1 %
Accuracy active energy (kWh, …/5 A)	Class 2
Number of measurement points per period	50
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power / total and per phase	•
Power factor / total and per phase	•
Energy measurement	
Active, reactive energy [∑ L1–L3]	•
Recording of the mean values	
Voltage, current / actual and maximum	•
Active, reactive and apparent power / actual and maximum	•
Frequency / actual and maximum	•
Other measurements	
Operating hours measurement	•
Technical data	
Measurement in quadrants	4
Networks	TN, TT
Measured voltage input	
Frequency measuring range	45 ... 65 Hz
Power consumption	approx. 0.1 VA / approx. 0.2 VA
Sampling frequency (50 Hz)	2.5 kHz / phase
Measured current input	
Rated current	1 / 5 A
Measurement range	0.02 ... 6 Arms
Overvoltage category	CAT III
Measurement surge voltage	4 kV
Power consumption	approx. 0.2 VA
Overload for 2 sec.	180 A (sinusoidal)
Sampling frequency (50/60 Hz)	2.5 / 3 kHz / Phase
Digital outputs*1	
Switching voltage	max. 60 V DC, 5 – 24 V DC
Switching current	max. 50 mA Eff AC / DC
Pulse output (energy pulse)	max. 10 Hz
Maximum cable length	up to 30 m unscreened, from 30 m screened
Mechanical properties	
Weight	250 g
Device dimensions in mm (H x W x D)	96 x 96 x 48
Protection class per EN 60529	Front: IP40, Rear: IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	Front panel installation
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	 0.08 to 2.5 mm² 1.5 mm²

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included   - = not included

*1 Refers exclusively to the UMG 96.

Environmental conditions	
Temperature range	Operation: K55 (-10 ... +55 °C)
Relative humidity	Operation: 15 to 95 % (at 25 °C)
Operating height	0 ... 2,000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of equipment	Directive 89/336/EEC
Electrical equipment for use within certain voltage limits	Directive 73/23/EEC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class B: Residential environment	IEC/EN 61326-1
Radio disturbanc voltage strength 30 – 1000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Safety	
Europe	CE labelling

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

UMG 96RM – Multifunction power analyser

Communication (device-specific)
- Modbus (RTU)
- Profibus DP V0
- Profinet
- TCP/IP
- M-Bus

Interfaces
- RS485 (UMG 96RM, UMG 96RM-P, UMG 96RM-CBM)
- Profibus (UMG 96RM-P)
- Profinet (UMG 96RM-PN)
- M-Bus (UMG 96RM-M)
- Ethernet (UMG 96RM-EL)
- USB (UMG 96RM-P, UMG 96RM-CBM)

Accuracy of measurement
- Energy: Class 0.5S (... / 5 A)
- Current: 0.2 %
- Voltage: 0.2 %

Power quality
- Harmonics up to 40th harmonic
- Rotary field components
- Distortion factor THD-U / THD-I
- Waveform display (UMG 96RM-EL) via GridVis®-Basic software

Networks
- TN, TT, IT networks
- 3 and 4-phase networks
- Up to 4 single-phase networks

Measured data memory (UMG 96RM-CBM, UMG 96RM-P)
(UMG 96RM, UMG 96RM-M und UMG 96RM-EL without measurement data memory, energy, minimum and maximum values will be saved in the EEPROM)
- 256 MB Flash

Up to 4 digital inputs
- Pulse input
- Logic input
- State monitoring

Up to 6 digital outputs
- Pulse output kWh / kvarh
- Switch output
- Threshold value output
- Logic output
- Remote via Modbus / Profibus

Network visualisation software
- Free GridVis®-Basic

Areas of application

- Measurement, monitoring and checking of electrical characteristics in energy distribution systems
- Recording of load profiles for energy management systems (e.g. ISO 50001)
- Acquisition of the energy consumption for cost centre analysis
- Measured value transducer for building management systems or PLC (Modbus)

Main features

Particular advantages

- Compact construction saves space and costs during installation
- Seamless and sustained recording thanks to large measured data memory or via the online data acquisition (e.g. GridVis®-Service)
- High data security and redundancy
- Comprehensive communications options and protocols
- Multifaceted, pre-defined reports for power quality and energy consumption analysis (via GridVis®-Service)
- Simple report generation at the press of a button or automatically in accordance with defined time plans
- Precision measurement results provide an effective infrastructure as well as high production availability
- Generic Modbus profile: Arbitrary Modbus-capable devices and systems from other manufacturers can be incorporated and visualised in the monitoring solutions
- Long-term availability of the measurement devices guarantees simple retrofitting with system expansions

Energy data acquisition & load profile

- Detailed acquisition of the energy data and the load profile
- More transparency in energy supply through energy analyses
- Safer design of the power distribution systems

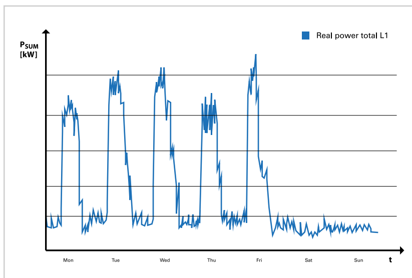


Fig.: Load profiles are the basis for energy management

Cost centre analysis

- Determination of energy costs
- Breakdown and allocation of energy consumers

	January	February	March	April	December	Total
HKA Water Boiler Heating	2480 12 kWh	1240 6 kWh	160 0,8 kWh	380 1,9 kWh	240 1,2 kWh	**4500 € 21,9 kWh**
HKA Water Total	737 3,7 m³	386 1,9 m³	790 3,9 m³	506 2,5 m³	454 2,3 m³	**2873 € 14,3 m³**
Hall 1 Final assembly	166 831 kWh	155 776 kWh	183 920 kWh	174 871 kWh	171 856 kWh	**849 € 4254 kWh**
Hall 2 Painting	155 776 kWh	171 856 kWh	166 831 kWh	195 980 kWh	191 956 kWh	**878 € 4399 kWh**
Total	**3538 €**	**1952 €**	**1299 €**	**1255 €**	**1056 €**	**9100 €**

Fig.: Cost centre analysis

Energy management systems (ISO 50001)

- Continuous increase in energy efficiency
- Cost reduction
- UMG 96RM series multifunctional power analysers are an important part of energy management systems

Transparency of energy supply

- More transparency through a multi-stage, scalable measurement system
- Acquisition of individual events through continuous measurement with high resolution

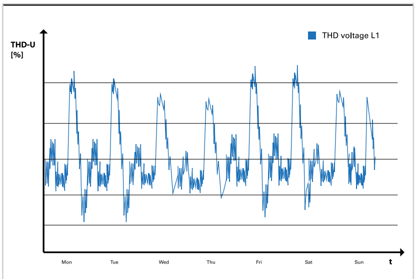


Fig.: Transparency of energy supply

Power quality monitoring

- Notification of inadequate power quality
- Introduction of measures to address network problems
- Prevention of production downtimes
- Significantly longer service life for equipment
- Improved sustainability

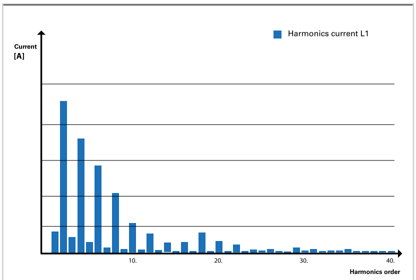


Fig.: Power quality monitoring (Harmonics analysis for the current up to 40th order harmonics)

Measurement accuracy of 0.2 % (V), kWh class = 0.5S

- High sampling rate at 21.3 kHz
- Reliable measurement accuracy of 0.2 % (V)
- Effective energy class (kWh): 0.5S

Energy meter with 8 tariffs, effective and reactive energy

- Energy measurement in 4 quadrants, each with 8 tariffs for effective and reactive energy
- Safe and precise acquisition of operational values for individual electrical loads

Communications options: Ethernet, Profibus, Modbus, M-Bus, …

- Numerous interfaces and protocols, guaranteeing an easy system connection (energy management system, PLC, SCADA, BMS)

Large measurement data memory

- Saving of measurement data possible over very long periods of time
- Recording freely user configurable

Harmonics analyser

- Harmonics analysis up to 40th harmonic
- Information about power quality, grid disturbances and possible "network polluters"

Pluggable screw terminals

- Convenient installation even where spaces are tight

Backlight

- Large, high-contrast LCD display with backlighting
- Very good readability and intuitive operation, even in poor lighting conditions

Basic device

- RS485 interface with Modbus protocol and 2 digital outputs enable quick and low-cost monitoring of power quality and energy consumption

Profibus and digital IOs

- The Profibus connection is used in systems where the UMG 96RM-P is to be incorporated into the automation environment (PLC controllers)

M-Bus

- The UMG 96RM-M can be simply and cost-effectively integrated into consumption data acquisition systems via the M-Bus connection.
- The M-Bus is primarily used for the acquisition of consumption data collection from various different consumption meters, such as water, gas, heat or electrical current.

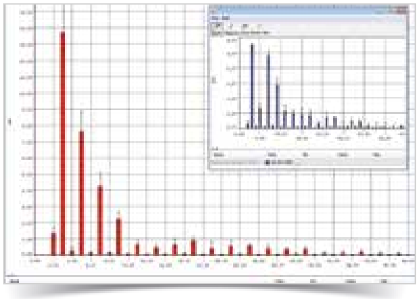


Fig.: GridVis® software: Harmonics analysis

Fig.: Pluggable screw terminals for easy connection

Fig.: LCD Display backlight

Ethernet (TCP/IP) with the UMG 96RM-EL

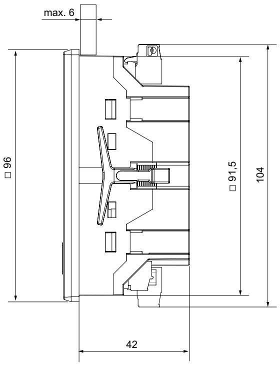
- Simple integration into the Ethernet (LAN) network
- Fast and reliable data communication

4th current transformer input

- Continuous monitoring of the N-conductor by means of the 4th current input
- Available with variants UMG 96RM-P and UMG 96RM-CBM

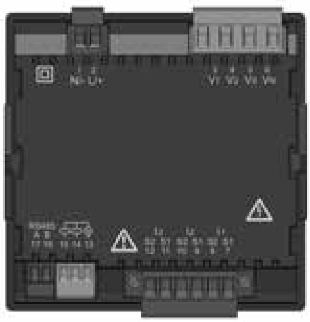
Dimension diagrams

All dimensions in mm

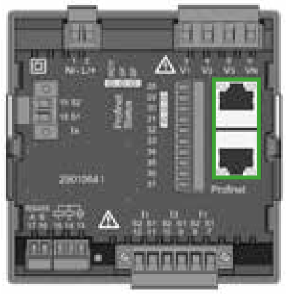


Side view UMG 96RM

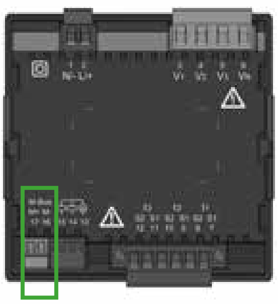
Cut out: $92^{+0,8}$ x $92^{+0,8}$ mm



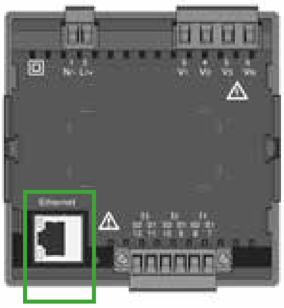
Rear view UMG 96RM (basic device)



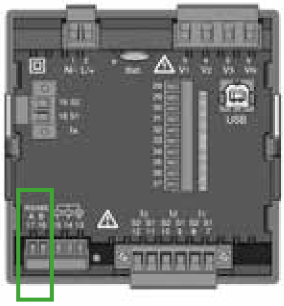
Rear view UMG 96RM-PN
Profinet variant



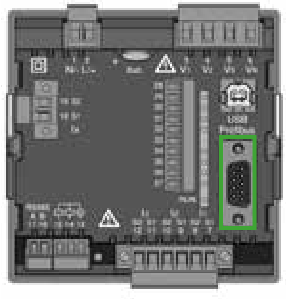
Rear view 96RM-M
M-Bus variant



Rear view 96RM-EL
Ethernet light variant



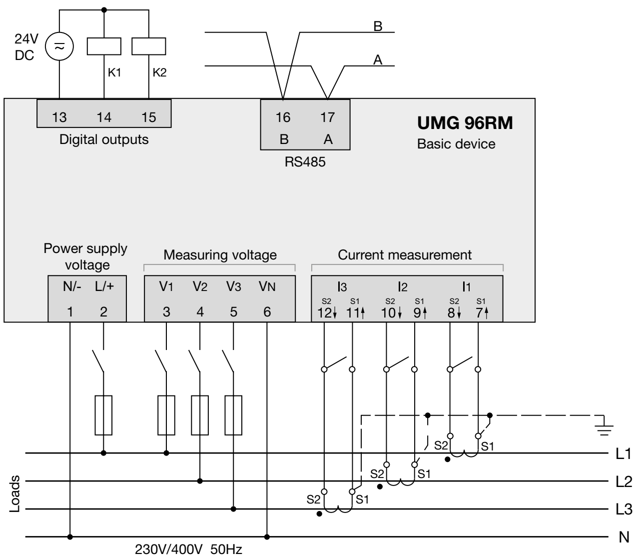
Rear view 96RM-CBM
Modbus variant



Rear view 96RM-P
Profibus variant

The illustrations shown here are examples. Further dimensional drawings and connection diagrams are available on request or can be viewed on our homepage.

Typical connection



Connection variant UMG 96RM

The illustration shown here is an example.
Further connection diagrams are available on request or can be viewed on our homepage.

Device overview and technical data

	UMG 96RM*1	UMG 96RM-M*1	UMG 96RM-EL*1	UMG 96RM-CBM*1	UMG 96RM-P*1	UMG 96RM-PN*1
Item no. (90–277 V AC/90–250 V DC)	**52.22.061**	**52.22.069**	**52.22.068**	**52.22.066**	**52.22.064**	**52.22.090**
Item no. (24–90 V AC/24–90 V DC)	**52.22.070**	**52.22.073**	**52.22.072**	**52.22.067**	**52.22.065**	**52.22.091**
Interfaces	RS485	M-Bus	Ethernet	RS485, USB	RS485, Profibus, USB	RS485, Ethernet, Profinet
Protocols						
Modbus RTU	•	-	-	•	•	•
Modbus TCP	-	-	•	-	-	•
Profibus DP V0	-	-	-	-	•	-
Profinet	-	-	-	-	-	•
M-Bus	-	•	-	-	-	-
DHCP oder DCP	-	-	•	-	-	•
ICMP (Ping)	-	-	•	-	-	•
Measured data recording						
Current measurement channel	3	3	3	4	4	4 (+2)
Memory (Flash)	-	-	-	256 MB	256 MB	-
Battery	-	-	-	Type CR2032 3 V, Li-Mn	Type CR2032 3 V, Li-Mn	-
Clock	-	-	-	•	•	-
Digital inputs and outputs						
Digital inputs	-	-	-	4	4	3*3
Digital outputs (as switch or pulse output)	2	2	-	6	6	2 (+3)*3
Mechanical properties						
Device dimensions in mm (H x W x D)*2	96 x 96 x approx. 48	96 x 96 x approx. 48	96 x 96 x approx. 48	96 x 96 x approx. 78	96 x 96 x approx. 78	96 x 96 x approx. 78

Comment: For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

*1 Inclusive UL certification.

*2 Accurate device dimensions can be found in the operation manual.

*3 Optionally 3 digital inputs or outputs (no pulse output)

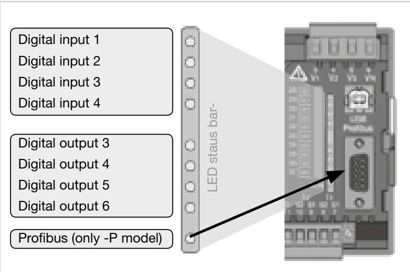


Fig.: LED status bar for the inputs and outputs (UMG 96RM-CBM and UMG 96RM-P)

Fig.: UMG 96RM-PN with Profinet interface

Fig.: Battery insertion on the rear (UMG 96RM-CBM and UMG 96RM-P)

General	
Use in low and medium voltage networks	•
Accuracy voltage measurement	0.2 %
Accuracy current measurement	0.2 %
Accuracy active energy (kWh, .../5 A)	Class 0.5S
Number of measurement points per period	426
Uninterrupted measurement	•
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power / total and per phase	•
Power factor / total and per phase	•
Energy measurement	
Active, reactive and apparent energy [L1,L2,L3, ∑ L1–L3]	•
Number of tariffs	14
Recording of the mean values	
Voltage, current / actual and maximum	•
Active, reactive and apparent power / actual and maximum	•
Frequency / actual and maximum	•
Demand calculation mode (bi-metallic function) / thermal	•
Other measurements	
Operating hours measurement	•
Power quality measurements	
Harmonics per order / current and voltage	1st – 40th
Distortion factor THD-U in %	•
Distortion factor THD-I in %	•
Rotary field indication	•
Current and voltage, positive, zero and negative sequence component	•
Measured data recording	
Average , minimum, maximum values	•
Alarm messages	•
Time stamp	•
Time basis average value	freely user-defined
RMS averaging, arithmetic	•
Displays and inputs / outputs	
LCD display (with backlighting), 2 buttons	•
Voltage inputs	L1, L2, L3 + N
Password protection	•
Software GridVis®-Basic*4	
Online and historic graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports (energy, power quality)	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Programming / threshold values / alarm management	
Comparator (2 Groups with 3 comparators each)	•

Technical data	
Type of measurement	Constant true RMS Up to 40th harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	277 / 480 V AC
Nominal voltage, three-phase, 3-conductor (L-L)	480 V AC
Measurement in quadrants	4
Networks	TN, TT, IT

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

*4 Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.

Measured voltage input	
Overvoltage category	300 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	10 ... 300 Vrms
Measured range, voltage L-L, AC (without potential transformer)	18 ... 520 Vrms
Resolution	0.01 V
Impedance	4 MOhm / phase
Frequency measuring range	45 ... 65 Hz
Power consumption	approx. 0.1 VA
Sampling frequency per channel (50 / 60 Hz)	21.33 / 25.6 kHz
Measured current input	
Rated current	1 / 5 A
Resolution	0.1 mA
Measurement range	0.001 ... 6 Amps
Overvoltage category	300 V CAT II
Measurement surge voltage	2 kV
Power consumption	approx. 0.2 VA (Ri = 5 mOhm)
Overload for 1 sec.	120 A (sinusoidal)
Sampling frequency per channel (50 / 60 Hz)	21.33 / 25.6 kHz
Digital inputs and outputs	
Digital inputs*5	
Maximum counting frequency	20 Hz
Input signal present	18 ... 28 V DC (typical 4 mA)
Input signal not present	0 ... 5 V DC, current < 0.5 mA
Digital outputs*6	
Switching voltage	max. 60 V DC, 33 V AC
Switching current	max. 50 mA Eff AC / DC
Response time	10 / 12 periods + 10 ms
Pulse output (energy pulse)	max. 50 Hz
Maximum cable length	up to 30 m unscreened, from 30 m screened
Mechanical properties	
Weight	approx. 0.3 kg
Protection class per EN 60529	Front: IP40; Front with seal: IP54; Back: IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	Front panel installation
Cable cross section	
Supply voltage	0.2 to 2.5 mm²
Current measurement	0.2 to 2.5 mm²
Voltage measurement	0.08 to 4.0 mm²
Environmental conditions	
Temperature range	Operation: K55 (-25 ... +70 °C)
Relative humidity	Operation: 0 to 90 % RH
Operating height	0 ... 2000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical equipment for use within certain voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Class A: Industrial environment*7	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class B: Residential environment	IEC/EN 61326-1
Radio disturbanc voltage strength 30 – 1000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com/downloads

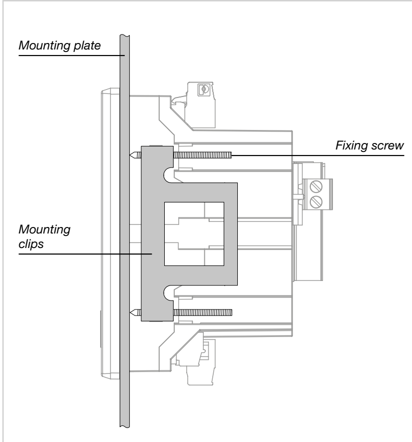


Fig.: The fastening into a switchboard is implemented via the side-mounted fastening clamps (UMG 96RM-P / UMG 96RM-CBM)

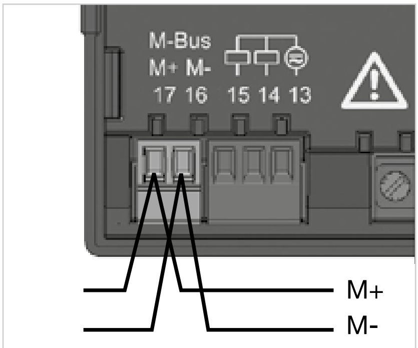


Fig.: M-Bus interface with 2-pole plug contact

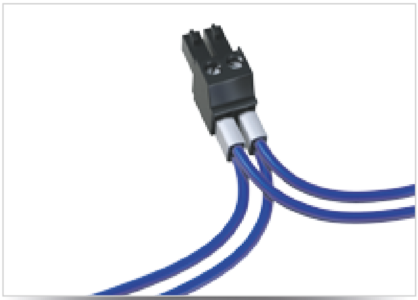


Fig.: 2-pole plug contact with cable connection (cable type: 2 x 0.75 mm²) via twin core end sheathes

Comment: For detailed technical information please refer to the operation manual and the Modbus address list

• = included - = not included

*5 The information relates exclusively to the measurement devices UMG 96RM-CBM, UMG 96RM-P and UMG 96RM-PN.
*6 The information relates exclusively to the measurement devices UMG 96RM, UMG 96RM-M, UMG 96RM-CBM, UMG 96RM-P and UMG 96RM-PN.
*7 UMG 96RM-PN exclusive Class A: Industrial environment

Memory 256 MB

Residual current measurement

Ethernet-Modbus gateway

Alarm management

Homepage

BACnet (optional)

UMG 96RM-E – Power analyser with Ethernet and RCM

Communication
- Modbus (RTU, TCP, Gateway)
- TCP/IP
- HTTP (configurable homepage)
- FTP (file transfer)
- SNMP
- NTP (time synchronisation)
- SMTP (email function)
- DHCP
- SNTP
- TFTP
- BACnet (optional)

Interfaces
- RS485
- Ethernet

Accuracy of measurement
- Energy: Class 0.5S (... / 5 A)
- Current: 0.2 %
- Voltage: 0.2 %

Power quality
- Harmonics up to 40th harmonic
- Rotary field components
- Distortion factor THD-U / THD-I

Networks
- TN, TT, IT networks
- 3 and 4-phase networks
- Up to 4 single-phase networks

Measured data memory
- 256 MB Flash

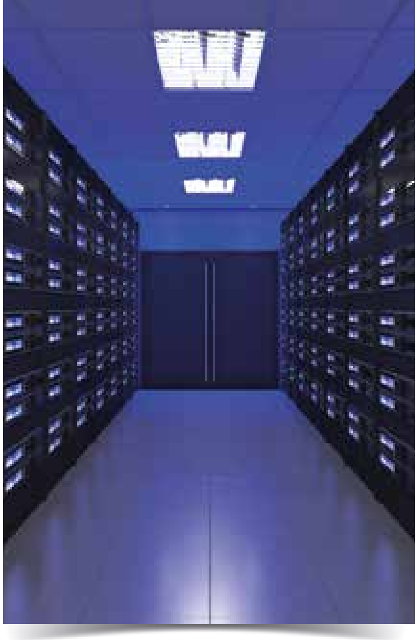
Temperature measurement
- PT100, PT1000, KTY83, KTY84

2 digital outputs
- Pulse output kWh / kvarh
- Switch output
- Threshold value output
- Logic output
- Remote via Modbus / Profibus

3 digital inputs/outputs
- Usable as either inputs or outputs

2 analogue inputs
- Analogue, temperature or residual current input (RCM)

Network visualisation software
- Free GridVis®-Basic



Areas of application

- Measurement, monitoring and checking of electrical characteristics in energy distribution systems
- Recording of load profiles in energy management systems (e.g. ISO 50001)
- Acquisition of the energy consumption for cost centre analysis
- Measured value transducer for building management systems or PLC (Modbus)
- Monitoring of power quality characteristics, e.g. harmonics up to 40th harmonic
- Residual current monitoring (RCM)

Main features

Universal meter

- Operating current monitoring for general electrical parameters
- High transparency through a multi-stage and scalable measurement system in the field of energy measurement
- Acquisition of events through continuous measurement with 200 ms high resolution

RCM device

- Continuous monitoring of residual currents (Residual Current Monitor, RCM)
- Alarming in case a preset threshold fault current reached
- Near-realtime reactions for triggering countermeasures
- Permanent RCM measurement for systems in permanent operation without the opportunity to switch off

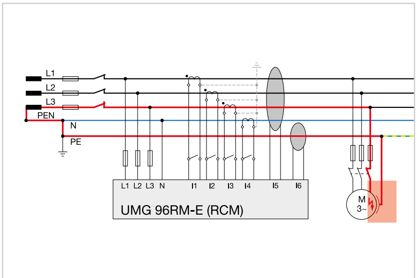


Fig.: UMG 96RM-E with residual current monitoring via measuring inputs I5 / I6

Energy measurement device

- Continuous acquisition of the energy data and load profiles
- Essential both in relation to energy efficiency and for the safe design of power distribution systems

Harmonics analyser / event recorder

- Analysis of individual harmonics for current and voltage
- Prevention of production downtimes
- Significantly longer service life for equipment
- Rapid identification and analysis of power quality fluctuations by means of user-friendly tools (GridVis®)

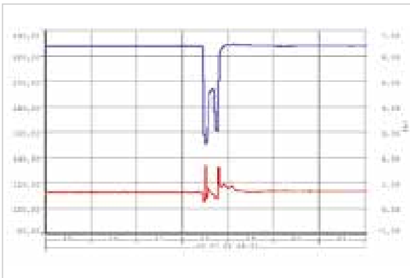


Fig.: Event logger: Voltage dip in the low voltage distribution system

Extensive selection of tariffs

- 7 tariffs each for effective energy (consumption, delivery and without backstop)
- 7 tariffs each for reactive energy (inductive, capacitive and without backstop)
- 7 tariffs for apparent energy
- L1, L2 and L3, for each phase

Highest possible degree of reliability

- Continuous leakage current measurement
- Historical data: Long-term monitoring of the residual current allows changes to be identified in good time, e.g. insulation faults
- Time characteristics: Recognition of time relationships
- Prevention of neutral conductor carryover
- RCM threshold values can be optimized for each individual case: Fixed, dynamic and stepped RCM threshold value
- Monitoring of the CGP (central ground point) and the sub-distribution panels

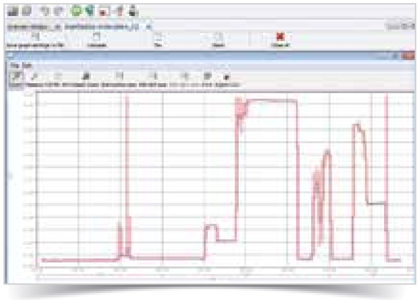


Fig.: Continuous leakage current measurement

Analysis of fault current events

- Event list with time stamp and values
- Presentation of fault currents with characteristic and duration
- Reproduction of phase currents during the fault current surge
- Presentation of the phase voltages during the fault current surge

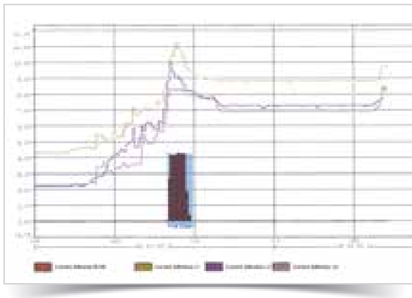


Fig.: Analysis of fault current events

Analysis of the harmonic fault current components

- Frequencies of the fault currents (fault type)
- Current peaks of the individual frequency components in A and %
- Harmonics analysis up to 40th harmonic
- Maximum values with real-time bar display

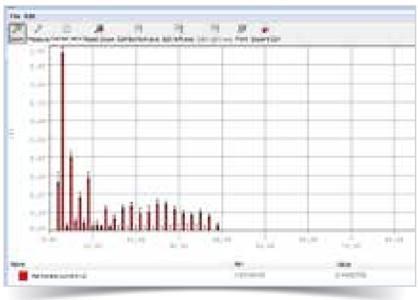


Fig.: Analysis of the harmonic fault current components

Digital IOs

- Extensive configuration of IOs for intelligent integration, alarm and control tasks

Ethernet (TCP/IP)- / Homepage- / Ethernet-Modbus gateway functionality

- Simple integration into the network
- More rapid and reliable data transfer
- Modern homepage
- World-wide access to measured values by means of standard web browsers via the device's inbuilt homepage
- Access to measurement data via various channels
- Reliable saving of measurement data possible over a very long periods of time in the 256 MByte measurement data memory
- Connection of Modbus slave devices via Ethernet-Modbus gateway

Fig.: Ethernet-Modbus gateway functionality

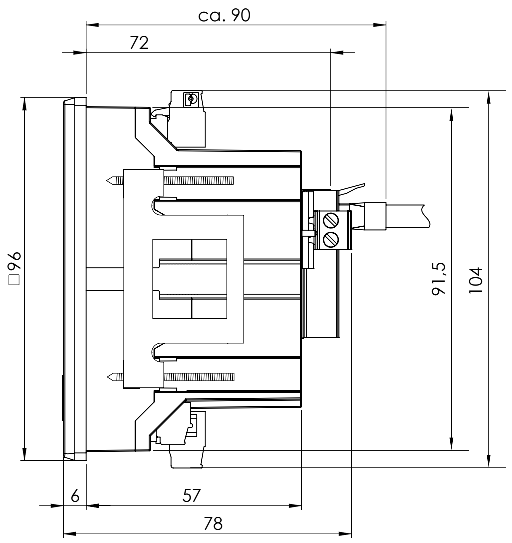
Measuring device homepage

- Webserver on the measuring device, i.e. device's own homepage
- Remote operation of the device display via the homepage
- Comprehensive measurement data incl. PQ
- Online data directly available via the homepage, historic data optional via the APP measured value monitor, 51.00.246

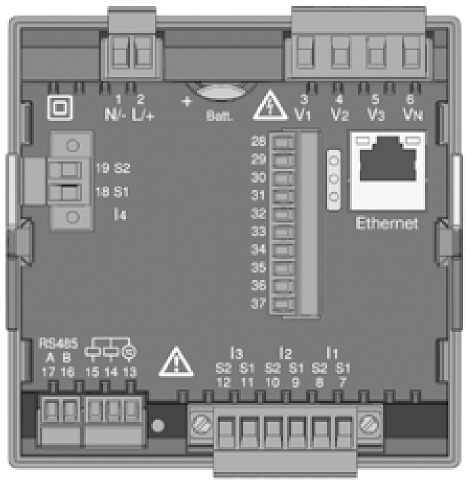
Fig.: Illustration of the online data via the device's inbuilt homepage

Dimension diagrams

All dimensions in mm



Side view



Rear view

Cut out: 92$^{+0,8}$ x 92$^{+0,8}$ mm

Typical connection

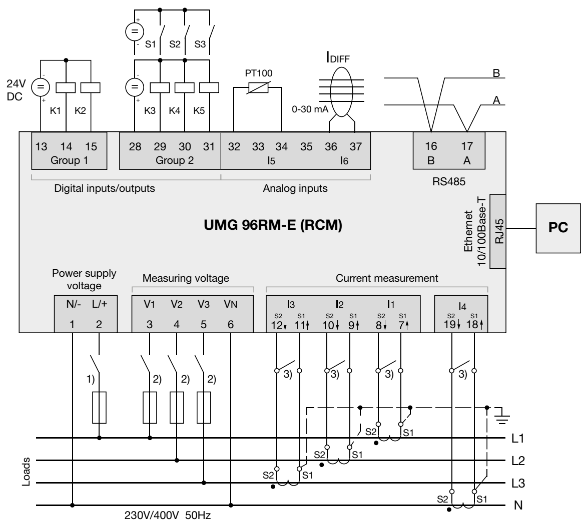


Fig.: Connection example with temperature and residual current measurement

Device overview and technical data

	UMG 96RM-E*1
Item number (90–277 V AC / 90–250 V DC)	**52.22.062**
Item number (24–90 V AC / 24–90 V DC)	**52.22.063**
BACnet communication	52.22.081
General	
Use in low and medium voltage networks	•
Accuracy voltage measurement	0.2 %
Accuracy current measurement	0.2 %
Accuracy active energy (kWh, …/5 A)	Class 0.5S
Number of measurement points per period	426
Uninterrupted measurement	•
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power / total and per phase	•
Power factor / total and per phase	•
Energy measurement	
Active, reactive and apparent energy [L1, L2, L3, ∑ L1–L3]	•
Number of tariffs	14
Recording of the mean values	
Voltage, current / actual and maximum	•
Active, reactive and apparent power / actual and maximum	•
Frequency / actual and maximum	•
Demand calculation mode (bi-metallic function) / thermal	•

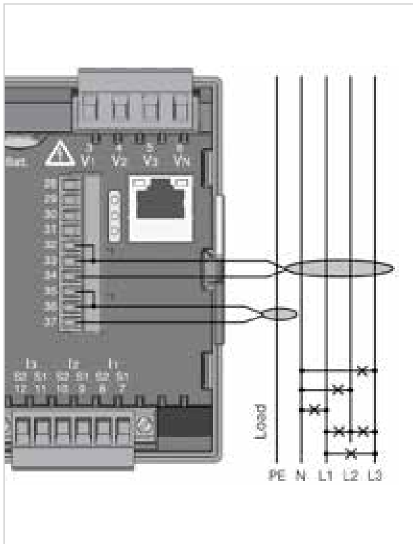


Fig.: Connection example residual current measurement and PE monitoring

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

*1 Inclusive UL certification.

Other measurements	
Operating hours measurement	•
Clock	•
Power quality measurements	
Harmonics per order / current and voltage	1st – 40th
Distortion factor THD-U in %	•
Distortion factor THD-I in %	•
Rotary field indication	•
Current and voltage, positive, zero and negative sequence component	•
Error / event recorder function	•
Under and overvoltage recording	•
Measured data recording	
Memory (Flash)	256 MB
Average, minimum, maximum values	•
Current measurement channel	4 (+2)
Alarm messages	•
Time stamp	•
Time basis average value	freely user-defined
RMS averaging, arithmetic	•
Displays and inputs / outputs	
LCD display (with backlighting), 2 buttons	•
Digital outputs (as switch or pulse output)	2
Digital inputs and outputs (selectable)	3
Analogue inputs (RCM, temperature, analogue)	2
Voltage inputs	L1, L2, L3 + N
Password protection	•
Communication	
Interfaces	
RS485: 9.6 – 115.2 kbps (Screw-type terminal)	•
Ethernet 10/100 Base-TX (RJ-45 socket)	•
Protocols	
Modbus RTU	•
Modbus TCP/IP	•
Modbus RTU over Ethernet	•
Modbus Gateway for Master-Slave configuration	•
HTTP (homepage configurable)	•
SMTP (email)	•
NTP (time synchronisation)	•
TFTP	•
FTP (File-Transfer)	•
SNMP	•
DHCP	•
BACnet (optional)	•
ICMP (Ping)	•
Software GridVis®-Basic*2	
Online and historic graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports (energy, power quality)	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Programming / threshold values / alarm management	
Comparator (5 Groups with 10 comparators each)	•
Comprehensive adjustment options for RCM	•

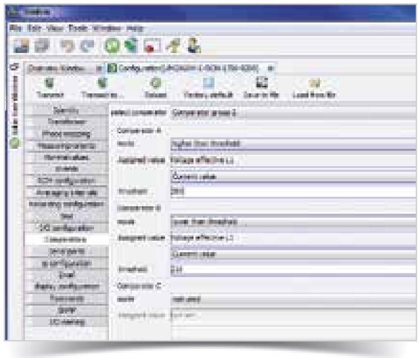


Fig.: GridVis® software, configuration menu

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included   - = not included

*2 Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.

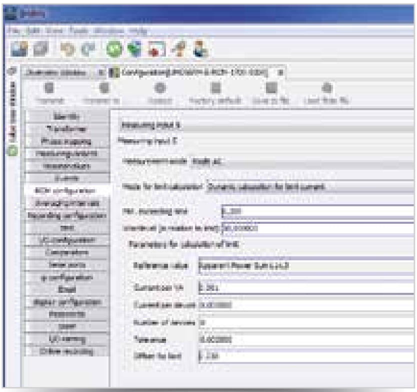


Fig.: RCM configuration, e.g. dynamic threshold value formation, for load-dependent threshold value adaptation

Fig.: Residual current transformer for the acquisition of residual currents. Wide range with different configurations and sizes allow use in almost all applications

Technical data	
Type of measurement	Constant true RMS Up to 40th harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	277 / 480 V AC
Nominal voltage, three-phase, 3-conductor (L-L)	480 V AC
Measurement in quadrants	4
Networks	TN, TT, IT
Measured voltage input	
Overvoltage category	300 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	10 ... 300 Vrms
Measured range, voltage L-L, AC (without potential transformer)	18 ... 520 Vrms
Resolution	0.01 V
Impedance	4 MOhm / phase
Frequency measuring range	45 ... 65 Hz
Power consumption	approx. 0.1 VA
Sampling frequency per channel (50 / 60 Hz)	21.33 / 25.6 kHz
Measured current input	
Rated current	1 / 5 A
Resolution	0.1 mA
Measurement range	0.001 ... 6 Amps
Overvoltage category	300 V CAT II
Measurement surge voltage	2 kV
Power consumption	approx. 0.2 VA (Ri = 5 mOhm)
Overload for 1 sec.	120 A (sinusoidal)
Sampling frequency per channel (50 / 60 Hz)	21.33 / 25.6 kHz
Residual current input	
Analogue inputs	2 (for residual current or temperature measurement)
Measurement range, residual current input*3	0.05 ... 30 mA
Digital outputs	
Switching voltage	max. 60 V DC, 33 V AC
Switching current	max. 50 mA Eff AC / DC
Response time	10 / 12 periods + 10 ms
Pulse output (energy pulse)	max. 50 Hz
Maximum cable length	up to 30 m unscreened, from 30 m screened
Mechanical properties	
Weight	approx. 370 g
Device dimensions in mm (H x W x D)*4	96 x 96 x 78
Battery	CR2032, 3 V,type Lithium
Protection class per EN 60529	Front: IP40; Front with seal: IP54; Back: IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	Front panel installation
Cable cross section	
Supply voltage	0.2 to 2.5 mm²
Current measurement	0.2 to 2.5 mm²
Voltage measurement	0.08 to 4.0 mm²
Environmental conditions	
Temperature range	Operation: K55 (-10 ... +70 °C)
Relative humidity	Operation: 0 to 75 % RH
Operating height	0 ... 2,000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

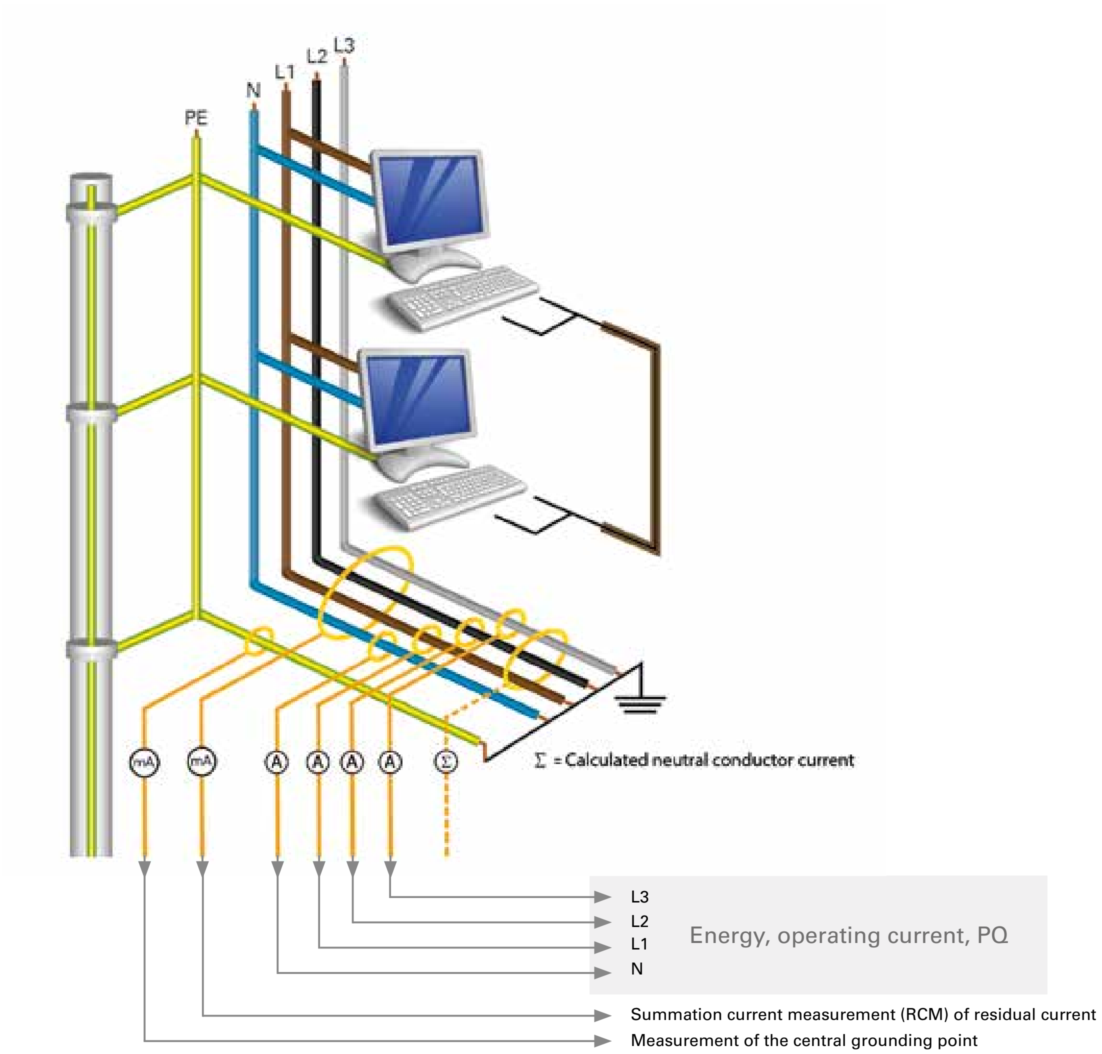
*3 Example of residual current input 30 mA with 600/1 residual current transformer: 600 x 30 mA = 18,000 mA

*4 Accurate device dimensions can be found in the operation manual.

Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Class A: Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class B: Residential environment	IEC/EN 61326-1
Radio disturbanc voltage strength 30 – 1000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Safety	
Europe	CE labelling
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included   - = not included



Janitza®

ISO 50001
Made in Germany

UMG 508 – Multifunction power analyser

Communication
- Profibus (DP/V0)
- Modbus (RTU, TCP, Gateway)
- TCP/IP
- BACnet (optional)
- HTTP (Homepage)
- FTP (File transfer)
- SNMP
- TFTP
- NTP (time synchronisation)
- SMTP (email function)
- DHCP

Interfaces
- Ethernet
- Profibus / RS485 (DSUB-9)

Accuracy of measurement
- Energy: Class 0.2S (… / 5 A)
- Current: 0.2 %
- Voltage: 0.1 %

Power quality
- Harmonics up to 40th harmonic
- Short-term interruptions (> 20 ms)
- Transient recorder (> 50 µs)
- Starting currents (> 20 ms)
- Unbalance
- Full wave effective value recording (up to 4.5 min.)

Networks
- IT, TN, TT networks
- 3 and 4-phase networks
- Up to 4 single-phase networks

Measured data memory
- 256 MByte Flash
- 32 MB SDRAM

PLC functionality
- Graphical programming
- Jasic® programming language
- Programming of threshold values etc.

8 digital inputs
- Pulse input
- Logic input
- State monitoring
- HT / LT switching

5 digital outputs
- Pulse output kWh / kvarh
- Switch output
- Threshold value output
- Logic output

Peak demand management (optional)
- Up to 64 switch-off stages

Network visualisation software
- Free GridVis®-Basic

Areas of application

- Continuous monitoring of the power quality
- Energy management systems (ISO 50001)
- Master device with Ethernet gateway for subordinate measurement points
- Visualisation of the energy supply in the LVDB
- Analysis of electrical disturbances in the event of power quality problems
- Cost centre analysis
- Remote monitoring in the property operation
- Use in test fields (e.g. in universities)

Main features

High quality measurement with high sampling rate (20 kHz per channel)

Power quality

- Harmonics analysis up to 40th harmonic
- Acquisition of short-term interruptions
- Acquisition of transients
- Display of waveforms (current and voltage)
- Unbalance
- Vector diagram

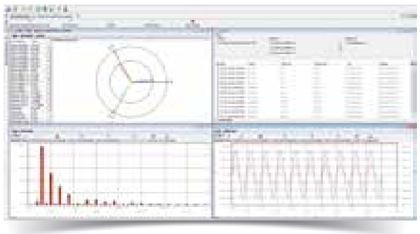


Fig.: GridVis® – Graph set

User-friendly, colour graphical display with intuitive user guidance

- High resolution graphics display
- User-friendly, self-explanatory and intuitive operation
- Clear and informative representation of online graphs and further power quality events

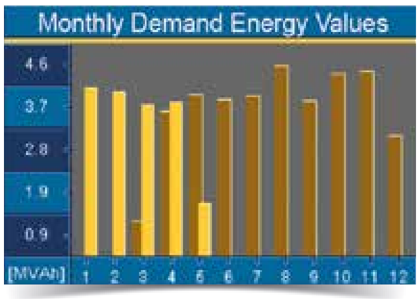


Fig.: Large colour display, e.g. 12 monthly demand values

Modern communications architecture via Ethernet

- Ethernet interface and web server
- Faster, better cost-optimised and more reliable communication system
- High flexibility due to the use of open standards
- Integration in PLC systems and BMS through additional interfaces
- BACnet optionally available

Modbus Gateway function

- Economical connection of devices without Ethernet interface
- Integration of devices with Modbus-RTU interface possible
- Data can be scaled and described
- Minimised number of IP addresses required

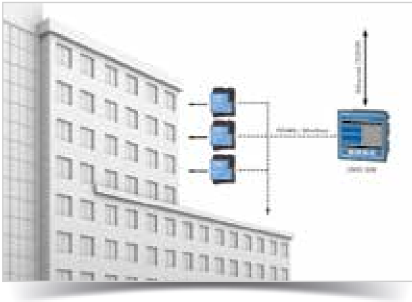


Fig.: GridVis® topology view

Graphical programming

- Comprehensive programming options (PLC functionality)
- Jasic® source code programming
- Sustainable functional expansions far beyond pure measurement
- Complete APPs from the Janitza library

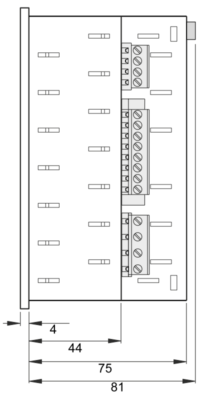
Powerful alarm management

- Can be programmed via the graphic programming or Jasic® source code
- All measured values can be used
- Can be arbitrarily, mathematically processed
- Individual forwarding via email sending, switching of digital outputs, writing to Modbus addresses etc.
- Watchdog APP
- Further alarm management functions via GridVis®-Service alarm management

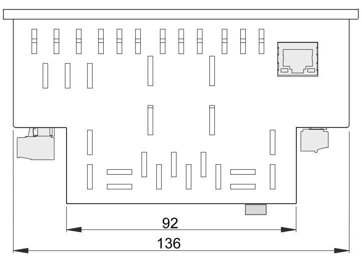
Fig.: The alarm management system reports events arising in good time.

Dimension diagrams

All dimensions in mm



Side view

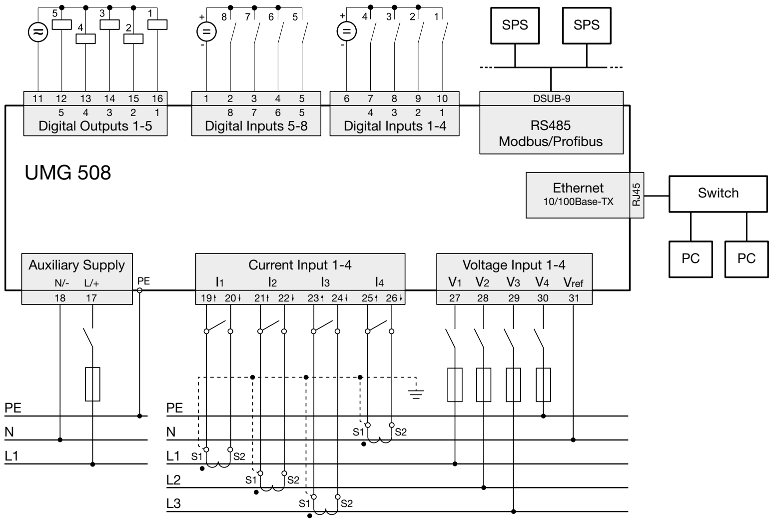


View from below

Ethernet connection

Cut out: $138^{+0,8}$ x $138^{+0,8}$ mm

Typical connection



Device overview and technical data

	UMG 508	
Item number	**52.21.001**	**52.21.002**
Supply voltage AC	95 ... 240 V AC	44 ... 130 V AC
Supply voltage DC	80 ... 340 V DC	48 ... 180 V DC
Item number (UL)	**52.21.011**	**52.21.012**
Supply voltage AC	95 ... 240 V AC	44 ... 130 V AC
Supply voltage DC	80 ... 280 V DC	48 ... 180 V DC
Device options		
BACnet communication	**52.21.081**	**52.21.081**

General	
Use in low, medium and high voltage networks	•
Accuracy voltage measurement	0.1 %
Accuracy current measurement	0.2 %
Accuracy active energy (kWh, .../5 A)	Class 0.2S
Number of measurement points per period	400
Uninterrupted measurement	•
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power / total and per phase	•
Power factor / total and per phase	•
Energy measurement	
Active, reactive and apparent energy [L1, L2, L3, L4, ∑ L1–L3, ∑ L1–4]	•
Number of tariffs	8
Recording of the mean values	
Voltage, current / actual and maximum	•
Active, reactive and apparent power / actual and maximum	•
Frequency / actual and maximum	•
Demand calculation mode (bi-metallic function) / thermal	•
Other measurements	
Operating hours measurement	•
Clock	•
Weekly timer	Jasic®
Power quality measurements	
Harmonics per order / current and voltage	1st – 40th
Harmonics per order / active and reactive power	1st – 40th

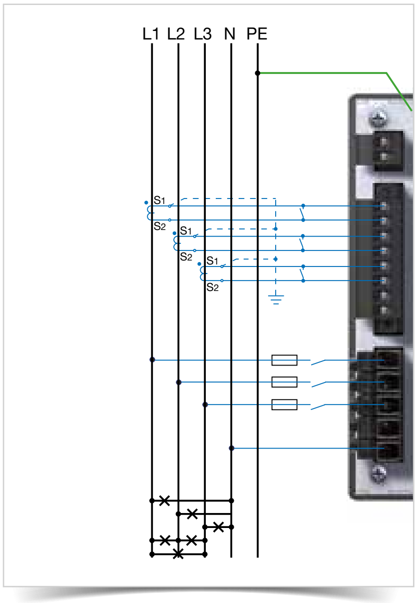


Fig.: Current and voltage measurement

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list

• = included - = not included

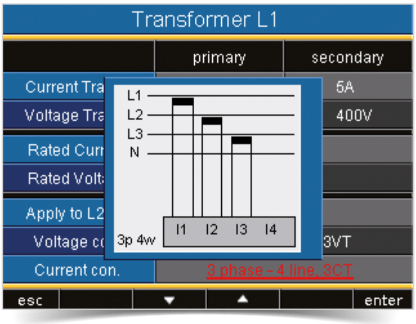


Fig.: Example for the configuration of current measurement via 3 current transformers in a three-phase 4-wire network on the UMG 508 display

Fig.: Illustration of the full wave effective values for an event

Distortion factor THD-U in %	•
Distortion factor THD-I in %	•
Voltage unbalance	•
Rotary field indication	•
Current and voltage, positive, zero and negative sequence component	•
Transients	> 50 µs
Error / event recorder function	•
Short-term interruptions	20 ms
Oscillogram recording (waveform U and I)	•
Full wave effective values (U, I, P, Q)	•
Under and overvoltage recording	•
Measured data recording	
Memory (Flash)	256 MB
Average, minimum, maximum values	•
Measured data channels	8
Alarm messages	•
Time stamp	•
Time basis average value	freely user-defined
RMS averaging, arithmetic	•
Displays and inputs / outputs	
LCD colour graphical display 320 x 240, 256 colours, 6 buttons	•
Language selection	•
Digital inputs	8
Digital outputs (as switch or pulse output)	5
Voltage and current inputs	each 4
Password protection	•
Peak load management (optionally 64 channels)	•
Communication	
Interfaces	
RS485: 9.6 – 921.6 kbps (DSUB-9 connector)	•
Profibus DP: Up to 12 Mbps (DSUB-9-plug)	•
Ethernet 10/100 Base-TX (RJ-45 socket)	•
Protocols	
Modbus RTU, Modbus TCP, Modbus RTU over Ethernet	•
Modbus Gateway for Master-Slave configuration	•
Profibus DP V0	•
HTTP (homepage configurable)	•
SMTP (email)	•
NTP (time synchronisation)	•
TFTP	•
FTP (File-Transfer)	•
SNMP	•
DHCP	•
TCP/IP	•
BACnet (optional)	•
ICMP (Ping)	•
Software GridVis®-Basic*1	
Online and historic graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports (energy, power quality)	•
Graphical programming	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Programming / threshold values / alarm management	
Application programs freely programmable	7
Graphical programming	•
Programming via source code Jasic®	•

Technical data	
Type of measurement	Constant true RMS Up to 40th harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	417 / 720 V AC *2
Nominal voltage, three-phase, 3-conductor (L-L)	600 V AC
Measurement in quadrants	4
Networks	TN, TT, IT
Measurement in single-phase/multi-phase networks	1 ph, 2 ph, 3 ph, 4 ph and up to 4 times 1 ph
Measured voltage input	
Overvoltage category	600 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	10 ... 600 Vrms

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

*1 Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.

*2 With UL variants: 347/600 V

Measured range, voltage L-L, AC (without potential transformer)	18 ... 1000 Vrms
Resolution	0.01 V
Impedance	4 MOhm / phase
Frequency measuring range	40 ... 70 Hz
Power consumption	approx. 0.1 VA
Sampling frequency	20 kHz / phase
Measured current input	
Rated current	1 / 5 A
Resolution	0.1 mA
Measurement range	0.001 ... 8.5 Amps
Overvoltage category	300 V CAT III
Measurement surge voltage	4 kV
Power consumption	approx. 0.2 VA (Ri = 5 MOhm)
Overload for 1 sec.	120 A (sinusoidal)
Sampling frequency	20 kHz
Digital inputs and outputs	
Number of digital inputs	8
Maximum counting frequency	20 Hz
Reaction time (Jasic® program)	200 ms
Input signal present	18 ... 28 V DC (typical 4 mA)
Input signal not present	0 ... 5 V DC, current < 0.5 mA
Number of digital outputs	5
Switching voltage	max. 60 V DC, 30 V AC
Switching current	max. 50 mA Eff AC / DC
Output of voltage dips	20 ms
Pulse output (energy pulse)	max. 20 Hz
Maximum cable length	up to 30 m unscreened, from 30 m screened
Mechanical properties	
Weight	1080 g
Device dimensions in mm (H x W x D)	144 x 144 x approx. 81
Battery	Type CR1/2AA, 3 V, Li-Mn
Protection class per EN 60529	Front: IP40; Rear: IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	Front panel installation
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	 0.2 to 2.5 mm² 0.2 to 2.5 mm²
Environmental conditions	
Temperature range	Operation: K55 (-10 ... +55 °C)
Relative humidity	Operation: 0 ... 75 % RH
Operating height	0 ... 2,000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Class A: Industrial environment	IEC/EN 61326-1, EMV-ILA Version 01-03
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11, EMV-ILA V01-03
Emissions	
Class B: Residential environment	IEC/EN 61326-1, EMV-ILA Version 01-03
Radio disturbanc voltage strength 30 – 1000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 9 – 150 kHz	EMV-ILA V01-03
Safety	
Europe	CE labelling
USA and Canada	UL variants available
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com

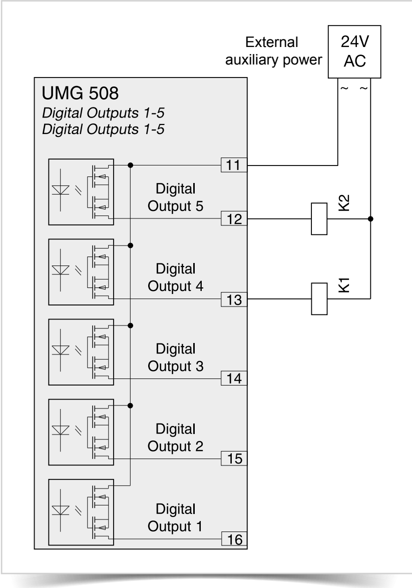


Fig.: Connection of two electronic relays to digital outputs 4 and 5

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

Power quality

Ethernet connection

Graphic programming

Residual current monitoring

Ethernet-Modbus gateway

Alarm management

ISO 50001
Made in Germany

UMG 509-PRO – Multifunction power analyser with RCM

Communication
- Profibus (DP/V0)
- Modbus (RTU, TCP, Gateway)
- TCP/IP
- BACnet (optional)
- HTTP (Homepage)
- FTP (File transfer)
- SNMP
- TFTP
- NTP (time synchronisation)
- SMTP (email function)
- DHCP

Interfaces
- Ethernet
- Profibus (DSUB-9)
- RS485 Modbus (terminal strip)

Accuracy of measurement
- Energy: Class 0.2S (… / 5 A)
- Current: 0.2 %
- Voltage: 0.1 %

Power quality
- Harmonics up to 63th harmonic
- Short-term interruptions (> 20 ms)
- Transient recorder (> 50 µs)
- Starting currents (> 20 ms)
- Unbalance

Networks
- IT, TN, TT networks
- 3 and 4-phase networks
- Up to 4 single-phase networks

Measured data memory
- 256 MByte Flash
- 32 MB SDRAM

PLC functionality
- Graphical programming
- Jasic® programming language
- Programming of threshold values etc.

2 digital inputs
- Pulse input
- Logic input
- State monitoring
- HT / LT switching

2 digital outputs
- Pulse output kWh / kvarh
- Switch output
- Threshold value output
- Logic output

Network visualisation software
- Free GridVis®-Basic

Thermistor input
- PT100, PT1000, KTY83, KTY84

RCM – Residual Current Monitoring
- 2 residual current inputs

Areas of application

- Continuous monitoring of the power quality
- Energy management systems (ISO 50001)
- Master device with Ethernet gateway for subordinate measurement points
- Visualisation of the energy supply in the LVDB
- Analysis of electrical disturbances in the event of power quality problems
- Cost centre analysis
- Remote monitoring in the property operation
- Use in test fields (e.g. in universities)

Main features

High quality measurement with high sampling rate (20 kHz per channel)

Power quality

- Harmonics analysis up to 63rd harmonic
- Acquisition of short-term interruptions
- Acquisition of transients
- Display of waveforms (current and voltage)
- Unbalance
- Vector diagram

RCM (Residual Current Monitoring)

- Continuous monitoring of residual currents (Residual Current Monitor, RCM)
- Alarming in case a preset threshold fault current reached
- Near-realtime reactions for triggering countermeasures
- Permanent RCM measurement for systems in permanent operation without the opportunity to switch off
- Ideal for the central earthing point in TN-S systems

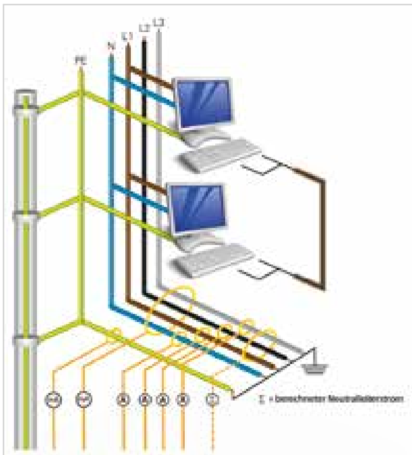


Fig.: Example RCM measurement

Modern communications architecture via Ethernet

- Ethernet interface and web server
- Faster, better cost-optimised and more reliable communication system
- High flexibility due to the use of open standards
- Integration in PLC systems and BMS through additional interfaces
- BACnet optionally available
- Up to 4 ports simultaneous
- Versatile IP protocols

Modbus Gateway function

- Economical connection of devices without Ethernet interface
- Integration of devices with Modbus-RTU interface possible
- Data can be scaled and described
- Minimised number of IP addresses required

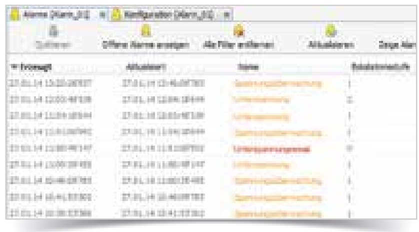


Fig.: GridVis® – Alarmmanagement

Graphical programming

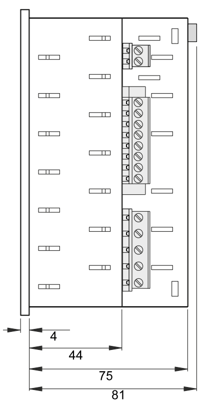
- Comprehensive programming options (PLC functionality)
- Jasic® source code programming
- Sustainable functional expansions far beyond pure measurement
- Complete APPs from the Janitza library

Powerful alarm management

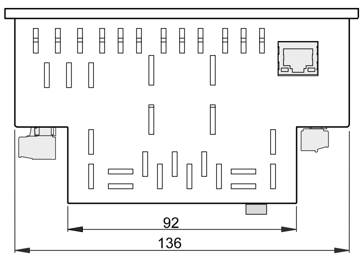
- Can be programmed via the graphic programming or Jasic® source code
- All measured values can be used
- Can be arbitrarily, mathematically processed
- Individual forwarding via email sending, switching of digital outputs, writing to Modbus addresses etc.
- Watchdog APPs
- Further alarm management functions via GridVis®-Service alarm management

Dimension diagrams

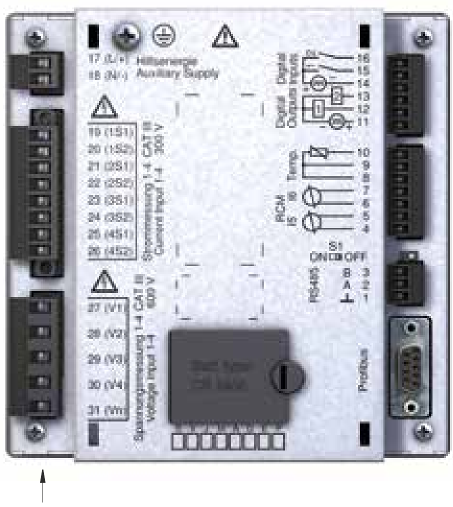
All dimensions in mm



Side view



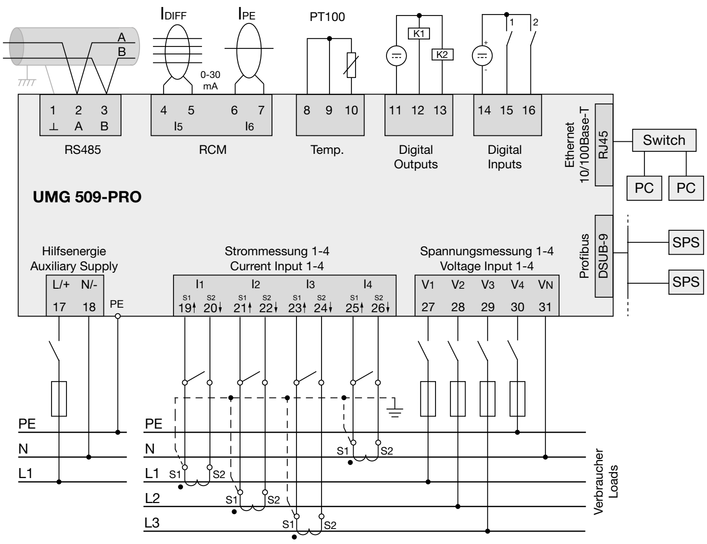
View from below



Ethernet connection

Cut out: 138+0,8 x 138+0,8 mm

Typical connection



Device overview and technical data

	UMG 509-PRO	
Item number	**52.26.001**	**52.26.003**
Supply voltage AC	95 ... 240 V AC	48 ... 110 V AC
Supply voltage DC	80 ... 300 V DC	24 ... 150 V DC
Device options		
BACnet communication	**52.26.081**	**52.26.081**
General		
Use in low, medium and high voltage networks		•
Accuracy voltage measurement		0.1 %
Accuracy current measurement		0.2 %
Accuracy active energy (kWh, …/5 A)		Class 0.2S
Number of measurement points per period		400
Uninterrupted measurement		•
RMS - momentary value		
Current, voltage, frequency		•
Active, reactive and apparent power / total and per phase		•
Power factor / total and per phase		•
Energy measurement		
Active, reactive and apparent energy [L1, L2, L3, L4, ∑ L1–L3, ∑ L1–4]		•
Number of tariffs		8
Recording of the mean values		
Voltage, current / actual and maximum		•
Active, reactive and apparent power / actual and maximum		•
Frequency / actual and maximum		•
Demand calculation mode (bi-metallic function) / thermal		•
Other measurements		
Operating hours measurement		•
Clock		•
Weekly timer		Jasic®
Power quality measurements		
Harmonics per order / current and voltage		1st – 63rd
Harmonics per order / active and reactive power		1st – 63rd
Distortion factor THD-U in %		•
Distortion factor THD-I in %		•

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list

• = included   - = not included

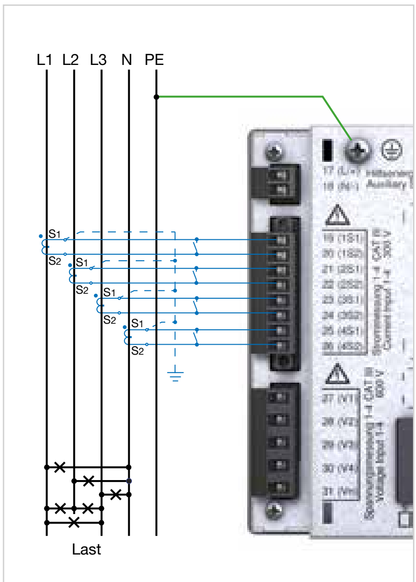


Fig.: Example current measurement

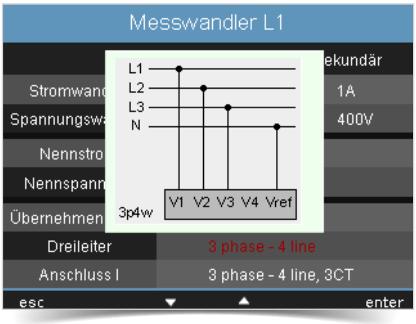


Fig.: Example for the configuration of current measurement via 3 current transformers in a three-phase 4-wire network on the UMG 509-PRO display

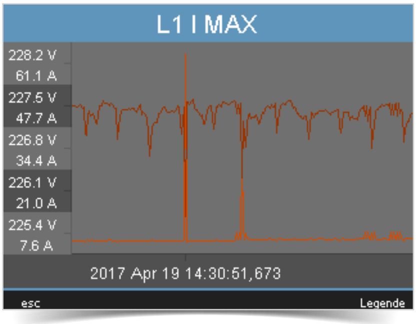


Fig.: Illustration of the full wave effective values for an event (voltage drop)

Voltage unbalance	•
Rotary field indication	•
Current and voltage, positive, zero and negative sequence component	•
Transients	> 50 µs
Error / event recorder function	•
Short-term interruptions	20 ms
Oscillogram recording (waveform U and I)	•
Full wave effective values (U, I, P, Q)	•
Under and overvoltage recording	•
Measured data recording	
Memory (Flash)	256 MB
Average, minimum, maximum values	•
Measured data channels	10
Alarm messages	•
Time stamp	•
Time basis average value	freely user-defined
RMS averaging, arithmetic	•
Displays and inputs / outputs	
LCD colour graphical display 320 x 240, 256 colours, 6 buttons	•
Language selection	•
Digital inputs	2
Digital outputs (as switch or pulse output)	2
Voltage and current inputs	each 4
Residual current inputs	2
Temperature input	1
Password protection	•
Communication	
Interfaces	
RS485: 9.6 – 921.6 kbps (terminal board)	•
Profibus DP: Up to 12 Mbps (DSUB-9-plug)	•
Ethernet 10/100 Base-TX (RJ-45 socket)	•
Protocols	
Modbus RTU, Modbus TCP, Modbus RTU over Ethernet	•
Modbus Gateway for Master-Slave configuration	•
Profibus DP V0	•
HTTP (homepage configurable)	•
SMTP (email)	•
NTP (time synchronisation)	•
TFTP	•
FTP (File-Transfer)	•
SNMP	•
DHCP	•
TCP/IP	•
BACnet (optional)	•
ICMP (Ping)	•
Software GridVis®-Basic*1	
Online and historic graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports (energy, power quality)	•
Graphical programming	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Programming / threshold values / alarm management	
Application programs freely programmable	7
Graphical programming	•
Programming via source code Jasic®	•
Technical data	
Type of measurement	Constant true RMS Up to 63rd harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	417 / 720 V AC *2
Nominal voltage, three-phase, 3-conductor (L-L)	600 V AC
Measurement in quadrants	4
Networks	TN, TT, IT
Measurement in single-phase/multi-phase networks	1 ph, 2 ph, 3 ph, 4 ph and up to 4 times 1 ph
Measured voltage input	
Overvoltage category	600 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	10 … 600 Vrms

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

*1 Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.

*2 With UL variants: 347/600 V

Measured range, voltage L-L, AC (without potential transformer)	18 ... 1000 Vrms
Resolution	0.01 V
Impedance	4 MOhm / phase
Frequency measuring range	40 ... 70 Hz
Power consumption	approx. 0.1 VA
Sampling frequency	20 kHz / phase
Measured current input	
Rated current	1 / 5 A
Resolution	0.1 mA
Measurement range	0.001 ... 7 Amps
Overvoltage category	300 V CAT III
Measurement surge voltage	4 kV
Power consumption	approx. 0.2 VA (Ri = 5 MOhm)
Overload for 1 sec.	120 A (sinusoidal)
Sampling frequency	20 kHz
Residual current / Temperature inputs	
Residual current inputs	2
Measurement range, residual current inputs	0,05 ... 30 mA
Temperature input	1
Digital inputs and outputs	
Number of digital inputs	2
Maximum counting frequency	20 Hz
Reaction time (Jasic® program)	200 ms
Input signal present	18 ... 28 V DC (typical 4 mA)
Input signal not present	0 ... 5 V DC, current < 0.5 mA
Number of digital outputs	2
Switching voltage	max. 60 V DC, 30 V AC
Switching current	max. 50 mA Eff AC / DC
Output of voltage dips	20 ms
Pulse output (energy pulse)	max. 20 Hz
Maximum cable length	up to 30 m unscreened, from 30 m screened
Mechanical properties	
Weight	1080 g
Device dimensions in mm (H x W x D)	144 x 144 x approx. 81
Battery	Type CR2450, 3 V, Li-Mn
Protection class per EN 60529	Front: IP40; Rear: IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	Front panel installation
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	0.2 to 2.5 mm² 0.2 to 2.5 mm²
Environmental conditions	
Temperature range	Operation: K55 (-10 ... +55 °C)
Relative humidity	Operation: 0 ... 75 % RH
Operating height	0 ... 2,000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Class A: Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class B: Residential environment	IEC/EN 61326-1
Radio disturbanc voltage strength 30 – 1000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Safety	
Europe	CE labelling
USA and Canada	UL variants available
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com

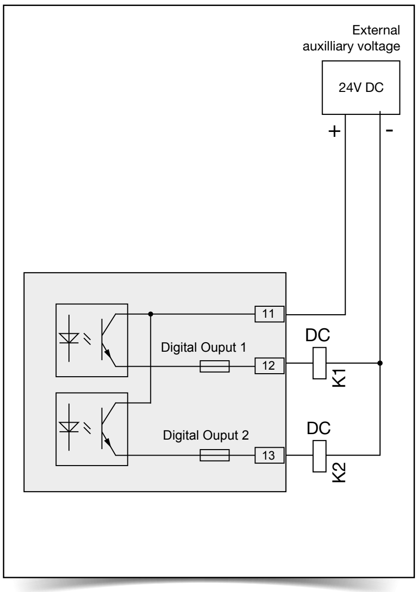


Fig. Example for two electronical relays connected to the digital outputs

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included   - = not included

UMG 511 – Class A power quality analyser

Communication
- Profibus (DP/V0)
- Modbus (RTU, TCP, Gateway)
- TCP/IP
- BACnet (optional)
- HTTP (configurable homepage)
- FTP (file transfer)
- TFTP
- NTP (time synchronisation)
- SMTP (email function)
- DHCP
- SNMP

Interfaces
- Ethernet
- Profibus / RS485 (DSUB-9)

Accuracy of measurement
- Energy: Class 0.2S (... / 5 A)
- Current: 0.2 %
- Voltage: 0.1 %

Power quality acc. Class A
- Harmonics up to the 63rd harmonic
- Flicker measurement
- Short-term interruptions (> 20 ms)
- Transient recorder (> 50 µs)
- Starting currents (> 10 ms)
- Unbalance
- Half wave RMS recordings (up to 4.5 min.)

Networks
- IT, TN, TT networks
- 3 and 4-phase networks

Measured data memory
- 256 MByte Flash

Programming language
- Graphical programming
- Jasic®
- PLC functionality

8 digital inputs
- Pulse input
- Logic input
- State monitoring
- HT / LT switching

5 digital outputs
- Pulse output kWh / kvarh
- Switch output
- Threshold value output
- Logic output

(expandable via external I/O modules)

Peak demand management (optional)
- Up to 64 switch-off stages

Network visualisation software
- Free GridVis®-Basic
- PQ Report Generator

Areas of application

- Continuous monitoring of the power quality
- Harmonics analysis with power quality problems
- Checking the internal supply network according to EN 61000-4-7, EN 6100-4-15, EN 61000-4-30
- Fault analysis in case of problems with the energy supply
- Documentation of the power quality for customers and regulatory authorities
- Ethernet Gateway for subordinate measurement points
- Report generator for power quality standards: EN 50160, IEE519, ITIC ...
- Report generator for energy consumptions
- Energy Dashboard
- Remote monitoring of critical processes

Main features

Power quality

- Harmonics analysis up to the 63rd harmonic, even / odd (U, I, P, Q)
- Interharmonics (U, I)
- Distortion factor THD-U / THD-I / TDD
- Measurement of positive, negative and zero sequence component
- Unbalance
- Direction of rotation field
- Voltage crest factor
- Flicker measurement in accordance with DIN EN 61000-4-15
- Logging and storage of transients (> 50 µs)
- Short-term interruptions (> 20 ms)
- Monitoring start-up processes


Certificate of Conformity
IEC 61000-4-30 Class A
Janitza UMG511

Fig.: UMG 511 Class A-certified

High quality measurement

- Constant true RMS measurement
- Measurement process in accordance with IEC 61000-4-30
- Certified accuracy of measurement according to class A
- Continuous sampling of the voltage and current measurement inputs at 20,000 Hz
- 400 measurement points per period
- Recording of over 2,000 measured values per measurement cycle
- Accuracy of active energy measurement: Class 0.2S
- Fast measurement even enables the logging of rapid transients from 50 µs
- Logging of currents and voltages (15 – 440 Hz)

User-friendly, colour graphical display with intuitive user guidance

- High resolution colour graphical display 320 x 240, 256 colours, 6 buttons
- User-friendly, self-explanatory and intuitive operation
- Backlight for optimum reading, even in darker environments
- Illustration of measured values in numeric form, as a bar graph or line graph
- Clear and informative representation of online graphs and power quality events
- Multilingual: German, English, Russian, Spanish, Chinese, French, Japanese, Turkish ...

Fig.: Transients list

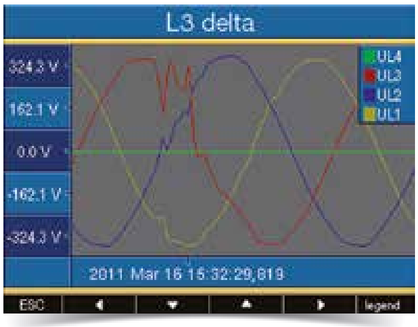


Fig.: Graphical representation of a transient

Various characteristics

- 4 voltage and 4 current measurement inputs, i.e. logging of N and / or PE possible
- 8 digital inputs, e.g. as data logger for S0 meter
- 5 digital outputs for alarm message or e.g. for connection to a BMS or PLC
- Free name assignment for the digital IOs, e.g. if used as data logger

Comprehensive communication and connection possibilities

- Modbus
- Profibus
- Ethernet (TCP/IP)
- Digital IOs
- BACnet (optional)
- Configurable Firewall

Modern communications architecture via Ethernet

- Simple integration in an Ethernet network
- Reliable and cost-optimised establishment of communication
- Ideal for Master-Slave structures
- High flexibility due to the use of open standards
- Integration in PLC systems and BMS through additional interfaces
- Various IP protocols: SNMP, ICMP (Ping), NTP, FTP ...

Measuring device homepage

- Web server on the measuring device, i.e. device's inbuilt homepage
- Function expansion possible through APPs
- Remote operation of the device display via the homepage
- Comprehensive measurement data incl. PQ (transients, events…)
- Online data directly available via the homepage, historic data optional via the APP measured value monitor, 51.00.245

Fig.: Illustration of the historic data via the homepage

BACnet protocol for building communication

- Optimal interoperability between devices from various manufacturers
- Predefined BIBBs (BACnet Interoperability Building Block)
- BACnet is optionally available with UMG 511
- UMG 511 supports the device type B-SA with the BIBBs DS-RP-B and DS-WP-B
- Furthermore, the BIBBs DS-COV-B and DM-UTC-B are also supported

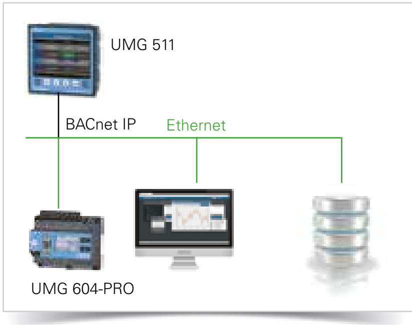


Fig.: BACnet topology

Modbus Gateway function

- Economical connection of subordinate measuring devices without Ethernet interface
- Integration of devices with Modbus-RTU interface possible (harmonisation of data format and function code necessary)
- Data can be scaled and described
- Minimised number of IP addresses required
- Tried and tested integrated solution without additional hardware

Programming / PLC functionality

- Further processing of the measurement data in the measuring device (local intelligence)
- Monitoring and alarm functions simple to program
- Sustainable functional expansions far beyond pure measurement
- Comprehensive programming options with
  - Jasic® source code programming
  - Graphical programming
- Complete APPs from the Janitza library

Large measurement data memory

- 256 MB data memory
- Memory range up to 2 years (configuration-dependent)
- Individually configurable recordings

- Recording averaging times can be freely selected
- PQ recordings template preconfigured for conventional standards (e.g. EN 50160)
- User-defined memory segmenting possible

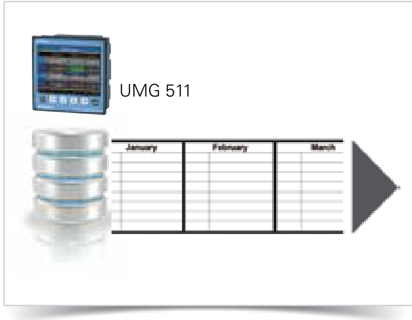


Fig.: Large measurement data memory

Powerful alarm management

- Information available immediately by email
- Inform maintenance personnel via the powerful device homepage
- Via digital outputs, Modbus addresses, GridVis® software
- Programming via Jasic® or graphical programming
- Further alarm management functions via GridVis®-Service alarm management

Fig.: GridVis® alarm management, alarm list (logbook)

Peak load representation and peak load management

- Illustration of the 3 highest monthly power peaks on the LCD display (P, Q, S)
- Rolling bar chart representation of the peak power values over 3 years on the LCD display (P, Q, S)
- Plain text representation on the LCD display (P)

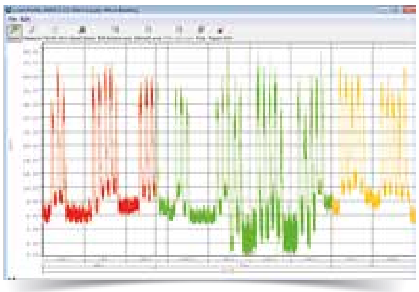


Fig.: GridVis® load profile, asic instrument for EnMS

GridVis®-Basic power quality analysis software

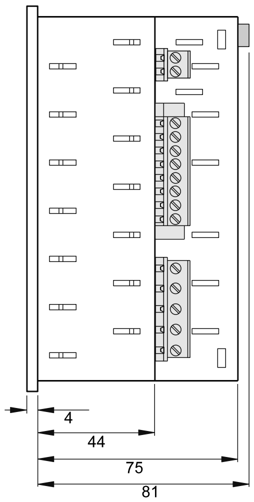
- Multilingual
- Manual read-out of the measuring devices
- Manual report generation (power quality and energy consumption reports)
- Comprehensive PQ analysis with individual graphs
  - Online graphs
  - Historic graphs
  - Graph sets
- Integrated databases (Janitza DB, Derby DB)
- Graphical programming
- Topology views
- High memory range

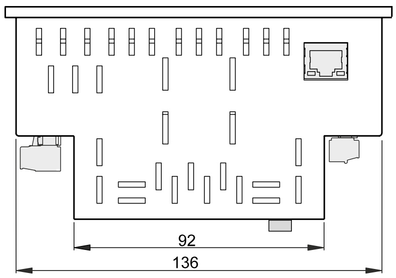
Certified quality through independent institutes

- ISO 9001
- Energy management certified according to ISO 50001
- Class A certificate (IEC 61000-4-30)
- UL certificate
- EMC-tested product

Dimension diagrams

All dimensions in mm





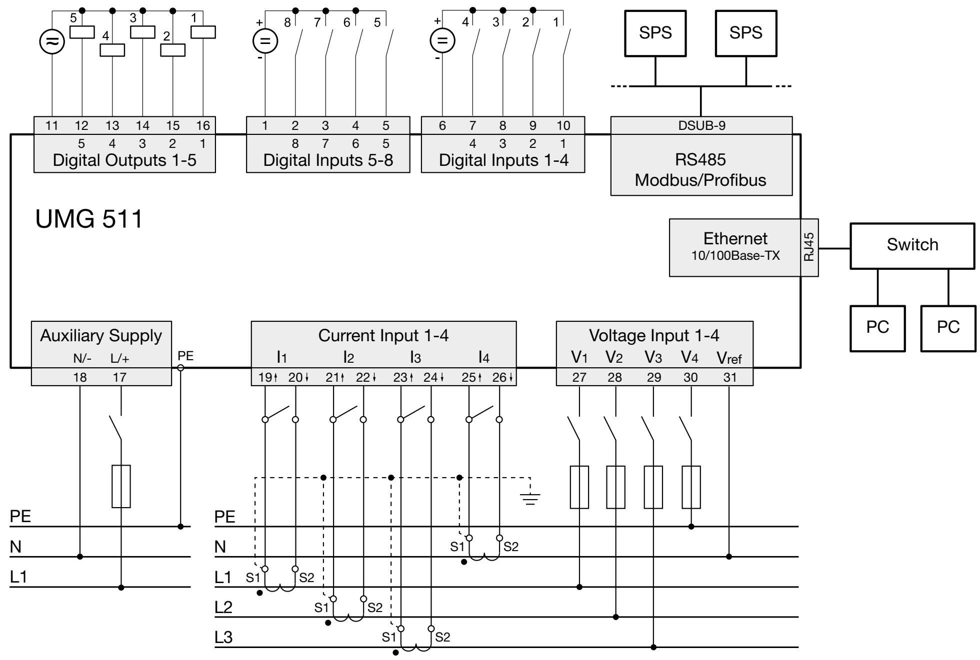
Side view

View from below

Rear view

Cut out: 138$^{+0,8}$ x 138$^{+0,8}$ mm

Typical connection



Device overview and technical data

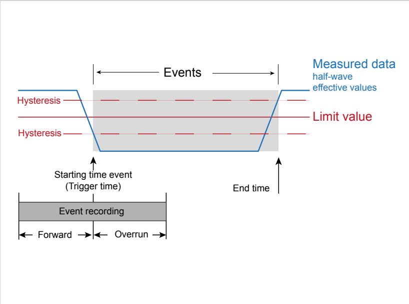


Fig.: The event record consists of a mean value, a minimum or maximum value, a start time and an end time.

	UMG 511	
Item number	**52.19.001**	**52.19.002**
Supply voltage AC	95 ... 240 V AC	44 ... 130 V AC
Supply voltage DC	80 ... 340 V DC	48 ... 180 V DC
Item number (UL)	**52.19.011**	**52.19.012**
Supply voltage AC	95 ... 240 V AC	44 ... 130 V AC
Supply voltage DC	80 ... 280 V DC	48 ... 180 V DC
Device options		
BACnet communication	**52.19.081**	**52.19.081**

General information	
Use in low, medium and high voltage networks	•
Accuracy voltage measurement	0.1 %
Accuracy current measurement	0.2 %
Accuracy active energy (kWh, .../5 A)	Class 0.2S
Number of measurement points per period	400
Seamless measurement	•
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power / total and per phase	•
Power factor / total and per phase	•
Energy measurement	
Active, reactive and apparent energy [L1, L2, L4, L3, ∑ L1–L3, ∑ L1–4]	•
Number of tariffs	8
Recording of the mean values	
Voltage, current / actual and maximum	•
Active, reactive and apparent power / actual and maximum	•
Frequency / actual and maximum	•
Demand calculation mode (bi-metallic function) / thermal	•
Other measurements	
Operating hours measurement	•
Clock	•
Weekly timer	Jasic®
Power quality measurements	
Harmonics per order / current and voltage	1st - 63rd
Harmonics per order / active and reactive power	1st - 63rd
Distortion factor THD-U in %	•
Distortion factor THD-I in %	•
Voltage unbalance	•
Current and voltage, positive, zero and negative sequence component	•
Flicker	•
Transients	> 50 µs
Error / event recorder function	•
Short-term interruptions	20 ms
Oscillogram function (wave form U and I)	•
Ripple voltage signal	•
Under and overvoltage recording	•
Measured data recording	
Memory (Flash)	256 MB
Average, minimum, maximum values	•
Measured data channels	8
Alarm messages	•
Time stamp	•
Time basis average value	freely user-defined
RMS averaging, arithmetic	•

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

Displays and inputs / outputs	
LCD colour graphical display 320 x 240, 256 colours, 6 buttons	•
Language selection	•
Digital inputs	8
Digital outputs (as switch or pulse output)	5
Voltage and current inputs	each 4
Password protection	•
Peak load management (optionally 64 channels)	•
Communication	
Interfaces	
RS485: 9.6 – 921.6 kbps (DSUB-9 connector)	•
Profibus DP: Up to 12 Mbps (DSUB-9 connector)	•
Ethernet 10/100 Base-TX (RJ-45 socket)	•
Protocols	
Modbus RTU, Modbus TCP, Modbus RTU over Ethernet	•
Modbus Gateway for Master-Slave configuration	•
Profibus DP V0	•
HTTP (homepage configurable)	•
SMTP (email)	•
NTP (time synchronisation)	•
TFTP	•
FTP (file transfer)	•
SNMP	•
DHCP	•
TCP/IP	•
BACnet (optional)	•
ICMP (Ping)	•
Software GridVis®-Basic*1	
Online and historic graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports (energy, power quality)	•
Graphical programming	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Programming / threshold values / alarm management	
Application programs freely programmable	7
Graphical programming	•
Programming via source code Jasic®	•

Technical data	
Type of measurement	Constant true RMS up to the 63rd harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	417 / 720 V AC *2
Nominal voltage, three-phase, 3-conductor (L-L)	600 V AC
Measurement in quadrants	4
Networks	TN, TT, IT
Measurement in single-phase/multi-phase networks	1 ph, 2 ph, 3 ph, 4 ph and up to 4 times 1 ph
Measured voltage input	
Overvoltage category	600 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	10 … 600 Vrms
Measured range, voltage L-L, AC (without potential transformer)	18 … 1000 Vrms
Resolution	0.01 V
Impedance	4 MOhm / phase
Frequency measuring range	15 … 440 Hz
Power consumption	approx. 0.1 VA
Sampling frequency	20 kHz / phase
Measured current input	
Rated current	1 / 5 A
Resolution	0.1 mA
Measurement range	0.001 … 8.5 Amps
Overvoltage category	300 V CAT III
Measurement surge voltage	4 kV
Power consumption	approx. 0.2 VA (Ri = 5 MOhm)
Overload for 1 sec.	120 A (sinusoidal)
Sampling frequency	20 kHz

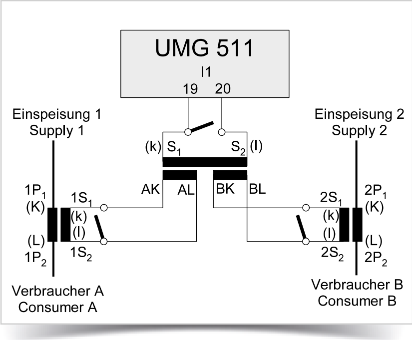


Fig.: Example, current measurement via a summation current transformer

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

*1 Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.
*2 With UL variants: 347/600 V

Digital inputs and outputs	
Number of digital inputs	8
Maximum counting frequency	20 Hz
Reaction time (Jasic® program)	200 ms
Input signal present	18 ... 28 V DC (typically 4 mA)
Input signal not present	0 ... 5 V DC, current < 0.5 mA
Number of digital outputs	5
Switching voltage	max. 60 V DC, 30 V AC
Switching current	max. 50 mA Eff AC / DC
Output of voltage dips	20 ms
Pulse output (energy pulse)	max. 20 Hz
Maximum cable length	up to 30 m unscreened, from 30 m screened
Mechanical properties	
Weight	1080 g
Device dimensions in mm (H x W x D)	144 x 144 x approx. 81
Battery	Type CR1/2AA, 3 V, Li-Mn
Protection class per EN 60529	Front: IP40; Rear: IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	Front panel installation
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	 0.2 to 2.5 mm² 0.25 to 2.5 mm²
Environmental conditions	
Temperature range	Operation: K55 (-10 ... +55 °C)
Relative humidity	Operation: 0 to 95 % RH
Operating height	0 ... 2,000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Class A: Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class B: Residential environment	IEC/EN 61326-1
Radio disturbanc voltage strength 30 – 1000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Safety	
Europe	CE labelling
USA and Canada	UL variants available
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

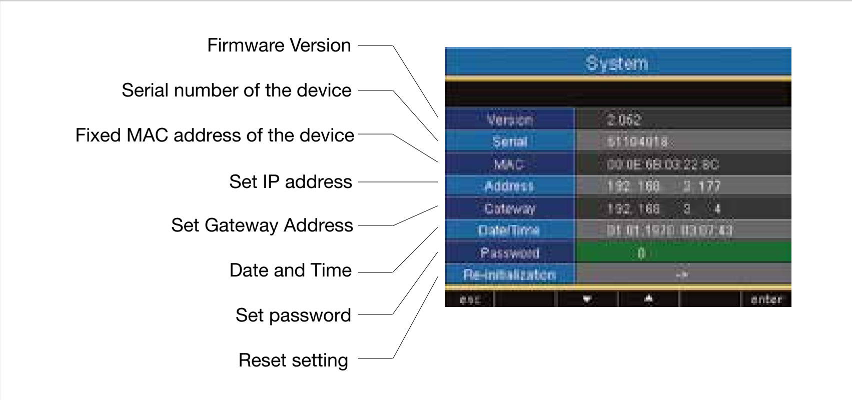
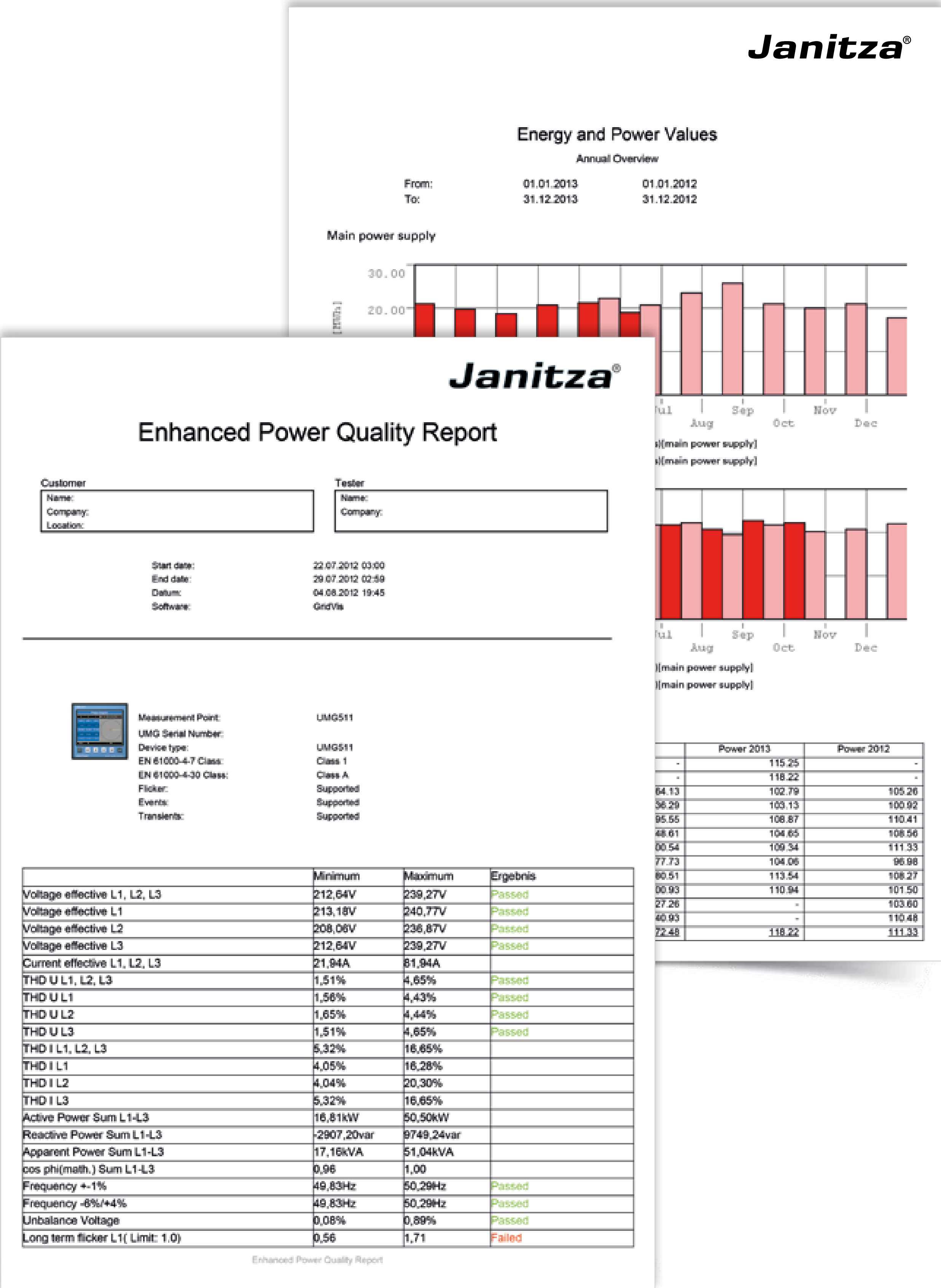


Fig.: User-friendly system of IP addresses, date, time and password



Janitza®

Energy and Power Values

Annual Overview

From: 01.01.2013 01.01.2012
To: 31.12.2013 31.12.2012

Main power supply

Power 2013	Power 2012
115.25	-
118.22	-
102.79	105.26
103.13	100.92
108.87	110.41
104.65	108.56
109.34	111.33
104.06	96.98
113.54	108.27
110.94	101.50
-	103.60
-	110.48
118.22	111.33

Janitza®

Enhanced Power Quality Report

Customer
Name:
Company:
Location:

Tester
Name:
Company:

Start date: 22.07.2012 03:00
End date: 29.07.2012 02:59
Datum: 04.08.2012 19:45
Software: GridVis

Measurement Point: UMG511
UMG Serial Number:
Device type: UMG511
EN 61000-4-7 Class: Class 1
EN 61000-4-30 Class: Class A
Flicker: Supported
Events: Supported
Transients: Supported

	Minimum	Maximum	Ergebnis
Voltage effective L1, L2, L3	212,64V	239,27V	Passed
Voltage effective L1	213,18V	240,77V	Passed
Voltage effective L2	208,06V	236,87V	Passed
Voltage effective L3	212,64V	239,27V	Passed
Current effective L1, L2, L3	21,94A	81,94A	
THD U L1, L2, L3	1,51%	4,65%	Passed
THD U L1	1,56%	4,43%	Passed
THD U L2	1,65%	4,44%	Passed
THD U L3	1,51%	4,65%	Passed
THD I L1, L2, L3	5,32%	16,65%	
THD I L1	4,05%	16,28%	
THD I L2	4,04%	20,30%	
THD I L3	5,32%	16,65%	
Active Power Sum L1-L3	16,81kW	50,50kW	
Reactive Power Sum L1-L3	-2907,20var	9749,24var	
Apparent Power Sum L1-L3	17,16kVA	51,04kVA	
cos phi(math.) Sum L1-L3	0,96	1,00	
Frequency +-1%	49,83Hz	50,29Hz	Passed
Frequency -6%/+4%	49,83Hz	50,29Hz	Passed
Unbalance Voltage	0,08%	0,89%	Passed
Long term flicker L1(Limit: 1.0)	0,56	1,71	Failed

Enhanced Power Quality Report

Fig.: Automatically generated power quality and energy report

EN 50160 / ISO 50001
Made in Germany

UMG 512-PRO – Class A power quality analyser with RCM

Communication
- Profibus (DP/V0)
- Modbus (RTU, TCP, Gateway)
- TCP/IP
- BACnet (optional)
- HTTP
- FTP (file transfer)
- TFTP
- NTP (time synchronisation)
- SMTP (email function)
- DHCP
- SNMP

Interfaces
- Ethernet
- Profibus (DSUB-9)
- RS485 Modbus (terminal strip)

Accuracy of measurement
- Energy: Class 0.2S (... / 5 A)
- Current: 0.1 %
- Voltage: 0.1 %

Networks
- IT, TN, TT networks
- 3 and 4-phase networks

Power quality
- Harmonics up to the 63rd harmonic, odd / even
- Flicker measurement
- Short term interruptions (from 10 ms)
- Transient recorder (> 39 μs)
- Start-up currents (> 10 ms)
- Imbalance
- Half wave RMS recordings (up to 11 min.)
- Events can be displayed as waveforms

Measured data memory
- 256 MByte Flash
- 32 MB SDRAM

Programming language
- Graphical programming
- Jasic®
- PLC functionality

Network visualisation software
- Free GridVis®-Basic

2 digital inputs
- Pulse input
- Logic input
- State monitoring
- HT / LT switching

2 digital outputs
- Pulse output kWh / kvarh
- Switch output
- Threshold value output
- Logic output

Thermistor input
- PT100, PT1000, KTY83, KTY84

RCM – Residual Current Monitoring
- 2 residual current inputs

Areas of application

- Continuous monitoring of the power quality
- Harmonics analysis with power quality problems
- Checking the internal supply network according to EN 61000-4-7, EN 6100-4-15, EN 61000-4-30
- Fault analysis in case of problems with the energy supply
- Documentation of the power quality for customers and regulatory authorities
- Ethernet Gateway for subordinate measurement points
- Report generator for power quality standards: EN 50160, IEE519, EN61000-2-4, ITIC ...
- Report generator for energy consumptions
- Energy Dashboard
- Remote monitoring of critical processes

Main features

Power quality

- Harmonics analysis up to the 63rd harmonic, even / odd (U, I, P, Q)
- Interharmonics (U, I)
- Distortion factor THD-U / THD-I / TDD
- Measurement of positive, negative and zero sequence component
- Unbalance
- Direction of rotation field
- Voltage crest factor
- Flicker measurement in accordance with DIN EN 61000-4-15
- Logging and storage of transients (> 39 µs)
- Short-term interruptions (> 10 ms)
- Monitoring start-up processes

COMPLIANCE TEST ACCORDING TO IEC 61000-4-30 ED.2

Janitza UMG 512

Power Quality Parameter	Class A Compliance
Power frequency	Yes
Magnitude of supply voltage	Yes
Flicker	Yes
Supply voltage unbalance	Yes
Voltage dips, swells and interruptions	Yes
Voltage harmonics	Yes
Voltage interharmonics	Yes
Mains signaling	Yes
Time-clock uncertainty	Yes

Fig.: UMG 512-PRO Class A certificated

High quality measurement

- Constant true RMS measurement
- Measurement process in accordance with IEC 61000-4-30
- Certified accuracy of measurement according to class A
- Continuous sampling of the voltage and current measurement inputs at 25,6 kHz
- 512 measurement points per period
- Recording of over 2,000 measured values per measurement cycle
- Accuracy of active energy measurement: Class 0.2S
- Fast measurement even enables the logging of rapid transients from 39 µs
- Logging of currents and voltages (15 – 440 Hz)

RCM (Residual Current Monitoring)

- Continuous monitoring of residual currents (Residual Current Monitor, RCM)
- Alarming in case a preset threshold fault current reached
- Near-realtime reactions for triggering countermeasures
- Permanent RCM measurement for systems in permanent operation without the opportunity to switch off
- Ideal for the central earthing point in TN-S systems

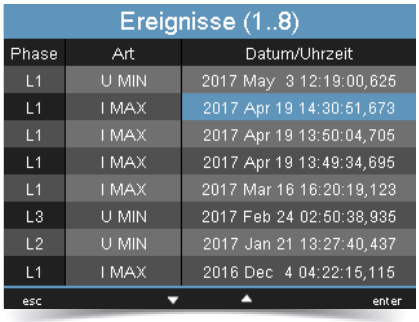


Fig.: Event list

User-friendly, colour graphical display with intuitive user guidance

- High resolution colour graphical display 320 x 240, 256 colours, 6 buttons
- User-friendly, self-explanatory and intuitive operation
- Backlight for optimum reading, even in darker environments
- Illustration of measured values in numeric form, as a bar graph or line graph
- Clear and informative representation of online graphs and power quality events
- Multilingual: German, English, Russian, Spanish, Chinese, French, Turkish ...

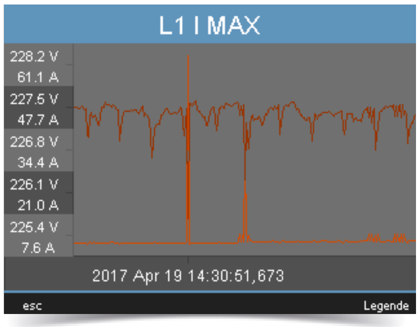


Fig.: Graphical event display (voltage drop)

Various characteristics

- 4 voltage and 6 current measurement inputs
- 2 digital inputs, e.g. as data logger for S0 meter
- 2 digital outputs for alarm message or e.g. for connection to a BMS or PLC
- Free name assignment for the digital IOs, e.g. if used as data logger

Comprehensive communication and connection possibilities

- Modbus
- Profibus
- Ethernet (TCP/IP)
- Digital IOs
- BACnet (optional)
- Configurable Firewall

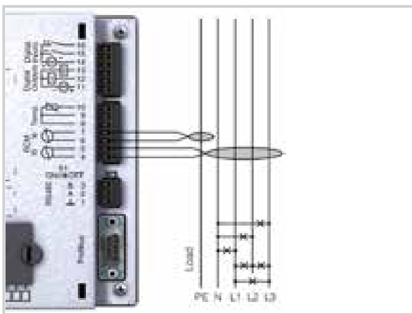


Abb.: Connection example of residual current monitoring and PE via current transformers

Modern communications architecture via Ethernet

- Simple integration in an Ethernet network
- Reliable and cost-optimised establishment of communication
- Ideal for Master-Slave structures
- High flexibility due to the use of open standards
- Integration in PLC systems and BMS through additional interfaces
- Various IP protocols: SNMP, ICMP (Ping), NTP, FTP ...
- Up o 4 ports simultaneous

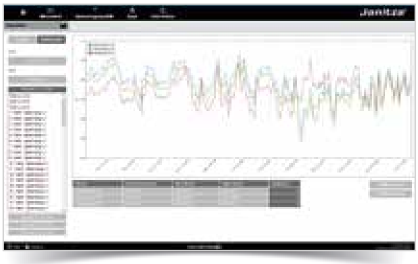


Fig.: Illustration of the historic data via the homepage (APP measurement monitor)

Measuring device homepage

- Web server on the measuring device, i.e. device's inbuilt homepage
- Function expansion possible through APPs
- Remote operation of the device display via the homepage
- Comprehensive measurement data incl. PQ (transients, events…)
- Online data directly available via the homepage, historic data optional via the APP measured value monitor, 51.00.245

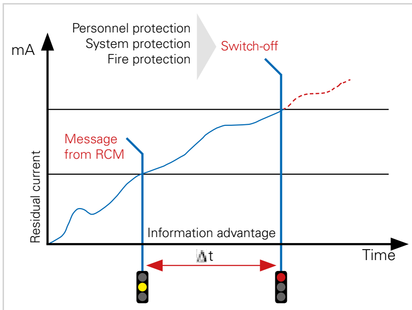


Fig.: Report prior to switching off – an aim of residual current monitoring

BACnet protocol for building communication

- Optimal interoperability between devices from various manufacturers
- Predefined BIBBs (BACnet Interoperability Building Block)
- BACnet is optionally available with UMG 512-PRO
- UMG 512-PRO supports the device type B-SA with the BIBBs DS-RP-B and DS-WP-B
- Furthermore, the BIBBs DS-COV-B and DM-UTC-B are also supported

Modbus Gateway function

- Economical connection of subordinate measuring devices without Ethernet interface
- Integration of devices with Modbus-RTU interface possible (harmonisation of data format and function code necessary)
- Data can be scaled and described
- Minimised number of IP addresses required
- Tried and tested integrated solution without additional hardware

Programming / PLC functionality

- Further processing of the measurement data in the measuring device (local intelligence)
- Monitoring and alarm functions simple to program
- Sustainable functional expansions far beyond pure measurement
- Comprehensive programming options with
  - Jasic® source code programming
  - Graphical programming
- Complete APPs from the Janitza library

Large measurement data memory

- 256 MB data memory
- Memory range up to 2 years (configuration-dependent)
- Individually configurable recordings
- Recording averaging times can be freely selected
- PQ recordings template preconfigured for conventional standards (e.g. EN 50160)
- User-defined memory segmenting possible

Abb.: Heatmap – total number of breaches of EN 50160

Powerful alarm management

- Information available immediately by email
- Inform maintenance personnel via the powerful device homepage
- Via digital outputs, Modbus addresses, GridVis® software
- Programming via Jasic® or graphical programming
- Further alarm management functions via GridVis®-Service alarm management

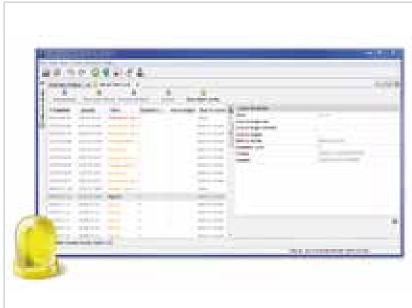


Fig.: GridVis® alarm management, alarm list (logbook)

Peak load representation and peak load management

- Illustration of the 3 highest monthly power peaks on the LCD display (P, Q, S)
- Rolling bar chart representation of the peak power values over 3 years on the LCD display (P, Q, S)
- Plain text representation on the LCD display (P)

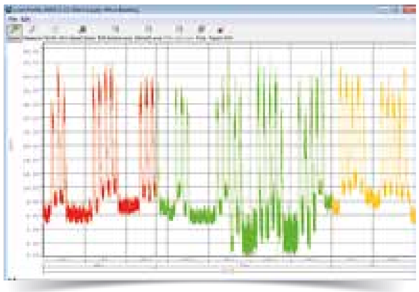


Fig.: GridVis® load profile, asic instrument for EnMS

GridVis®-Basic power quality analysis software

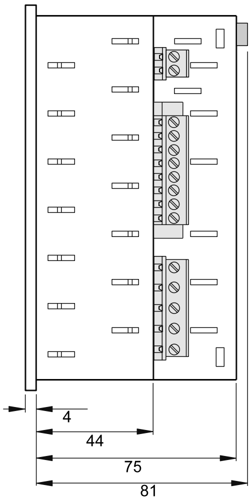
- Multilingual
- Manual read-out of the measuring devices
- Manual report generation (power quality and energy consumption reports)
- Comprehensive PQ analysis with individual graphs
  - Online graphs
  - Historic graphs
  - Graph sets
- Integrated databases (Janitza DB, Derby DB)
- Graphical programming
- Topology views
- High memory range

Certified quality through independent institutes

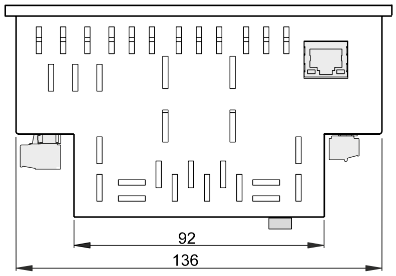
- ISO 9001
- Energy management certified according to ISO 50001
- Class A certificate (IEC 61000-4-30)
- UL certificate
- EMC-tested product

Dimension diagrams

All dimensions in mm



Side view

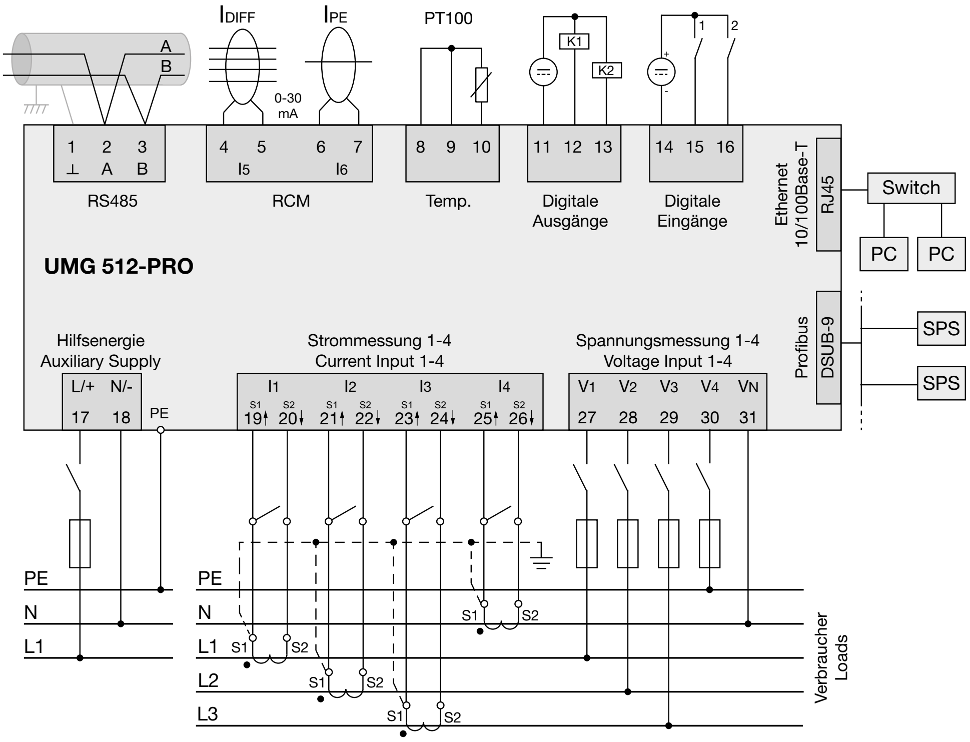


View from below

Rear view

Cut out: 138+0,8 x 138+0,8 mm

Typical connection



Device overview and technical data

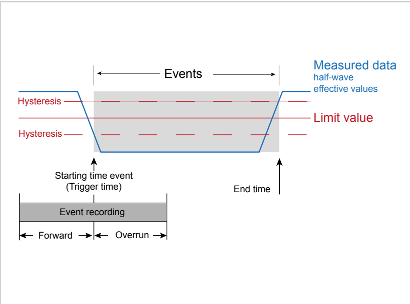


Fig.: The event record consists of a mean value, a minimum or maximum value, a start time and an end time.

	UMG 512-PRO	
Item number	**52.17.011**	**52.17.003**
Supply voltage AC	95 ... 240 V AC	48 ... 110 V AC
Supply voltage DC	80 ... 300 V DC	24 ... 150 V DC
Device options		
BACnet communication	**52.17.081**	**52.17.081**

General information	
Use in low, medium and high voltage networks	•
Accuracy voltage measurement	0.1 %
Accuracy current measurement	0.1 %
Accuracy active energy (kWh, .../5 A)	Class 0.2S
Number of measurement points per period	512
Seamless measurement	•
RMS - momentary value	
Current, voltage, frequency	•
Active, reactive and apparent power / total and per phase	•
Power factor / total and per phase	•
Energy measurement	
Active, reactive and apparent energy [L1, L2, L4, L3, ∑ L1–L3, ∑ L1–4]	•
Number of tariffs	8
Recording of the mean values	
Voltage, current / actual and maximum	•
Active, reactive and apparent power / actual and maximum	•
Frequency / actual and maximum	•
Demand calculation mode (bi-metallic function) / thermal	•
Other measurements	
Operating hours measurement	•
Clock	•
Weekly timer	Jasic®
Power quality measurements	
Harmonics per order / current and voltage	1st - 63rd
Harmonics per order / active and reactive power	1st - 63rd
Distortion factor THD-U in %	•
Distortion factor THD-I in %	•
Voltage unbalance	•
Current and voltage, positive, zero and negative sequence component	•
Flicker	•
Transients	> 39 µs
Error / event recorder function	•
Short-term interruptions	10 ms
Oscillogram function (wave form U and I)	•
Ripple voltage signal	•
Under and overvoltage recording	•
Measured data recording	
Memory (Flash)	256 MB
Average, minimum, maximum values	•
Measured data channels	10
Alarm messages	•
Time stamp	•
Time basis average value	freely user-defined
RMS averaging, arithmetic	•

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

Displays and inputs / outputs	
LCD colour graphical display 320 x 240, 256 colours, 6 buttons	•
Language selection	•
Digital inputs	2
Digital outputs (as switch or pulse output)	2
Voltage and current inputs	each 4
Residual current inputs	2
Temperature input	1
Password protection	•
Communication	
Interfaces	
RS485: 9.6 – 921.6 kbps (terminal board)	•
Profibus DP: Up to 12 Mbps (DSUB-9 connector)	•
Ethernet 10/100 Base-TX (RJ-45 socket)	•
Protocols	
Modbus RTU, Modbus TCP, Modbus RTU over Ethernet	•
Modbus Gateway for Master-Slave configuration	•
Profibus DP V0	•
HTTP (homepage configurable)	•
SMTP (email)	•
NTP (time synchronisation)	•
TFTP	•
FTP (file transfer)	•
SNMP	•
DHCP	•
TCP/IP	•
BACnet (optional)	•
ICMP (Ping)	•
Software GridVis®-Basic*1	
Online and historic graphs	•
Databases (Janitza DB, Derby DB)	•
Manual reports (energy, power quality)	•
Graphical programming	•
Topology views	•
Manual read-out of the measuring devices	•
Graph sets	•
Programming / threshold values / alarm management	
Application programs freely programmable	7
Graphical programming	•
Programming via source code Jasic®	•

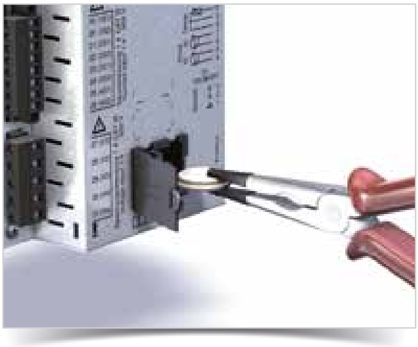


Abb.: Replacing the battery using long-nose pliers

Technical data	
Type of measurement	Constant true RMS up to the 63rd harmonic
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	417 / 720 V AC *2
Nominal voltage, three-phase, 3-conductor (L-L)	600 V AC
Measurement in quadrants	4
Networks	TN, TT, IT
Measurement in single-phase/multi-phase networks	1 ph, 2 ph, 3 ph, 4 ph and up to 4 times 1 ph
Measured voltage input	
Overvoltage category	600 V CAT III
Measured range, voltage L-N, AC (without potential transformer)	10 … 600 Vrms
Measured range, voltage L-L, AC (without potential transformer)	18 … 1000 Vrms
Resolution	0.01 V
Impedance	4 MOhm / phase
Frequency measuring range	15 … 440 Hz
Power consumption	approx. 0.1 VA
Sampling frequency	25,6 kHz / phase
Measured current input	
Rated current	1 / 5 A
Resolution	0.1 mA
Measurement range	0.001 … 7 Amps
Overvoltage category	300 V CAT III
Measurement surge voltage	4 kV
Power consumption	approx. 0.2 VA (Ri = 5 MOhm)
Overload for 1 sec.	120 A (sinusoidal)
Sampling frequency	25,6 kHz

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

*1 Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.
*2 With UL variants: 347/600 V

Digital inputs and outputs	
Number of digital inputs	2
Maximum counting frequency	20 Hz
Reaction time (Jasic® program)	200 ms
Input signal present	18 ... 28 V DC (typically 4 mA)
Input signal not present	0 ... 5 V DC, current < 0.5 mA
Number of digital outputs	2
Switching voltage	max. 60 V DC, 30 V AC
Switching current	max. 50 mA Eff AC / DC
Output of voltage dips	20 ms
Pulse output (energy pulse)	max. 20 Hz
Maximum cable length	up to 30 m unscreened, from 30 m screened
Mechanical properties	
Weight	1080 g
Device dimensions in mm (H x W x D)	144 x 144 x approx. 81
Battery	Type Li-Mn CR2450, 3 V (approval i.a.w. UL 1642)
Protection class per EN 60529	Front: IP40; Rear: IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	Front panel installation
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	 0.2 to 2.5 mm² 0.25 to 2.5 mm²
Environmental conditions	
Temperature range	Operation: K55 (-10 ... +55 °C)
Relative humidity	Operation: 0 to 95 % RH
Operating height	0 ... 2,000 m above sea level
Degree of pollution	2
Installation position	user-defined
Electromagnetic compatibility	
Electromagnetic compatibility of electrical equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2-030: Particular requirements for testing and measuring circuits	IEC/EN 61010-2-030
Noise immunity	
Class A: Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Voltage dips	IEC/EN 61000-4-11
Emissions	
Class B: Residential environment	IEC/EN 61326-1
Radio disturbanc voltage strength 30 – 1000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Safety	
Europe	CE labelling
USA and Canada	UL variants available
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com

Comment:
For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

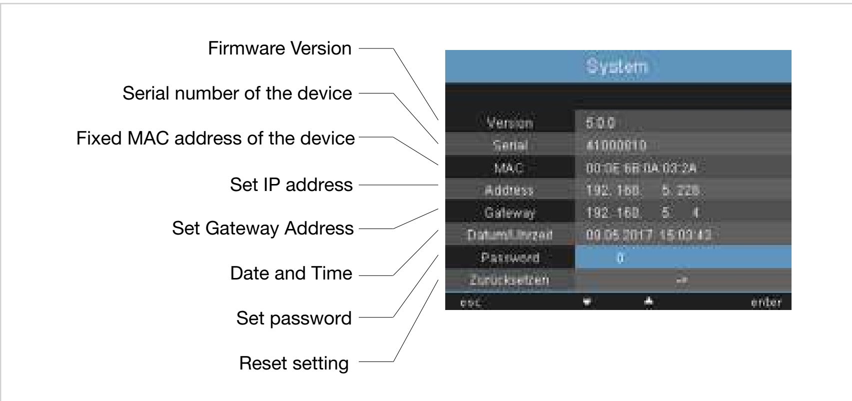
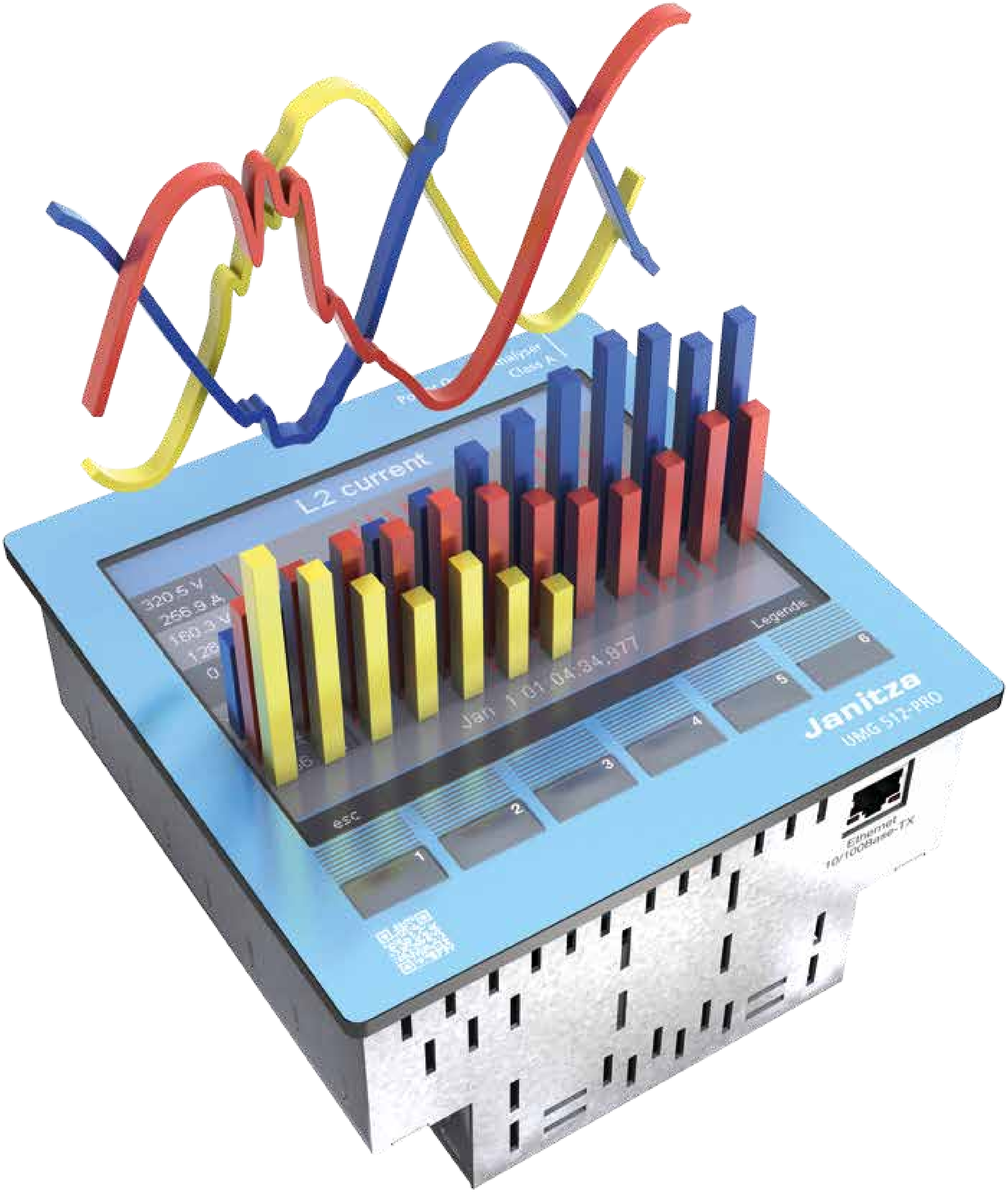


Fig.: User-friendly system of IP addresses, date, time and password


L2 current
320.5 V
266.9 A
Legende
Jan 1 01:04:34,877
esc
1
2
3
4
5
6
Janitza
UMG 512-PRO
Ethernet
10/100Base-TX

MRG 96RM-E RCM Flex & MRG 512 PQ Flex

Communication
- Modbus over TCP/IP
- BACnet (optional)
- HTTP
- FTP (File-Transfer)
- TFTP
- NTP (Zeitsynchronisierung)
- SMTP (E-Mail-Funktion)
- DHCP
- SNMP

Interfaces
- Ethernet 10/100Base-TX

RCM – Residual Current Monitoring
- 2 residual current inputs

Power quality
- Harmonics up to the 40th (MRG 96RM-E) or 63rd (MRG 512) harmonic
- Distortion factor THD-U / THD-I / TDD
- Measurement of positive, negative and zero sequence component (only MRG 512)
- Direction of rotation field
- Acquisition of short-term interruptions
- Transient recorder, 39 µs (only MRG 512)
- Starting currents (from 20 ms)
- Unbalance (only MRG 512)
- Flicker measurement per EN 61000-4-15 (only MRG 511 Flex)
- Display of waveforms (only MRG 512)

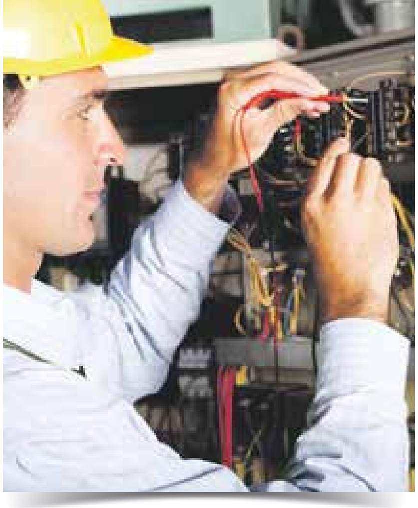
Buffered UPS (only MRG 512)
- Up to 3 hrs

PLC functionality (only MRG 512)
- Graphical programming
- Jasic® programming language

Networks
- TN,TT networks
- 3 and 4-phase networks
- Up to 4 single-phase networks

Network visualisation software
- Free GridVis®-Basic

Rogowski coil (300 mm)
- 100 – 4.000 A
- Measured range 100 A, 250 A, 400 A, 630 A, 1000 A, 1500 A, 2000 A, 4000 A



Areas of application

- High quality PQ analysis at class A level (IEC 61000-4-30)
- Temporary measurement e.g. for the design of power factor correction systems
- Analysis of electrical disturbances in the event of PQ problems
- Fault analysis with power quality problems
- High quality comparative measurement of energy measurement devices and meters
- Calibration of measurement devices (ISO 50001 audit)
- Recording of residual currents over an external current transformer (not included in the scope of delivery)

Main features

- Monitoring of the power quality
- Capturing of all power quality parameters (harmonics, short-term interruptions, asymmetries etc.)
- Remote access via Ethernet and embedded web server
- GridVis® PQ analysis software
- Standard PQ reports, depending on the version: EN 50160 , IEEE519, ITIC, EN 61000-2-4
- Cost centre report
- Large 256 MB internal memory for storing measurement data
- UPS-supported power supply for up to 3 hours

Fig.: MRG 512 PQ Flex –
Portable power quality analyser with RCM

MRG 512 PQ Flex: User-friendly, colour graphical display with intuitive user guidance

- High resolution graphics display
- User-friendly, self-explanatory and intuitive operation
- Clear and informative representation of online graphs and further power quality events

Fig.: MRG 96RM-E RCM Flex –
Portable energy measurement device with RCM

Modern communications architecture via Ethernet

- Ethernet interface and web server
- Faster, better cost-optimised and more reliable communication system
- High flexibility due to the use of open standards

Large measurement data memory

- 256 MByte
- Recording range of up to 2 years, depending on the recording configuration
- Recording freely configurable

RCM (Residual Current Monitoring)

- Continuous monitoring of residual currents (Residual Current Monitoring, RCM)
- Alarming in case a preset threshold fault current reached
- Near-realtime reactions for triggering countermeasures
- Permanent RCM measurement for systems in permanent operation without the opportunity to switch off
- Ideal for the central earthing point in TN-S systems

Graphical programming (only MRG 512)

- Comprehensive programming options (PLC functionality)
- Jasic® source code programming
- Sustainable functional expansions far beyond pure measurement
- Complete APPs from the Janitza library

Scope of delivery for the MRG product range

- Compact, robust plastic housing with measurement device and all connections
- UPS-supported power supply for up to 3 hours
- Supplementary description for each measurement device
- Operation manual for each measurement device
- DVD with following content:
  - Programming software GridVis®-Basic
  - Functional description - GridVis®
- Carry soft bag for accessories
- Mains connection cable
- 1 Crossover patch cable, CAT5e
- 1 set of voltage measuring cables with fuses (brown, black, grey, blue, green/yellow)
- Voltage tap-offs
- 2 connection cable 3 m for residual current measuring with connector
- Incl. Rogowski coil Ø 95 mm, length 300 mm, weight 190 g with connector for MRG 96RM-E RCM Flex / MRG 512 PQ Flex

Optional accessories:
Differential current transformer on request.

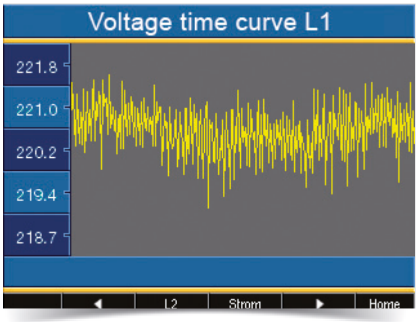


Fig.: Colour graphical display MRG 512 PQ Flex – Example voltage profile over time

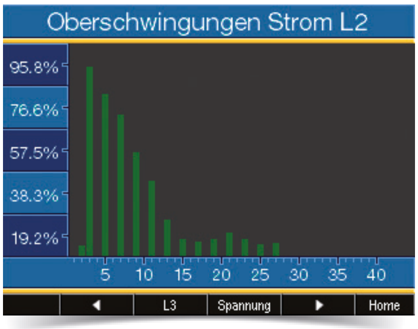


Fig.: Colour graphical display MRG 512 PQ Flex – Example harmonics analysis

Fig.: Measurement connection for current transformer and voltage; auxiliary voltage and ethernet connection

Device overview and technical data

	MRG 96RM-E RCM Flex	MRG 512 PQ Flex
Item number	**52.16.906**	**52.16.905**
Interfaces		
Ethernet 10/100 Base-TX (RJ-45 socket)	•	•
Measurement of the power quality		
Harmonics per order / current and voltage	1. – 40.	1. – 63.
Harmonics per order / active and reactive power	1. – 40.	1. - 63.
Interharmonics - current / voltage	-	•
Flicker: Short term, long term, present	-	•
Measured data recording		
Memory (Flash)	256 MB	256 MB
Measured voltage input		
Overvoltage category	600 V CAT III	600 V CAT III
Displays and inputs / outputs		
LCD display	LCD display with backlight, 2 buttons	Colour graphical display 320 x 240, 256 colours, 6 buttons

General	MRG 96RM-E RCM Flex	MRG 512 PQ Flex
Use in low and medium voltage networks	•	•
Accuracy of measurement with voltage	0.2 %	0.1%
Accuracy of measurement with current	0.2 %	0.1%
Accuracy of measurement with active energy (kWh, .../5 A)	Class 0.5S	Class 0.2S
Number of measurement points per period	426	512
Uninterrupted measurement	•	•
RMS - momentary value		
Current, voltage, frequency	•	•
Active, reactive and apparent power / total and per phase	•	•
Power factor / total and per phase	•	•
Energy measurement		
Active, reactive and apparent energy [L1, L2, L3, L4, Σ L1–3,Σ L1–4]	•	•
Recording of the mean values		
Voltage, current / actual and maximum	•	•
Active, reactive and apparent power / actual and maximum	•	•
Frequency / actual and maximum	•	•
Requirement calculation mode (bi-metallic function) / thermal	•	•
Other measurements		
Operating hours measurement	•	•
Clock	•	•
Measurement of the power quality		
Distortion factor THD-U in %	•	•
Distortion factor THD-I in %	•	•
Current and voltage, positive, zero and negative sequence component	•	•
Transients	-	> 39 µs
Error / event plotter function	•	•
Short term interruptions	•	•
Oscillogram function (wave form U and I)	-	•
Under and overvoltage recording	•	•
Measured data recording		
Mean, minimum, maximum values	•	•
Alarm messages	•	•
Time stamp	•	•
Time basis mean value	freely user-defined	freely user-defined
RMS averaging, arithmetic	•	•
Displays and inputs / outputs		
Analogue inputs (RCM, analogue)	•	•
Voltage and current inputs	L1, L2, L3 + N	every 4
Password protection	•	•

Comment:
For detailed technical information, please refer to the operation manual and the Modbus address list.

• = included
– = not included

Fig.: Rogowski coil with connector for MRG

Fig.: Voltage taps

	MRG 96RM-E RCM Flex	MRG 512 PQ Flex
Protocols		
Modbus TCP, Modbus RTU over Ethernet	•	•
HTTP (homepage configurable)	•	•
SMTP (email)	•	•
NTP (time synchronisation)	•	•
TFTP (automatic configuration)	•	•
FTP (file transfer)	•	•
SNMP	•	•
DHCP	•	•
TCP/IP	•	•
BACnet (optional)	•	•
ICMP (Ping)	•	•
Software GridVis® Basic *1		
Online graphs	•	•
Historical graphs	•	•
Databases (Janitza DB, Derby DB)	•	•
Manual reports (energy, power quality)	•	•
Graphical programming	-	•
Topology views	•	•
Manual read-out of the measuring devices	•	•
Graph sets	•	•
Programming / threshold values / alarm management		
Application programs freely programmable	-	7
Graphical programming	-	•
Programming via source code Jasic®	-	•
Comparator (5 Groups with 10 comparators each)	•	-
Technical data		
Nominal voltage, three-phase, 4-conductor (L-N, L-L)	277 / 480 V AC	417 / 720 V AC
Nominal voltage, three-phase, 3-conductor (L-L)	480 V AC	600 V AC
Measurement in which quadrants	4	4
Networks	TN, TT, IT	TN, TT
Measurement in single-phase/multi-phase networks	1 ph, 2 ph, 3 ph, 4 ph	1 ph, 2 ph, 3 ph, 4 ph and up to 4 times 1 ph
Measured voltage input		
Metering range, voltage L-N, AC (without transformer)	10 … 300 Vrms	10 … 600 Vrms
Metering range, voltage L-L, AC (without transformer)	18 … 520 Vrms	18 … 1000 Vrms
Resolution	0.01 V	0.01 V
Impedance	4 MOhm / phase	4 MOhm / phase
Frequency measuring range	45 to 65 Hz	15 … 440 Hz
Power consumption	approx. 0.1 VA	approx. 0.1 VA
Measured current input		
Rated current	5 A	5 A
Resolution	0.1 mA	0.1 mA
Metering range	0.001 - 6 Amps	0.001 - 7 Amps
Overvoltage category	300 V CAT II	300 V CAT III
Measurement surge voltage	2 kV	6 kV
Power consumption	approx. 0.2 VA (Ri = 5 mOhm)	approx. 0.1 VA (Ri = 5 MOhm)
Overload for 1 sec.	120 A (sinusoidal)	120 A (sinusoidal)
Sampling rate	20 kHz	25,6 kHz
Mechanical properties		
Weight	approx. 3,4 Kg	approx. 14,5 Kg
Device dimensions in mm (L x W x H)	350 x 295 x 150	ca. 500 x 390 x 230
Protection class per EN 60529	Front: IP40; Back: IP20	Front: IP40; Back: IP20
Security		
Europe	CE labelling	CE labelling

Comment:
For detailed technical information, please refer to the operation manual and the Modbus address list.

• = included
– = not included

*1 Optional additional functions with the packages GridVis®-Professional, GridVis®-Service and GridVis®-Ultimate.

GridMonitor

UMG 512-PRO – Class A power quality analyser
- Monitoring of the EN50160
- Memory for up to 10 million measured values
- Possibility of installing freely programmable programs (APPs)
- Harmonics analysis up to 63rd harmonic
- Short term interruptions (from 10 ms), illustration with effective values and waveforms
- Constant true RMS
- Measurement process in accordance with IEC 61000-4-30
- Certified accuracy of measurement per class A
- Accuracy of measurement of the active energy: Class 0.2S (.../5 A)
- Threshold value monitoring

UMG 20CM – 4 pole measurement of the individual low voltage outlets
- 20 current measurement channels +/- 0.5 %
- 4 voltage measurement channels +/0.5 %
- 20 LEDs – one LED for each current channel
- Threshold value monitoring for each current channel
- For up to 5 outlets

Mobile telephony modem and EasyGateway EG400 gateway
- UMTS modem incl. antenna
- SSL-encrypted from the PC to the gateway
- No VPN tunnel required
- Managing static IP addresses

GPS radio receiver for time synchronisation of the measurement devices
- Receive and process the GPS time signal (GMT)
- Works worldwide
- Small, compact construction

PowerToStore buffer power supply with capacitors
- Typically serves to bridge short term interruptions
- Operates with integrated ultra-capacitors for energy storage
- Lifelong maintenance-free
- Operation possible in extreme temperatures

Temperature sensor
- Compatible temperature sensors: PT100, PT1000, KTY83, KTY84
- For monitoring the temperature of the transformer oil or station, for example

Current transformer terminal strip
- Short circuiting of current transformers
- Insulated bridges for earthing and short circuiting of the transformer terminal

GridMonitor – Our contribution to the Smart Grid

The GridMonitor is a flexible solution that is produced in accordance with the individual requirements of the customer. A modular design is utilised here, in order that small production series can also be realised with ease.

Area of application
- Local distribution and transformer stations
- Substations
- Energy suppliers / public utilities
- Distribution system operators and transmission system operators

Main features
- Flexible turnkey solution
- Custom production per customer wishes
- Fixed installation or mobile variant available for selection
- Monitoring of the intermeshed low voltage networks
- Holistic measurement of individual local distribution stations
- Class A measurement in accordance with IEC61000-4-30
- Monitoring of the EN50160
- Recording the load flows of all outputs
- Intermediate storage of the measured values in the UMG 512-PRO

Fig.: UMG 512-PRO for monitoring the EN50160

Fig.: UMG 20CM for recording the load flows

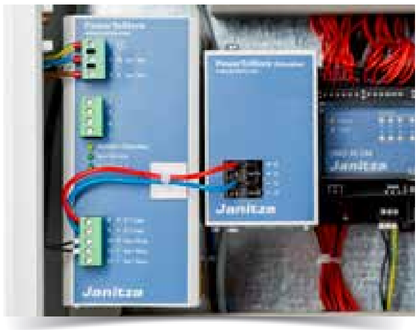


Fig.: PowerToStore for buffering the auxiliary voltage

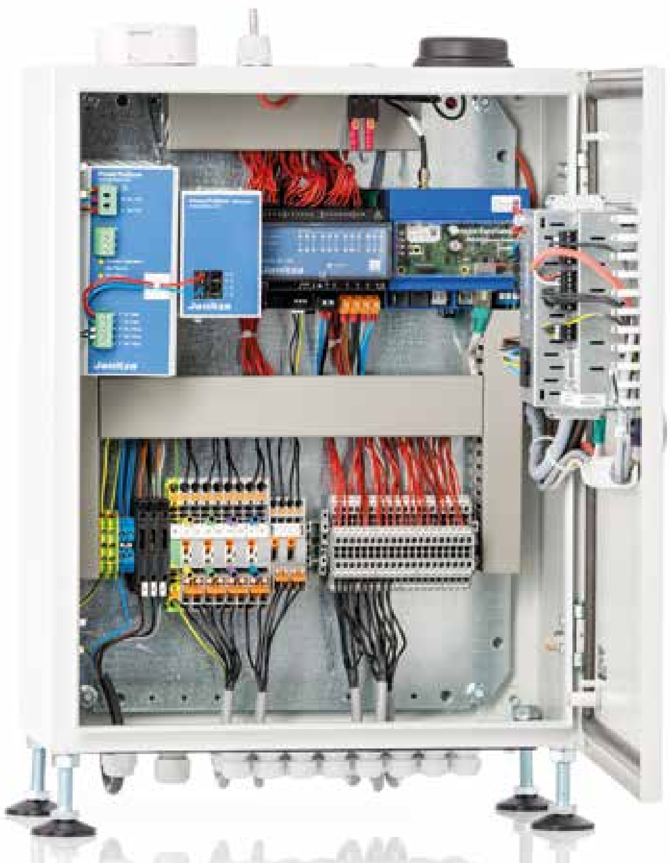


Fig.: GridMonitor for fixed installation, custom production per customer wishes

	GridMonitor for fixed installation	Mobile GridMonitor
Item number	**On request**	**On request**
Dimensions	**500 x 500 x 300**	**625 x 500 x 366**
Protection type	IP 42	IP 42
Protection class	1	1
AC supply voltage	100–240 V AC (50–60 Hz)	100–240 V AC (50–60 Hz)
Use in low, medium and high voltage networks	•	•
Current measurement channel	4 + x current channels*2	4 + x current channels*2
Uninterrupted measurement	•	•
Temperature range	Operation: K55 (-10 ... +55 °C)	Operation: K55 (-10 ... +55 °C)
Harmonics	Up to the 63rd*1	Up to the 63rd*1
Unbalance	•	•
Distortion factor THD-U in %	•	•
Distortion factor THD-I in %	•	•
Transients	•	•
Short term interruptions	•	•
Under and overvoltage recording	•	•
Measurement in quadrants	4	4
Three wire / four wire (L-N, L-L)	• / •	• / •
Accuracy of voltage / current measurement	Up to 0.1 % / 0.1 %*1	Up to 0.1 % / 0.1 %*1
Accuracy of active energy measurement (kWh, .../5 A)	Class 0.2S*1	Class 0.2S*1

*1 Valid for example with the UMG 512-PRO as a central measurement device
*2 Dependent on the type and number of measurement devices

Possible components	
Measurement point for supply	PQ: UMG 512-PRO / UMG 511 / UMG 605-PRO Load flow: UMG 509-PRO / UMG 508 / UMG 604-PRO
Measurement point for low voltage outputs	UMG 20CM
Measurement transducer	Current transformer (.../5 A, .../1 A) LowPower current transformer (... / 100 mA) Rogowski coils
Communication	Mobile telephony modem Easy Gateway EG400 (also possible for hard-wired communication lines) Gateway to IEC 60870-5-104 protocol
Buffering of the auxiliary voltage	PowerToStore
Further expansion possibilities	Socket, overvoltage protection, GPS clock, temperature sensor, current transformer terminal strips, etc.

Fig.: Internal view of the mobile GridMonitor

Fig.: Mobile GridMonitor

03 Energy management

MID energy meter ECSEM series

Areas of application

- Energy management
- Cost centre analysis
- Measured value transducer for PLC controls or building management systems (BMS)
- For energy billing purposes

Main features

- Communication: Modbus, M-Bus, S0 pulse outputs
- Direct measurement up to 65 A, transformer measurement up to 6 A, secondary (CT ration freely adjustable)
- 1 or 2 tariffs
- 4-quadrant measurement
- Class 1 for effective energy
- MID and IEC calibrated at the factory
- Lead-sealed terminal cover
- Measured values: Active energy, reactive energy, active power, reactive power
- Precision class 1 for active energy

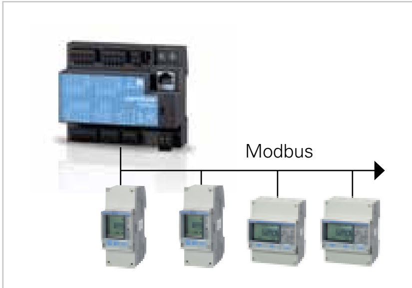


Fig.: Measured energy values are available via the integrated communication interface Modbus RTU.

Applications

- Logging of active and reactive energy
- S0 pulse outputs, proportional to energy flowing, can be connected to a control system PLC, SCADA system or data logger
- Integrated interface makes available protocols such as M-Bus or Modbus RTU
- Measurements of 1 and 3-phase systems with a voltage of L-N 230 V AC / L-L 400 V AC
- Measurement of input currents via direct connection or via current transformer (.../1 A or .../5 A)
- DIN rail installation

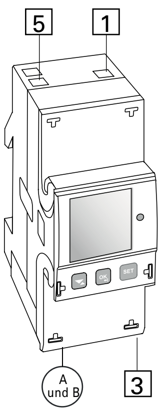
MID energy meter B21 – Single-phase energy meter, 65 A

Single-phase energy meter (1 + N)

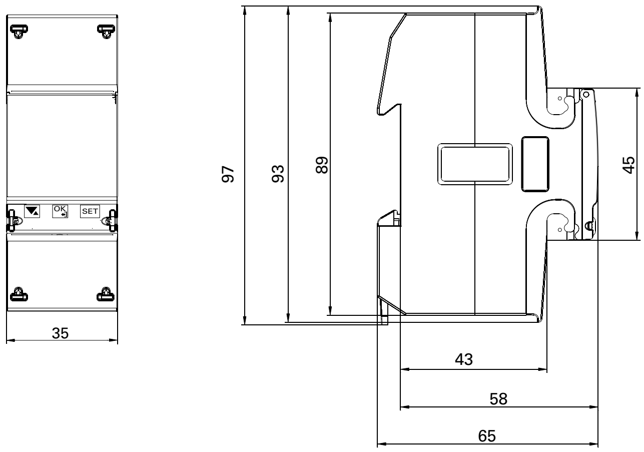
- Direct connection up to 65 A
- With measured values and alarm function
- Width, 2 DIN modules
- Tested and approved per MID*1 and IEC
- Pulse output included

*1 Regional different requirements apply in Switzerland in connection with MID energy meters.

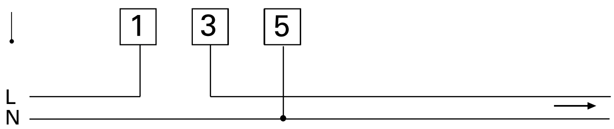
Voltage V	Precision class	Inputs/outputs	Communication	Type	Item no.	Weight
1 x 230 V AC	Active energy: B (class 1) Reactive energy: class 2	2 outputs, 2 inputs	Pulse output	B21 311-10J	14.01.353	0.14
			Pulse output, RS-485	B21 312-10J	14.01.354	0.15
			Pulse output, M-Bus	B21 313-10J	14.01.355	0.15



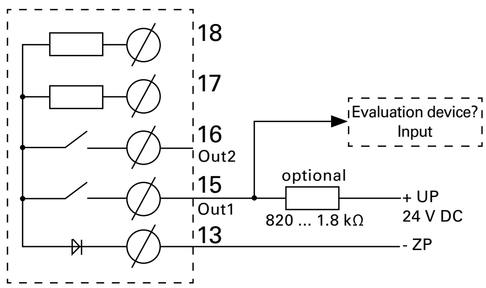
Dimensions in mm



B21 connection terminals



Pulse output S0

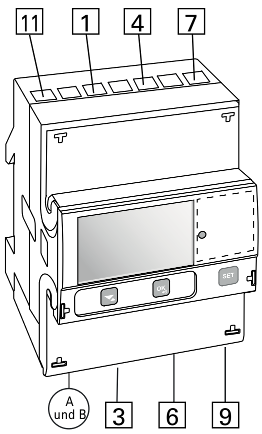


MID energy meter B23 –
Three-phase energy meter, direct measurement, 65 A

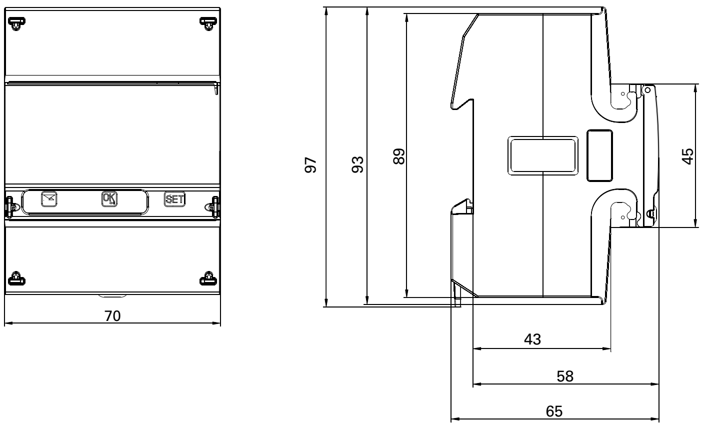
Three-phase energy meter, direct measurement (3 + N)
- Direct connection up to 65 A
- With measured values and alarm function
- For 3-conductor and 4-conductor connection
- Width, 4 DIN modules
- Tested and approved per MID*1 and IEC
- Pulse output included

*1 Regional different requirements apply in Switzerland in connection with MID energy meters.

Voltage V	Precision class	Inputs/outputs	Communication	Type	Item no.	Weight
3 x 230/400 V AC	Active energy: B (class 1) Reactive energy: class 2	2 outputs, 2 inputs	Pulse output	B23 311-10J	14.01.356	0.33
			Pulse output, RS-485	B23 312-10J	14.01.357	0.34
			Pulse output, M-Bus	B23 313-10J	14.01.358	0.35

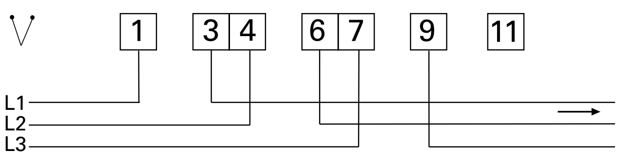


Dimensions in mm

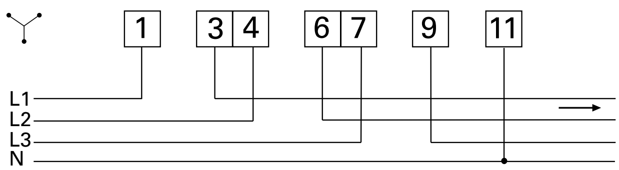


B23 connection terminals

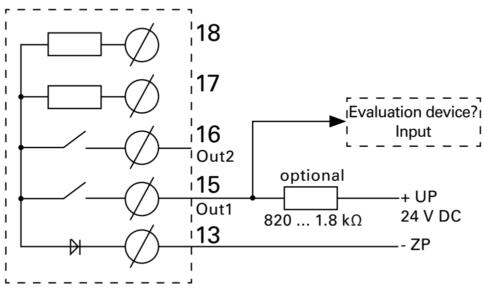
3-conductor connection with 2 measuring units



4-conductor connection with 3 measuring units



Pulse output S0



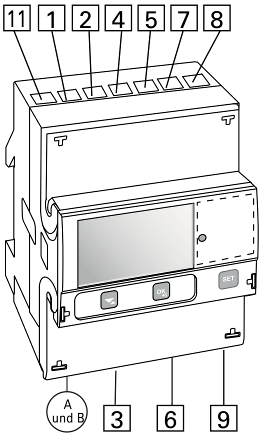
MID energy meter B24 –
Three-phase energy meter, CT measurement, 6 A

Three-phase energy meter, CT measurement (3 + N)

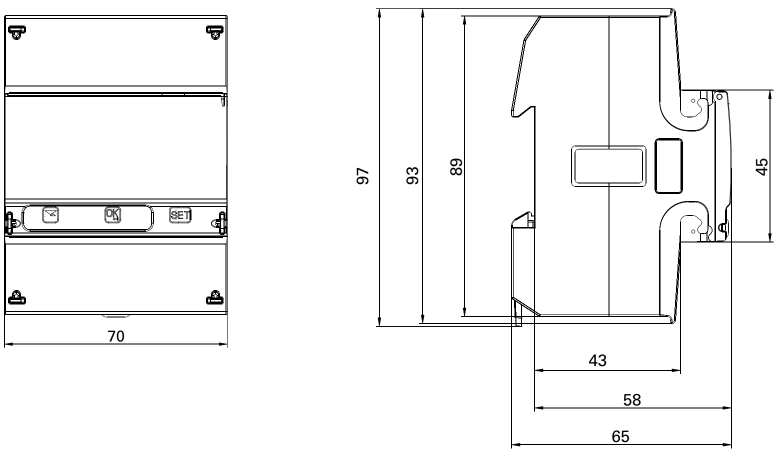
- Transformer connection CT, 1(6) A
- Transformer ratio freely adjusted up to 9999/1-6
- With measured values and alarm function
- For 3-conductor and 4-conductor connection
- Width, 4 DIN modules
- Tested and approved per MID*1 and IEC
- Pulse output included

*1 Regional different requirements apply in Switzerland in connection with MID energy meters.

Voltage V	Precision class	Inputs/outputs	Communication	Type	Item no.	Weight
3 x 230/400 V AC	Active energy: B (class 1) Reactive energy: class 2	2 outputs, 2 inputs	Pulse output	B24 311-10J	14.01.359	0.27
			Pulse output, RS-485	B24 312-10J	14.01.360	0.27
			Pulse output, M-Bus	B24 313-10J	14.01.361	0.29

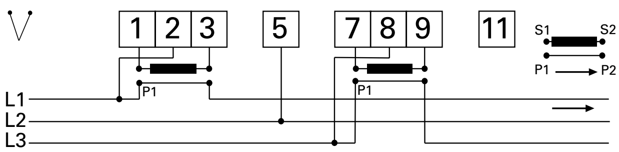


Dimensions in mm

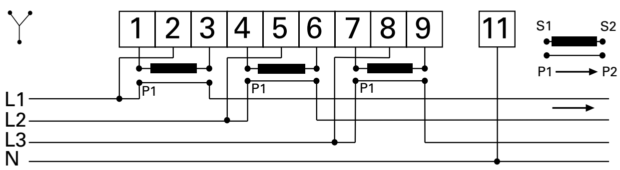


B24 connection terminals

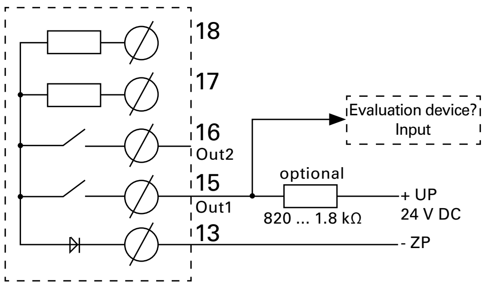
3-conductor connection with 2 measuring units



4-conductor connection with 3 measuring units



Pulse output S0

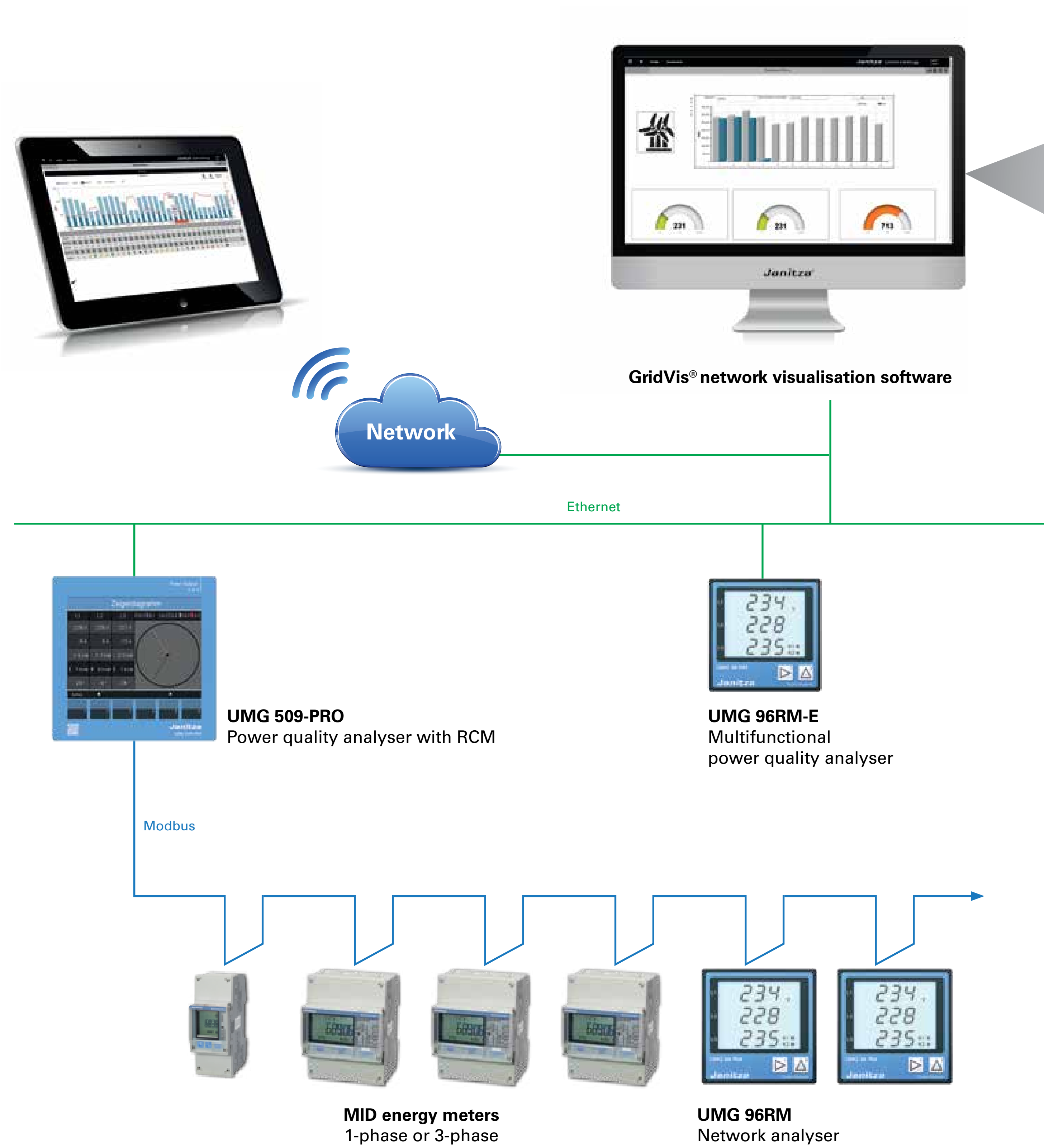


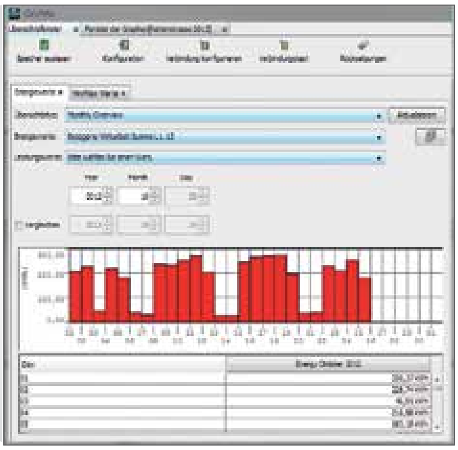
Device overview and technical data

	B21 Single-phase energy meter	B23 Three-phase energy meter, direct measurement	B24 Three-phase energy meter, CT measurement
Voltage/current inputs			
Rated voltage	230 V AC	3 x 230/400 V AC	3 x 230/400 V AC
Voltage range	220 – 240 V AC (-20% – +15%)	3 x 220 – 240 V AC (-20% – +15%)	3 x 220 – 240 V AC (-20% – +15%)
Power dissipation, voltage circuits	1.0 VA (0.4 W) total	1.6 VA (0.7 W) total	1.6 VA (0.7 W) total
Power dissipation, current circuits	0.007 VA (0.007 W) at 230 V AC and I_b	0.007 VA (0.007 W) per phase at 230 V AC and I_b	0.007 VA (0.007 W) per phase at 230 V AC and I_b
Reference current I_{ref}	5 A	5 A	1 A
Transition current I_{tr}	0.5 A	0.5 A	0.05 A
Max. current I_{max}	65 A	65 A	6 A
Min. current I_{min}	0.25 A	0.25 A	0.02 A
Start-up current I_{st}	< 20 mA	< 20 mA	< 1 mA
Connection cross-section	1 – 25 mm²	1 – 25 mm²	0.5 – 10 mm²
Recommended tightening torque	3 Nm	3 Nm	1.5 Nm
Transformer ratio			
Configurable current ratio (CT)	–	–	9999/1-6
Pulse display (LED)			
Pulse frequency	1000 imp/kWh	1000 imp/kWh	5000 imp/kWh
Pulse length	40 ms	40 ms	40 ms
General information			
Frequency	50 or 60 Hz ± 5%	50 or 60 Hz ± 5%	50 or 60 Hz ± 5%
Precision class	B (cl. 1) and reactive power cl. 2	B (cl. 1) and reactive power cl. 2	B (cl. 1) and reactive power cl. 2
Effective power	1%	1%	0,5%, 1%
Energy display	LCD with 6 digits	LCD with 7 digits	LCD with 7 digits
Environmental			
Operating temperature	-40 °C – +70 °C	-40 °C – +70 °C	-40 °C – +70 °C
Storage temperature	-40 °C – +85 °C	-40 °C – +85 °C	-40 °C – +85 °C
Humidity	75% annual average, 95% on 30 days/year	75% annual average, 95% on 30 days/year	75% annual average, 95% on 30 days/year
Fire and heat resistance	Terminal 960 °C, covering 650 °C (IEC 60695-2-1)	Terminal 960 °C, covering 650 °C (IEC 60695-2-1)	Terminal 960 °C, covering 650 °C (IEC 60695-2-1)
Water and dust resistance	IP20 on terminal strip without protective housing and IP51 in protective housing, per IEC 60529	IP20 on terminal strip without protective housing and IP51 in protective housing, per IEC 60529	IP20 on terminal strip without protective housing and IP51 in protective housing, per IEC 60529
Mechanical environment	Class M1 per Measuring Instrument Directive (MID), (2004/22/EC)	Class M1 per Measuring Instrument Directive (MID), (2004/22/EC)	Class M1 per Measuring Instrument Directive (MID), (2004/22/EC)
Electromagnetic environment	Class E2 per Measuring Instrument Directive (MID), (2004/22/EC)	Class E2 per Measuring Instrument Directive (MID), (2004/22/EC)	Class E2 per Measuring Instrument Directive (MID), (2004/22/EC)

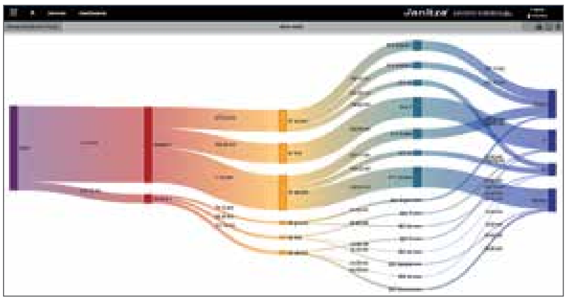
Digital outputs			
Current	2 – 100 mA	2 – 100 mA	2 – 100 mA
Voltage	24 V AC – 240 V AC, 24 V DC – 240 V DC. With meters with only 1 output, 5 – 40 V DC	24 V AC – 240 V AC, 24 V DC – 240 V DC. With meters with only 1 output, 5 – 40 V DC	24 V AC – 240 V AC, 24 V DC – 240 V DC. With meters with only 1 output, 5 – 40 V DC
Output pulse frequency	Programmable: 1 – 999999 pulse/ kWh, pulse/MWh	Programmable: 1 – 999999 pulse/ kWh, pulse/MWh	Programmable: 1 – 999999 pulse/ kWh, pulse/MWh
Pulse length	10 – 990 ms	10 – 990 ms	10 – 990 ms
Connection cross-section	0,5 – 1 mm²	0,5 – 1 mm²	0,5 – 1 mm²
Recommended tightening torque	0.25 Nm	0.25 Nm	0.25 Nm
Digital inputs			
Voltage	0 – 240 V AC/DC	0 – 240 V AC/DC	0 – 240 V AC/DC
OFF	0 – 12 V AC/DC	0 – 12 V AC/DC	0 – 12 V AC/DC
ON	57 – 240 V AC/24 – 240 V DC	57 – 240 V AC/24 – 240 V DC	57 – 240 V AC/24 – 240 V DC
Min. pulse length	30 ms	30 ms	30 ms
Connection cross-section	0,5 – 1 mm²	0,5 – 1 mm²	0,5 – 1 mm²
Recommended tightening torque	0,25 Nm	0.25 Nm	0.25 Nm
Electromagnetic compatibility			
Surge voltage testing	6 kV 1,2/50 µs (IEC 60060-1)	6 kV 1,2/50 µs (IEC 60060-1)	6 kV 1,2/50 µs (IEC 60060-1)
Voltage swell testing	4 kV 1,2/50 µs (IEC 61000-4-5)	4 kV 1,2/50 µs (IEC 61000-4-5)	4 kV 1,2/50 µs (IEC 61000-4-5)
Cable-based transients	4 kV (IEC 61000-4-4)	4 kV (IEC 61000-4-4)	4 kV (IEC 61000-4-4)
Immunity from interference from electromagnetic HF fields	80 MHz – 2 GHz (IEC 61000-4-6)	80 MHz – 2 GHz (IEC 61000-4-6)	80 MHz – 2 GHz (IEC 61000-4-6)
Immunity from interference from conducted interference	150 kHz – 80 MHz (IEC 61000-4-6)	150 kHz – 80 MHz (IEC 61000-4-6)	150 kHz – 80 MHz (IEC 61000-4-6)
Immunity from interference with harmonics	2 kHz – 150 kHz	2 kHz – 150 kHz	2 kHz – 150 kHz
High frequency emissions	EN 55022, Klasse B (CISPR22)	EN 55022, Klasse B (CISPR22)	EN 55022, Klasse B (CISPR22)
Electrostatic discharge	15 kV (IEC 61000-4-2)	15 kV (IEC 61000-4-2)	15 kV (IEC 61000-4-2)
Standards	IEC 62052-11, IEC 62053-21 class 1 & 2, IEC 62053-22 class 0,5S, IEC 62053-23 class 2, IEC 62054-21, GB/T 17215.211-2006, GB/T 17215.312-2008 class 1 & 2, GB/T 1725.322-2008 class 0.5S, GB 4208-2008, EN 50470-3 category A, B & C		
Mechanical			
Material	Polycarbonate in transparent front glass, top and bottom housing and terminal covering		
Dimensions	**35 x 97 x 65 mm (B x H x T)**	**70 x 97 x 65 mm (B x H x T)**	**70 x 97 x 65 mm (B x H x T)**
DIN modules	2	4	4

Remote read-out with a higher-level PC



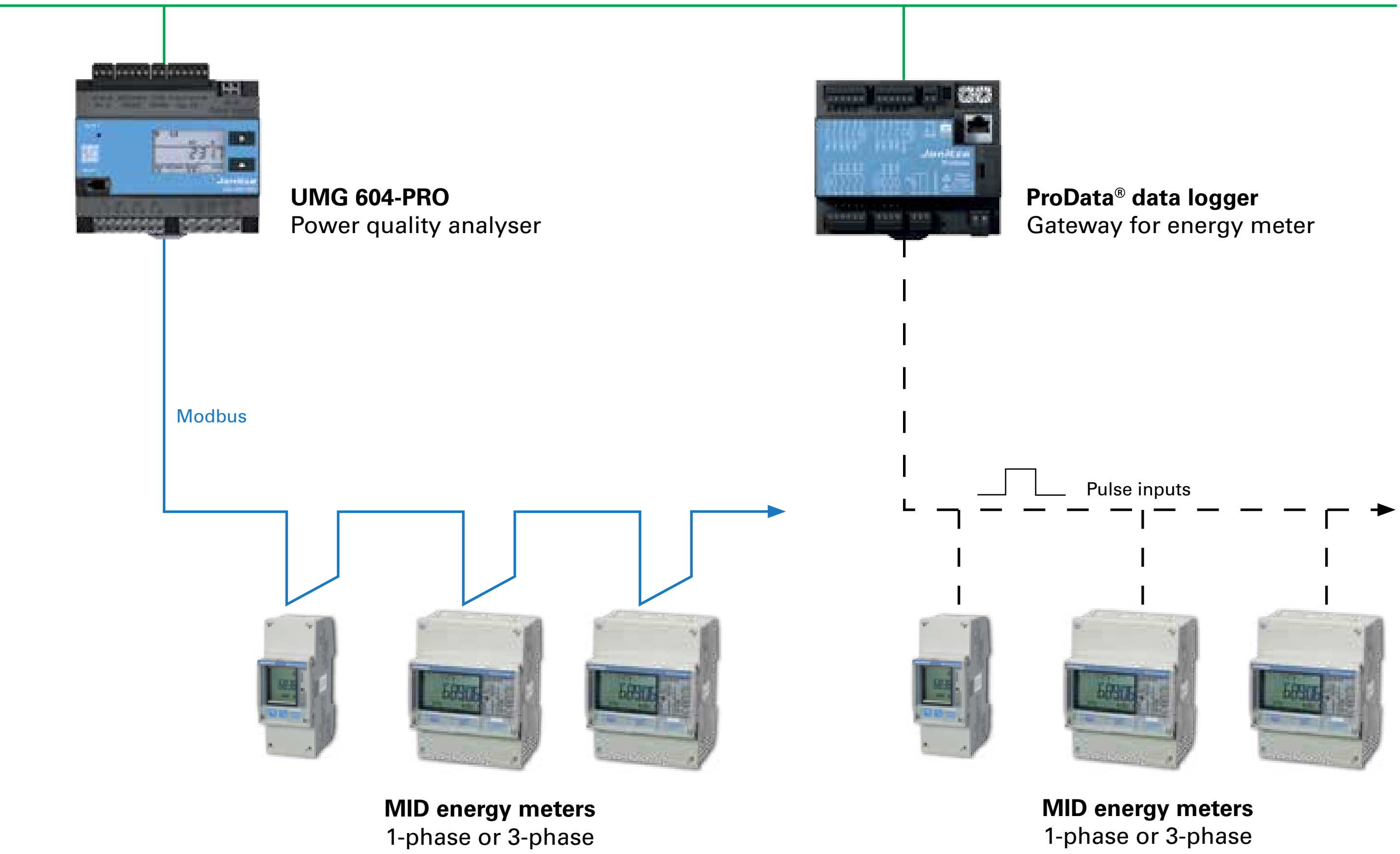


Tabular energy reports



Sankey diagrams

Dashboard Editor



Communication:
Modbus, M-Bus,
S0 pulse outputs

Direct measurement up to 65 A, transformer measurement up to 6 A secondary (CT ratio freely adjustable)

1 or 2 tariffs
4 quadrant measurement
Class 1 for effective energy

MID and IEC calibrated at the factory
Lead-sealed terminal cover

Measured values:
- Effective power
- Reactive energy
- Effective power
- Reactive power

Ethernet

Modbus-Ethernet gateway

Memory 32 MB

Pulse inputs and Pulse outputs

Thermistor input

Threshold value monitoring

ProData® data logger

Chapter 03
ProData® data logger

Smart and compact:
Save energy costs through the universal data logger

- Basis for a comprehensive energy management system (ISO 50001)
- Mapping of all consumption and process data (current, water, gas, steam, pressure, etc.)
- Monitoring of switching statuses (e.g. circuit breaker, etc.)
- Analysis of energy consumption and operating hours
- Flexible integration in superordinate systems (Modbus-Ethernet gateway)
- Long-term storage of data with 32 MB onboard memory
- Saving of 24 differential monthly energy values as well as maximum power values - for each of the fifteen individual inputs on board
- Direct reading out and analysis of data via GridVis® software
- Free programming of 64 independent weekly timers
- Tariff conversion: Each digital input can be assigned a selected tariff from 1 to 8

Universal data logger for all consumption media

- 15 digital / pulse inputs
- 3 digital outputs, switchable via Modbus, weekly timer, threshold value and temperature monitoring
- Temperature measurement input
- Ethernet interface (Modbus TCP/IP, NTP ...)
- RS485 (Modbus RTU, slave, up to 115 kbps)
- 32 MB flash data memory
- Clock and battery function
- 64 weekly timers
- Threshold value monitoring
- Modbus-Ethernet gateway functionality
- Saving of minimum and maximum values (with time stamp)
- Configurable records, can be read out via RS485 and Ethernet

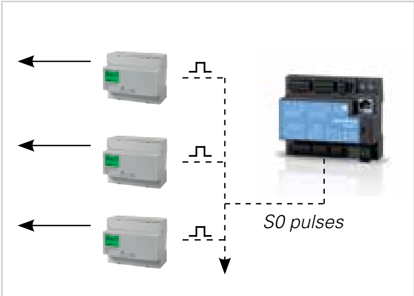


Fig.: Easy integration of existing meters

Applications

- EnMS per ISO 50001
- Integration of previously installed pulse counters in an EnMS
- Logging of non-electrical values
- Generation of performance indicators (key figures)
- Logging and monitoring of status messages
- Generation of alarms
- Ethernet-Modbus-Slave gateway

Fig.: Consolidation of diverse consumption media

Ethernet with gateway functionality

- Communication via Ethernet and Modbus RS485
- Simple integration in the LAN network
- Rapid and reliable data transfer
- Access to measurement data via various channels

Simple integration of existing meters

- Via Modbus-Ethernet Gateway integration and read-out of subordinate Modbus slave devices (e.g. electricity meters) possible with ease
- Conveniently capture measurements from all brands of meter with an S0 pulse output

Well thought-out to the last (vital) detail

- Internal clock generates precise data and time information for records and events
- Permanent operation of the clock thanks to integrated emergency battery
- Battery not permanently installed; as such convenient replacement possible

The ProData is the practical person's favourite

- Wide range power adapter (20 – 250 V AC, 20 – 300 V DC)
- Auto-Baud detection of the communication interface
- Screwable plug-in terminals
- Modbus address easily externally adjustable
- Rapid DIN rail installation

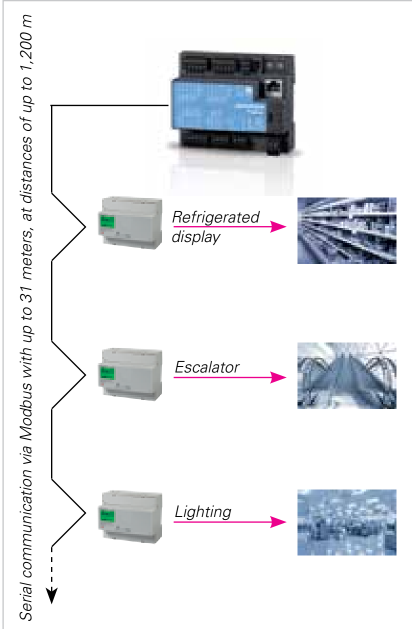
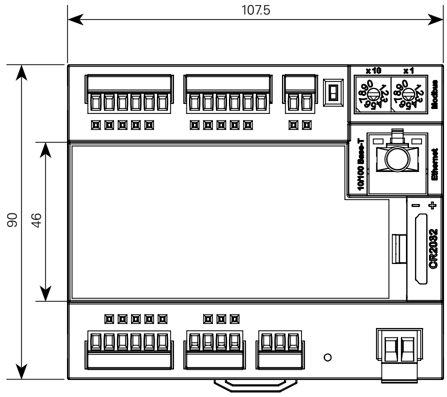


Fig.: Simple consolidation of Modbus meters

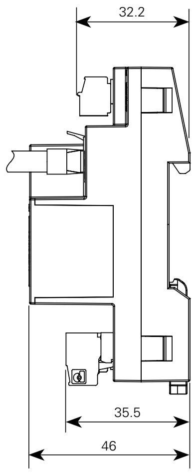
Fig.: Easy exchange of the battery during operation

Dimension diagrams

All dimensions in mm

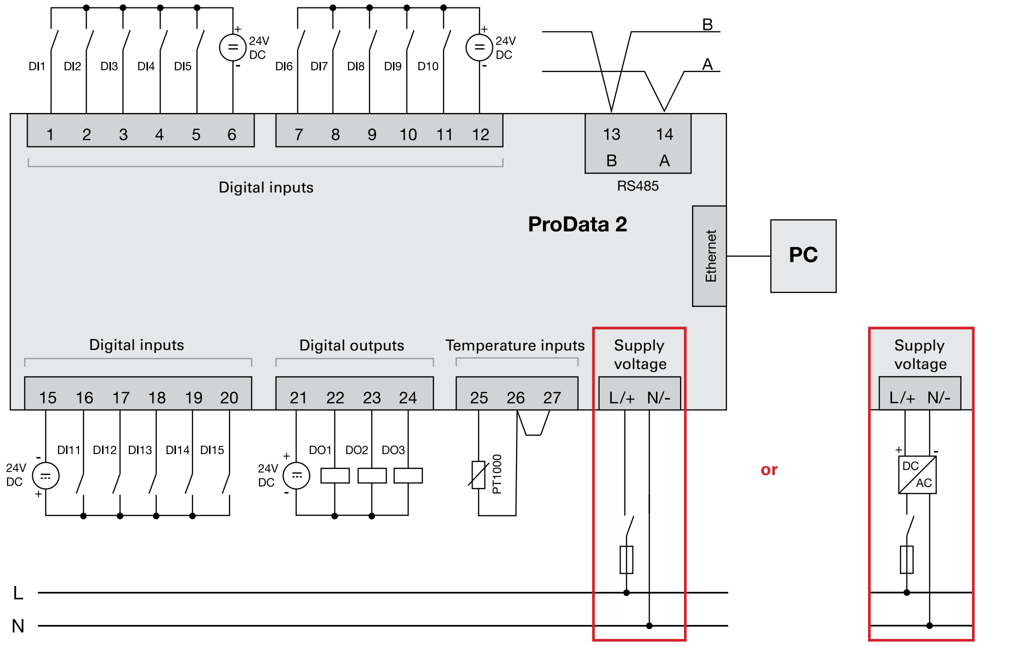


Front view



Side view

Typical connection



Connection example via
an external power supply

Device overview and technical data

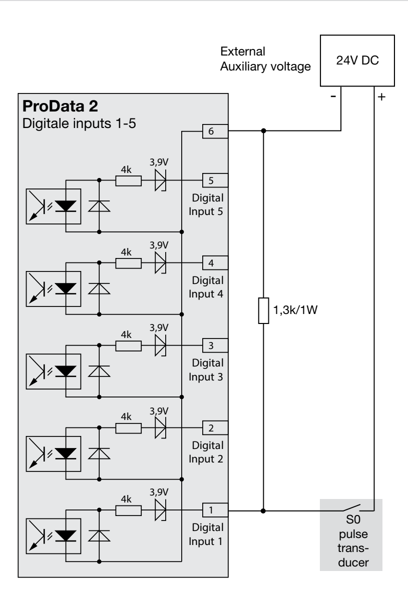


Fig.: S0 pulse input with external supply voltage and external plug-in resistor module*3

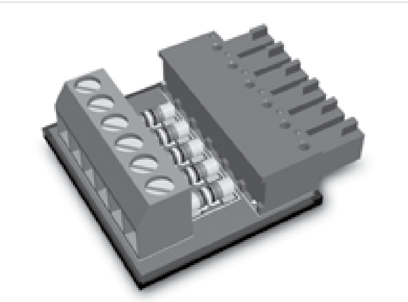


Fig.: S0 plug-in module (item no.: 52.24.111)

	ProData
Item number	**52.24.011**
Supply voltage	20 – 250 V AC or 20 – 300 V DC
Overvoltage category	300 V CAT II
Power consumption	max. 4 VA / 2 W

General	
Use in low voltage networks	•
Other measurements	
Operating hours measurement	•
Clock	•
Data logging	
Memory (Flash)	32 MB
Mean, minimum, maximum values	•
Alarm messages	•
Threshold value monitoring	•
Time stamp	•
Inputs / outputs	
Digital inputs	15
Digital outputs (as switch or pulse output)	3
Temperature measurement input	1
Password protection	•
Communication	
Interfaces	
RS485: 9.6 – 115.2 kbps	•
Ethernet 10/100 Base-TX (RJ-45 socket)	•
Protocols	
Modbus RTU, Modbus TCP	•
Modbus Gateway for Master-Slave configuration*1	•
NTP (time synchronisation)	•
DHCP	•
TCP/IP	•
ICMP (Ping)	•
Software GridVis®-Basic*2	
Online and historic graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports (energy)	•
Topology views	•
Manual reading	•
Graph sets	•

Technical data	
Digital inputs and outputs	
Number of digital inputs	15
Supply voltage	20 – 30 V DC (SELV or PELV supply)
Pulse output (S0), maximum count frequency	25 Hz
Input signal present	> 18 V DC (typical 4 mA for 24 V)
Input signal not present	0 ... 5 V DC
Number of digital outputs	3
Supply voltage	20 – 30 V DC (SELV or PELV supply)
Switching voltage	max. 60 V DC
Switching current	max. 50 mAeff DC
Pulse output (energy pulse)	max. 20 Hz
Maximum line length	up to 30 m unscreened, from 30 m screened
Temperature measurement input	1
Update time	1 sec.
Suitable temperature sensor	PT100, PT1000, KTY83, KTY84
Total burden (sensor and cable)	max. 4 kOhm

Comment: For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

*1 Use as a Modbus RTU slave is not possible in this mode. The ProData is only able to pass on requests to a Modbus slave device; it cannot request Modbus slave devices itself.

*2 Optional additional functions with the packages GridVis®-Professional, GridVis®-Enterprise and GridVis®-Service.

*3 External resistor S0 plug-in module for connection to an S0 pulse transducer required (item no.: 52.24.111)

Mechanical properties and others	
Weight	200 g
Device dimensions in mm (H x W x D)	90 x 107.5 x approx. 46
Battery	Lithium battery CR2032, 3 V (approval i.a.w. UL 1642)
Protection class per EN 60529	IP20
Assembly per IEC EN 60999-1 / DIN EN 50022	DIN rail mounting
Connection capacity of the terminals (digital inputs / outputs, temperature thermistor inputs) rigid / flexible Flexible with core end sheath without plastic sleeve Flexible with core end sheath with plastic sleeve	 0.2 to 1.5 mm² 0.2 to 1.5 mm² 0.2 to 1.5 mm²
Terminal connection capacity Serial interface Single core, multi-core, fine-stranded terminal pins, core end sheath	 0.2 to 1.5 mm² 0.2 to 1.5 mm²
Environmental conditions	
Temperature range	Operation: K55 (-40 ... +70 °C)
Relative humidity	Operation: 0 to 95 % RH
Operating altitude	0 ... 2,000 m above sea level
Pollution degree	2
Mounting position	any
Electromagnetic compatibility	
Electromagnetic compatibility of operating equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Particular requirements for Test and measurement current circuits	IEC/EN 61010-2-030
Noise immunity	
Class A: Industrial environment	IEC/EN 61326-1
Electrostatic discharge	IEC/EN 61000-4-2
Electromagnetic fields 80 – 1000 MHz	IEC/EN 61000-4-3, EMV-ILA V01-03
Electromagnetic fields 1000 – 2700 MHz	IEC/EN 61000-4-3, EMV-ILA V01-03
Rapid transients	IEC/EN 61000-4-4, EMV-ILA V01-03
Surge voltages	IEC/EN 61000-4-5, EMV-ILA V01-03
HF conducted interferences 0.15 – 80 MHz	IEC/EN 61000-4-6, EMV-ILA V01-03
Voltage dips, short term interruptions, voltage variations and frequency change	IEC/EN 61000-4-11, EMV-ILA V01-03
Emissions	
Class B: Residential environment	IEC/EN 61326-1
RFI Field Strength 30 – 1000 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 0.15 – 30 MHz	IEC/CISPR11/EN 55011
Radiated interference voltage 9 – 150 MHz	EMV-ILA V01-03
Safety	
Europe	CE labelling
USA and Canada	UL labelling
Firmware	
Firmware update	Update via GridVis® software. Firmware download (free of charge) from the website: http://www.janitza.com/downloads/

Comment: For detailed technical information please refer to the operation manual and the Modbus address list.

• = included - = not included

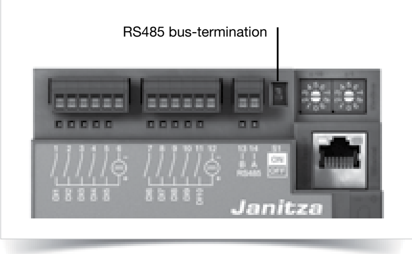
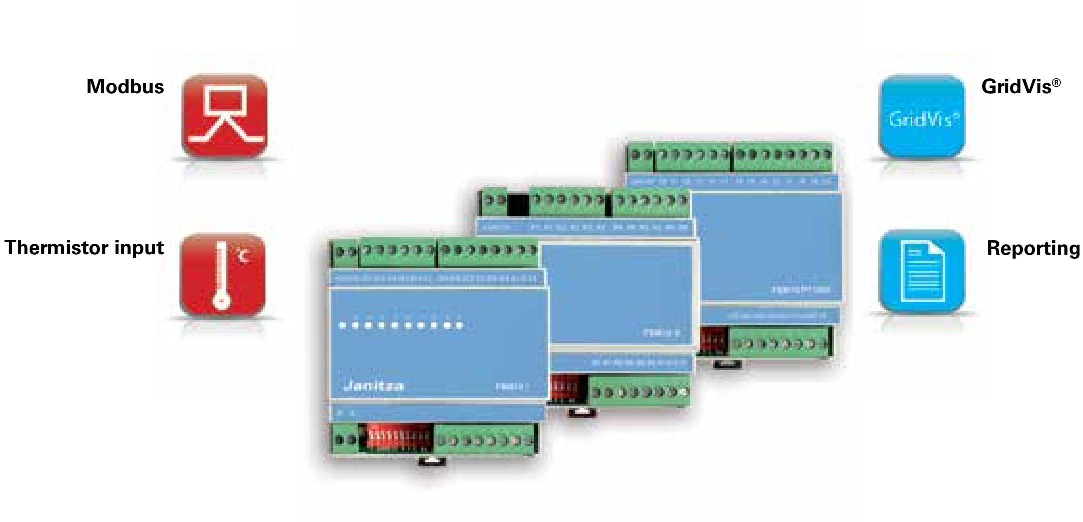


Fig.: Modbus / RS485 termination



Field bus modules series FBM

Decentralised I/O field bus module series FBM10

- RS485 interface
- Protocol Modbus RTU
- Can be used as a slave device to the measurement devices from series UMG 604-PRO, UMG 605-PRO, UMG 508, UMG 509-PRO, UMG 511 and UMG 512-PRO
- Also possible to connect over a distance of 1,000 m to the RS485 Modbus Master interface of the device; either via Profibus cable or e.g. a cable of type Li2YCY(TP) 2 x 2 x 0.22
- Modules are available pre-configured and programmed according to the selected measurement device

Use of the modules FBM10I and FBM10R

- Consolidation of various input and output signals in order to distribute to the respective participants
- Connection with the respective Modbus master from the device series UMG 604-PRO, UMG 605-PRO, UMG 508, UMG 509-PRO, UMG 511 or UMG 512-PRO is required in order to use the field bus modules.
- All data points are integrated into the Janitza system
- Detection of a wide range of key variables such as process data, states, error messages, threshold values, alarm outputs, etc.
- Archiving and visualisation via the software GridVis®

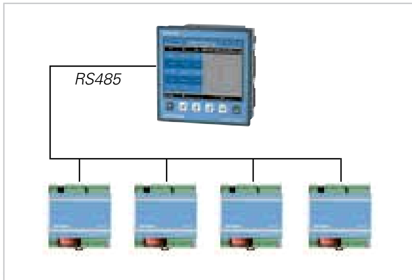


Fig.: Connection of the I/O field bus modules takes place via the RS485 interface of the UMG measurement device

Example of using the inputs

- Tariff conversion
- Synchronising measurement periods
- Error messages
- State measurements

Example of using the outputs

- Threshold value outputs for measured values

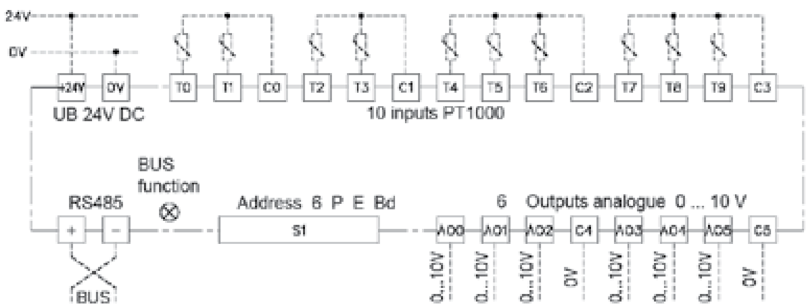


Fig.: Connection diagram FBM10 PT1000/PT100; thermistor input 2-wire

Use of the FBM10PT1000 module

- Temperature field bus module
- Logging of up to 10 temperature measurements (e.g. via PT100 or PT1000)
- The recording and visualisation of the measured values takes place with the aid of UMG 604-PRO, UMG 605-PRO, UMG 508, UMG 509-PRO, UMG 511 or UMG 512-PRO and the required expansion (see chapter 04 APPs – Expansion with know-how)

Fig.: Following the APP installation it is also possible to save the values.

Example

- Temperature monitoring
- Temperature logging

Field bus modules series FBM					
Type	Relay outputs	Digital inputs*1	Analogue inputs*2	Thermistor inputs	Item no.
FBM10I*3	–	10	–	–	**15.06.076**
FBM10PT1000*3	–	–	–	10	**15.06.077**
FBM10R-NC*3	10	–	–	–	**15.06.078**
FBM DI8-AI8*3	–	8	8	–	**15.06.079**

*1 Only state message
*2 4 – 20 m
*3 The modules are not suitable for the ProData in gateway operation.

General technical data	
Supply voltage	24 V DC ±20 %
No-load current	20 mA
Interface, protocol	RS485, Modbus-RTU
Transmission rate	4,800 to 38,400 Bit/s
Digital input	24 V DC, 5 mA
Relay outputs	24 V DC 0.5 A / 250 V / 3 A AC1 / 2 A AC3
Ambient temperature	-10 … +50 °C
Accuracy	<0.1 % for temperature measurement PT1000
EMC	per EN 55011
Terminal	plug-in terminals up to 1 mm²
Housing	45 mm installation row system 90 x 88 x 58 mm (H x W x D)
Installation	top-hat rail
Humidity	<95 % rel. humidity non-condensing
Protection class	IP20
Standards	CE conformity

04 Software and IT solutions

Janitza software and IT solutions

Fig.: The device's own homepage

Fig.: Energy-Portal

Fig.: GridVis®-Software

Janitza software & IT solutions

UMG measurement devices – homepage & APPs
- Display the measured values via the device's own homepage
- Expansions (APPs) for various different UMG measurement devices

Energy portal
- Cloud solution for energy management
- No investment in software, databases and IT infrastructure required
- Simple summarization of all energy data from different locations

GridVis®-Basic
- Free basic version

GridVis®-Professional
- As GridVis®-Basic, but with the following additional features:
- Automatic read-out of the measurement devices
- Virtual device
- MySQL / MS-SQL database driver
- User administration

GridVis®-Service
- As GridVis®-Professional, but with the following additional features:
- Service (runs activeley in the background for automatic data read-out)
- Online acquisition of measurement data
- REST interface (enables external applications to access the measurement values saved)
- Alarm management

GridVis®-Ultimate
- As GridVis®-Service, but with the following additional features:
- Includes the GridVis®-Energy web interface
- Expanded user management
- Create your own dashboards and templates
- Overview of all devices
- Upload your own images with the image manager

Grid visualisation software – GridVis®

CERTIFICATE

Janitza®

Janitza electronics GmbH
Vor dem Polstück 1
35633 Lahnau
Germany

ISO 50001:2011

GridVis® software

An elementary component for energy management systems and power quality monitoring systems

- Analysis and visualisation of energy measurement data, electrical- and power quality data
- Uninterrupted documentation of important measurement data
- Chronological arrangement of harmonics, voltage variations or power failures, for example
- Timely detection of inadequate power quality prevents production downtime and optimises the utilisation of operational equipment
- Introduction of measures for improving energy efficiency due to the analysis of the load profiles and consumptions
- Creation of framework conditions for operational energy management systems (ISO 50001)
- Software and hardware components provide more transparency and a more reliable documentation of the energy supply
- Energy management systems serve as support for economical, ecological and optimised use of energy in companies

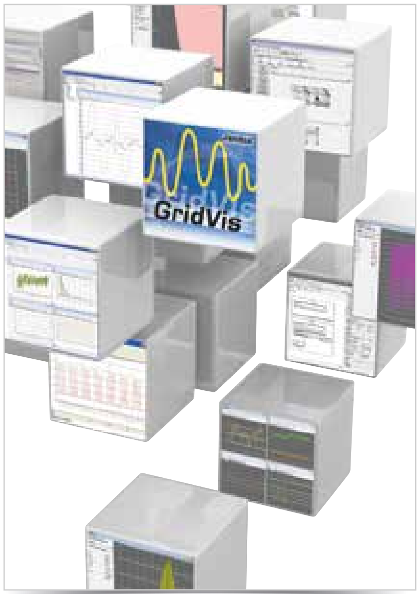
Promotion of energy management systems in Germany

- In principle all companies based in Germany or with a branch office in Germany are entitled to apply
- Companies that are not entitled to apply are those:
  - that have lodged a claim under the "Special compensation scheme per § 40 ff. Renewable energy act“ and were obligated to verify certification per § 41 section 1, number 2 of the Renewable energy act.
  - for whom an exoneration was granted within the scope of the equalisation of peaks per § 10 electricity tax law and § 55 energy tax law
- The amount of the grant is:
  - Max. 80% of the eligible tasks and max. 8,000 Euro for the first certification of an energy management system per DIN EN ISO 50001
  - Max. 80% of the eligible tasks and max. 1,500 Euro for the first certification of an energy control system
  - Max. 20 % of the eligible tasks and max. 8,000 Euro for the procurement of measurement equipment for energy management systems
  - Max. 20 % of the eligible tasks and max. 4,000 Euro for the procurement of software for energy management systems
  - The complete sum of the grant is restricted to max. 20,000 Euro per company within a period of 36 months
- Detailed and updated information can be found at www.bafa.de/bafa/de/energie/energiemanagementsysteme/index.html

Your benefits

- Reduction of energy costs
- Energy tax reduction in conjunction with an EnMS (e.g. in Germany)
- Transparency of energy consumption in the individual departments
- Increase in supply reliability
- Environmental protection, image enhancement (ecological mindset)
- Application of an improved energy mix
- Optimisation of energy contracts
- Greater employee awareness with regard to energy efficiency and climate protection
- Cost centre management: Cause-related assignment and breakdown of energy costs
- Increase in competitive capability

GridVis® main features



- AMR (automatic meter reading system)
- Configuration of the monitoring system and the UMG measurement devices
- Measurement device management
- Automatic or manual read out of the devices' measurement data
- Graphical display of online and historical measured values
- Display of minimum, average and maximum values in a graph
- Statistical evaluations
- Comprehensive export functions e.g. into an Excel file
- APPs management (customer-specific applications / programs)
- Saving of data in a database incl. database management (e.g. MySQL / MS SQL / Derby DB / Janitza DB)
- Topological views (configurable, graphical user interface with freely configurable register levels)
- Individually configurable schedules (e.g. report generator, memory read-out, etc.)
- Virtual devices e.g. summation of energy from multiple meters
- Generic Modbus device for incorporation of "Non-Janitza devices"
- Report generators allow the adjustment and configuration of reports (energy costs and power quality)
- Comprehensive alarm management with escalation management and log book function
- User administration

GridVis® license model / software variants

GridVis® Basic

Free basic variant
- Maximum of 5 devices
- Comprehensive graph screen
- Manual reports
- Topology view
- Janitza DB

+

GridVis® Professional

As GridVis®-Basic,
but with the following additional features:
- No restriction in number of measurement devices
- MySQL / MS SQL DB support
- Automatic read-out of the measurement devices
- Virtual measurement devices
- User management (for assigning user rights)
- Scheduling point in time
- CSV data import
- RCM report

+

GridVis® Service *1

As GridVis®-Professional,
but with the following additional features:
- Service for automatic data logging in the background
- Online logging of measurement data
- REST interface
- Comprehensive alarm management
- Excel export
- Generic Modbus
- Automatic reports I PQ reports
- Cost centers
- Scheduling time periods

+

GridVis® Ultimate

As GridVis®-Service,
but with the following additional features:
- GridVis®-Energy web interface
- Expanded user management
- Dashboards (customized creation of an unlimited number of pages)
- Widgets
- Key Performance Indicator (KPIs)
- Sankey diagram for energy flow analysis
- Device overview with graph function
- Image manager

*1 Some functions are only available in conjunction with GridVis® installation on the desktop.

See variants table on page 162 for details on the variants

Device configuration

Setting up and configuration of the measurement devices

- Comprehensive adjustment and customizing options
- User-friendly incorporation, parameterisation and configuration of the UMG devices
- Determination of trigger values for the measurement of events and transients
- Saving of individually defined measured values including their storage intervals
- Threshold values for the monitoring function can be programmed via comparators
- External temperature sensors allow the acquisition of transformer- or ambient temperature
- Time correlation of results at various different measurement points by means of time server (NTP)

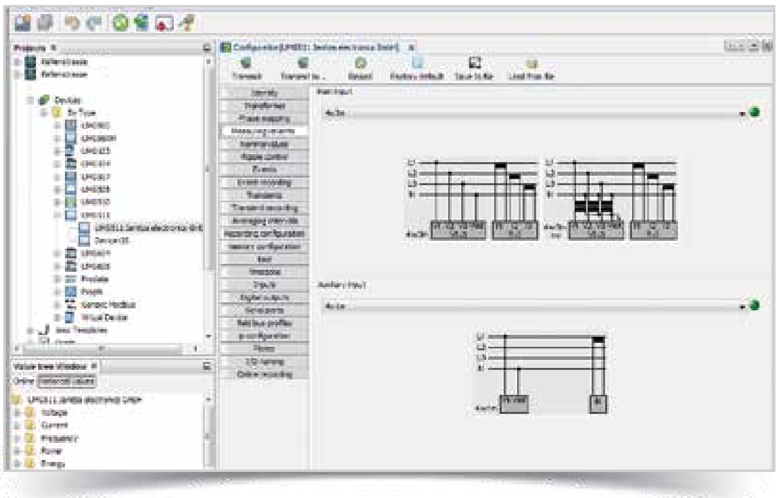


Fig.: Configuration of measurement devices in the GridVis® software

Generic Modbus devices

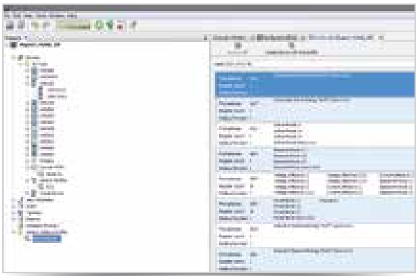


Fig.: Example of an ECS template for Modbus meters

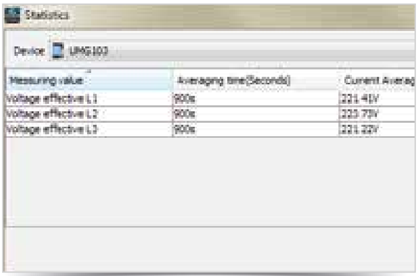


Fig.: Communication checking via integrated statistical function

Modbus RTU, Modbus TCP/IP

- Simple integration for devices from other manufacturers via Modbus RTU or Modbus TCP/IP

  Prerequisite:
  - Non-Janitza devices support Modbus RTU or Mod / TCP protocol
  - Data formats in accordance with the Modbus recommendations (Modbus-ASCII protocols are not supported)

- The connection of non-Janitza devices is implemented via a UMG Master or in the case of Mod/TCP via an arbitrary Mod/TCP gateway
- As an alternative the value read-out can be implemented directly with the GridVis® software (Modbus TCP/IP over Ethernet)
- Non-Janitza devices are integrated via profiles and administered as templates in GridVis®
- Templates can be exported
- Profiles can be created and edited directly in GridVis®
- Measured values read out from the non-Janitza devices can be displayed in the topology view
- With GridVis®-Service it is possible to save the measured values online, incl. the calculation of the average value
- Measured values are polled cyclically
- Checking of the communication via integrated statistical function

An overview of functions

- Data transfer rates 9.6; 19.2; 38.4; 57.6 ... 115.2 kbps
- Device integration via RS232, RS485, Modbus (Ethernet)
- Supported function codes: Read coil status (fc = 1), Read holding registers (fc = 3), Read input status (fc = 2), Read input registers (fc = 4) as well as the floating point formats (32 bit, 64 bit) each per IEEE 754 such as Short (16 bit), Unsigned Short (16 bit), Integer (32 bit), Unsigned Integer (32 bit) und Integer (64 bit)
- Profiles can be freely configured
- Online saving of values possible
- Values: Water, gas, heat, energy, etc.
- Importing and exporting of values possible
- Values are read in blocks

Topological views (visualisation)

- Quick overview of your energy distribution system
- Localisation of disturbances and monitoring of defined tolerances by comparison of individual measurement points
- Immediate and simple realisation of customer-specific solutions by using exisiting graphical data such as flow plans, manufacturing lines etc. as well as the incorporation of the associated measurement devices ("Drag-and-drop")
- View of threshold value exceedances as well as the conditions of the inputs and outputs
- Highlighting of threshold values being exceeded or dropped below by means of colour coding
- Device view can be called up for each measurement device connected to the network
- Selected measurement data can be called up remotely online (device dependent)

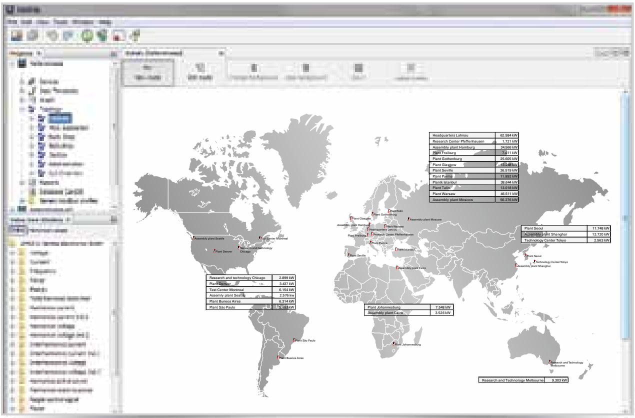


Fig.: Complete overview of the energy distribution by means of topological views

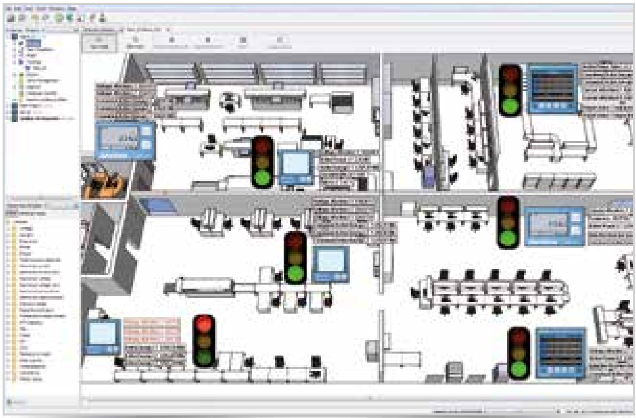


Fig.: A warning message of a certain production line

Animation in the topology

- Value-dependent display of images possible and thus, for example, colour coding.
- Possible to change view between images, measurement value dependent
- There is an option, for example, when the nominal voltage is exceeded to activate a red traffic-light style indicator or to mark a circuit breaker as tripped

Hyperlinks in the topology

- Hyperlinks can be set in the topological view for the following elements:
  - URLs, i.e. call-up of arbitrary internet sites
  - To other topological pages
  - To saved graphs
  - To documents, e.g. calibration- or PQ report
  - For execution of programs
- Access to calibration certificates, operations manuals, Excel evaluations or arbitrary homepages
- Starting batch jobs or other programs

Online and historical measured values

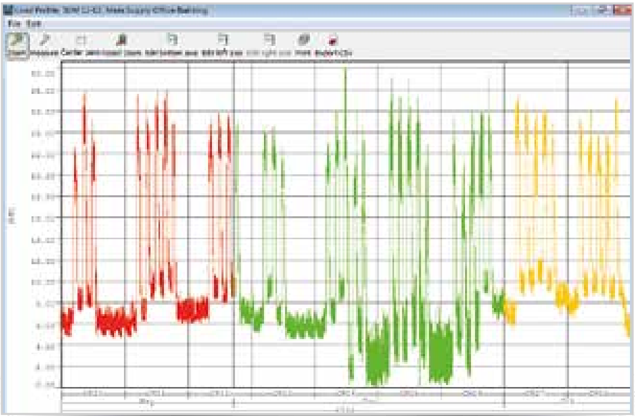


Fig.: Display of active power L1–L3, load profile as basic instrument for energy management considerations

Fig.: GridVis® Screen with historical evaluations

Online measurement data

- All measured values that are created transmitted by the measurement devices in realtime
- Data management of all measured points
- Measured values are available either as line graphs or bar charts in the online measurement mode
- Line graphs are always up-to-date (older data will be deleted, FIFO-principle)
- Display of double y-axes with two units (e.g. current and voltage synchronously) possible for measurement data
- Multiple measurement devices can be displayed in the same graphs for each unit
- Colours in the graphs can be individually changed

Historical measurement data

- Measured values that have been saved in accordance with defined rules for averaging times in the device or by reading out the device into a central database
- Each value receives a timestamp as well as the corresponding device ID
- Administration of the data saved in the database, sorted by parameter, year, month and day
- Selective marking of the data guaranteed
- Time periods of interest can be expanded with the zoom and can be quantified by means of the measurement function
- Annotating the bar charts / line graphs or histograms with headers and comments
- Display of transients and events in the transient or event browser
- Missing measurement data during particular time periods or unrealistic measurement information can be displayed by means of a flag browser
- Creation of load profiles (for example for the generation of precise forecasting for optimised energy delivery contracts)
- Statistical function (voltage etc.)

Fig.: Power quality report

Reporting

Power quality

- An important part of the PQ analysis is the GridVis® report generation
- Fast and clear presentation of whether the power quality in the time period in question is in line with a standard or not
- Further tools provided for determining causes of problems
- Power quality reports as based on international standards
  - EN 50160
  - EN 61000-2-4
  - NeQual
  - IEEE 519
  - ITIC (CBEMA) (only manual, not automatic)
- Reports can be generated, time-driven
- Manual report generation in cases of concrete needs
- Automatic report generation
- Freely configurable time plans

Energy management

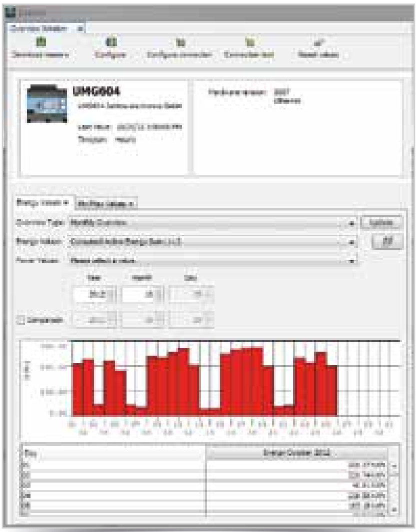


Fig.: Load profile, monthly view

- Measurement and monitoring of important parameters of the electrical power supply
- Visualisation of the data delivered by the measurement devices (online current values or historical values)
- Integrated report generator enables the evaluation of the delivered data
- Reports can generate different information, depending on the requirements or the settings
- Transmission of energy and power related cost centre reports
- Presentation of the electrical energy values from measurement devices as well as evaluation of other media (e.g. gas, water, etc.) possible
- Load profile analyses provide an overview of peak consumption throughout a stipulated period of time
- Automatic creation of the individual reports via freely configurable time plans or manual creation by the user
- Reports' outputs as paper or digital (HTML, XML, Excel, Word or PDF)

Export

Manually and automatically via time plans

- Time-driven, automatic Excel export (.xls, .csv, .pdf) of data
- Free data or specific energy selection
- Excel document with multiple pages to be filled with data by GridVis®
- Measurement data, time period and various different measurement devices will be selected by the user in GridVis® and contain pure data from the database as well as pre-calculated data (energies)
- There are three options available for the export:
  Overwrite existing data, create new data with date or change existing data
- Export options likewise time-driven and furnished with a time plan freely defined by the user
- Convenient evaluation guaranteed
- Customer-specific evaluations can be implemented

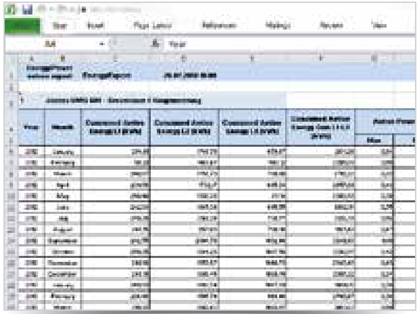


Fig.: Exported data from GridVis® in an Excel file

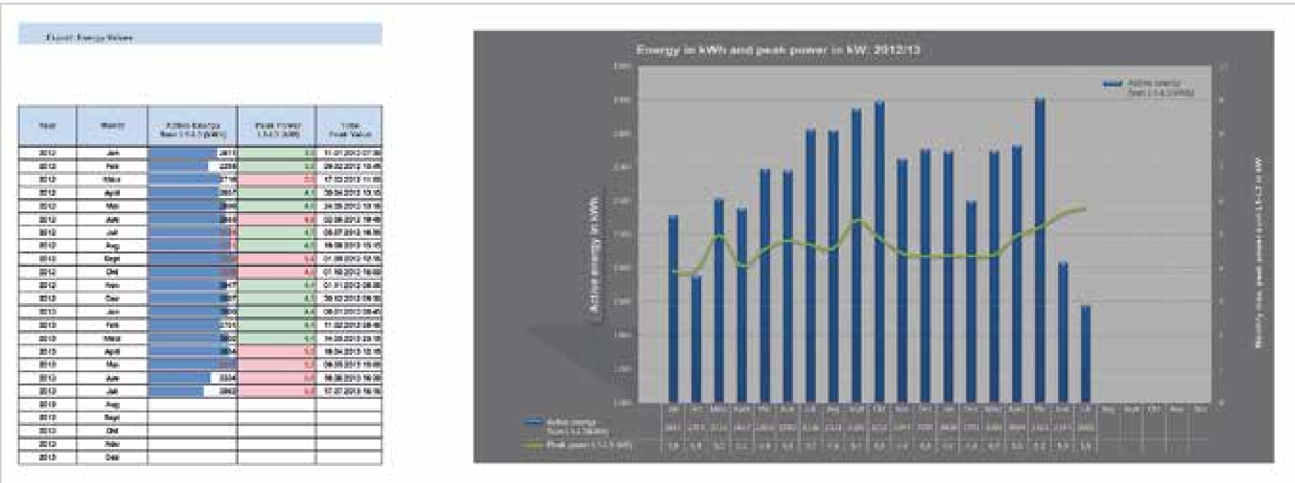


Fig.: Customer-specific Excel evaluation for el. power and energy based on the automatic Excel report

Database management

- Database integration in GridVis®-Desktop and -Service
- Backing up of data in a database when reading out the measurement device memory
- Possible databases: Apache Derby, MySQL, MS SQL and Janitza DB
- GridVis® Desktop and GridVis®-Service or a mixture of both are available
- The reading out of a UMG device at a point in time is always linked to precisely one GridVis® or one Service

GridVis®-Desktop

- The installation is implemented locally on a Desktop PC or centrally on a virtual machine
- The GridVis® must be active for the data to be read out
- Consequently, devices can be controlled, read out and configured
- Data created will be written into the database associated with the respective GridVis® Project

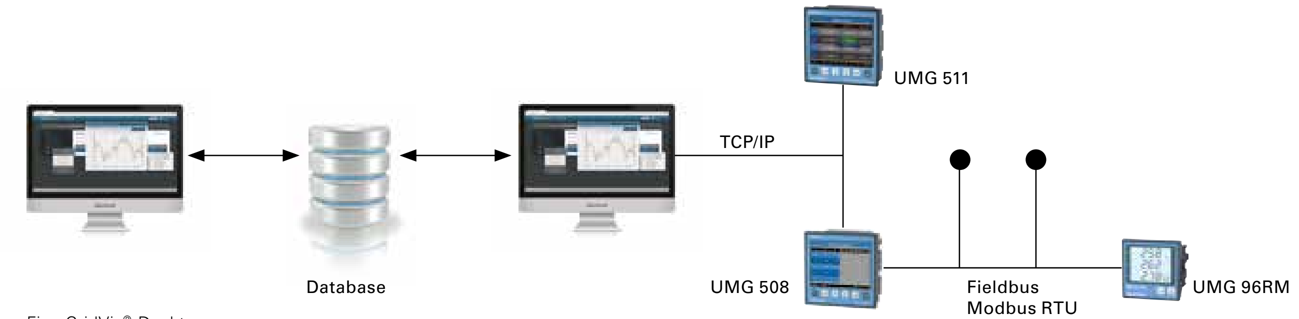


Fig.: GridVis®-Desktop

GridVis®-Service

- Works via a system service on a remote server
- The system service can read data in the background continuously from the measurement devices without GridVis® -Desktop being open and a user logged-in
- This service installation enables multiple clients to operate in parallel
- Configuration of UMG measurement devices or projects is implemented via the GridVis®-Desktop program
- There will be a subsequent transfer of the device rights to the GridVis® Service
- The GridVis® Service can be configured via a web browser
- Graphical and statistical evaluations continue to run via the GridVis® Desktop

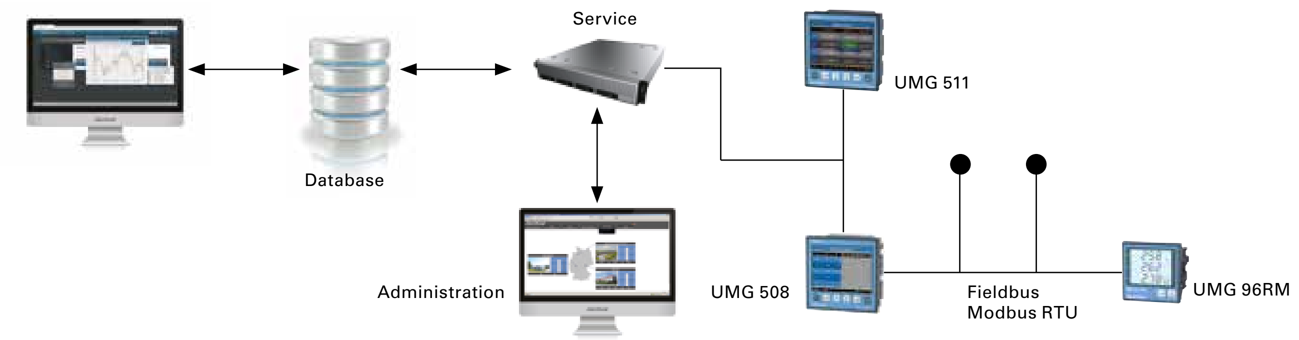


Fig: GridVis®-Service

Janitza DB

- Since GridVis® release # 4.1, the Janitza database "Janitza DB" has been released
- This database can be selected during the set-up of a new project
- Creation of the database through GridVis®
- This database has been specially optimised for GridVis®
- It is extremely fast
- Data exchange with other software platforms, homepages etc. can be realised via the REST interface
- Delivered with all editions of GridVis®
- There are no additional costs
- No additional installation effort

Note: With the Janitza DB it is not possible for multiple clients to access the Janitza DB! One can only connect a GridVis® Desktop and a GridVis® Service on "one" computer or server with the same Janitza DB!

Data exchange

- Uncomplicated system integration through numerous interfaces and protocols (Modbus, M-Bus)
- Networking of all energy measurement devices with one another possible
- The communication between GridVis® and the measurement devices is implemented typically via Modbus RTU or Modbus TCP (as well as other TCP/IP protocols)
- Automatic read-out of the measurement devices via a Fieldbus
- Measurement data will be made available for further use via central data servers
- Ethernet TCP/IP as backbone for the data communication to reduce installation costs
- Rapid, cost-optimised and reliable communication assured through integration into an Ethernet architecture
- PLC, BMS or SCADA software can access the Modbus addresses directly
- Alternatively, it is possible to integrate UMG measurement devices into a PLC environment via Profibus
- Communication of various different systems in the building automation via BACnet (available as an option)

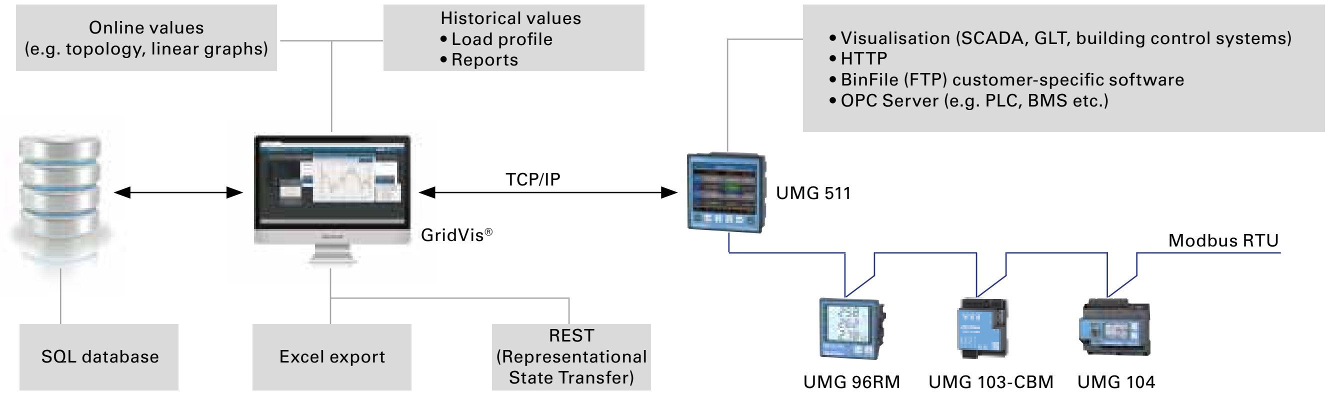


Fig.: Overview of the multifaceted integration options to superordinate software environments

Virtual measurement devices (cost centres, key figures)

- Virtual measurement devices are available for mathematical calculations by means of GridVis®
- Compilation of multiple sites through the addition of various different measurement points (cost centre management)
- Calculation of key figures e.g. for the evaluation of the energy efficiency in data centres
- Calculation of current and historical values with existing databases
- The following operations are possible: Addition, Division, Subtraction, Multiplication
- Generation of percentage values based on numeric constants
- No creation of additional measurement values in the database
- Calculation implemented in the runtime of the GridVis®
- There are various different target data points available (e.g. ProData® data logger) for the calculation of non-electrical media
- Possibility of incorporating devices from other manufacturers via the generic GridVis® Modbus option (integration test may be necessary)
- Measurement values from the measurement devices' global variables can be processed in virtual measurement devices as an option

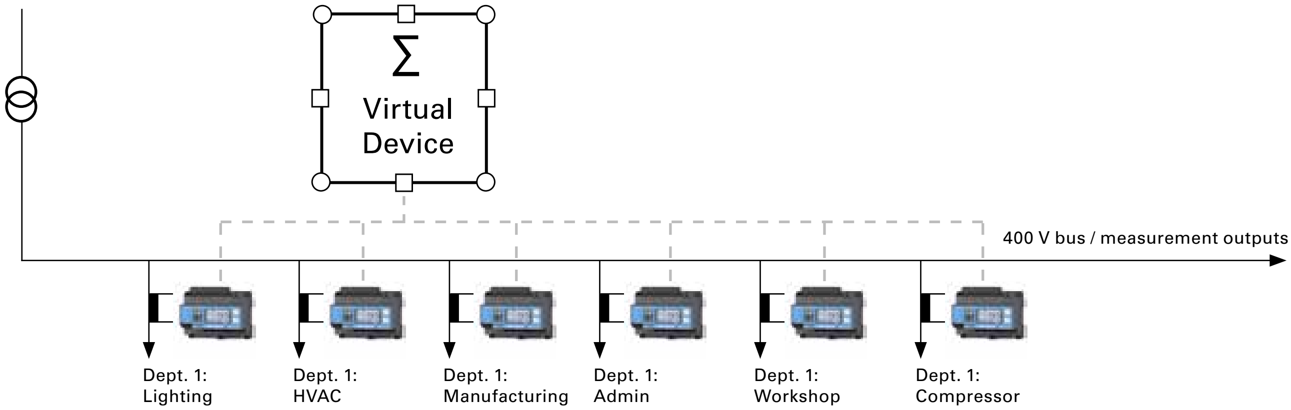


Fig.: The virtual measurement device calculates the total consumption in the supply line

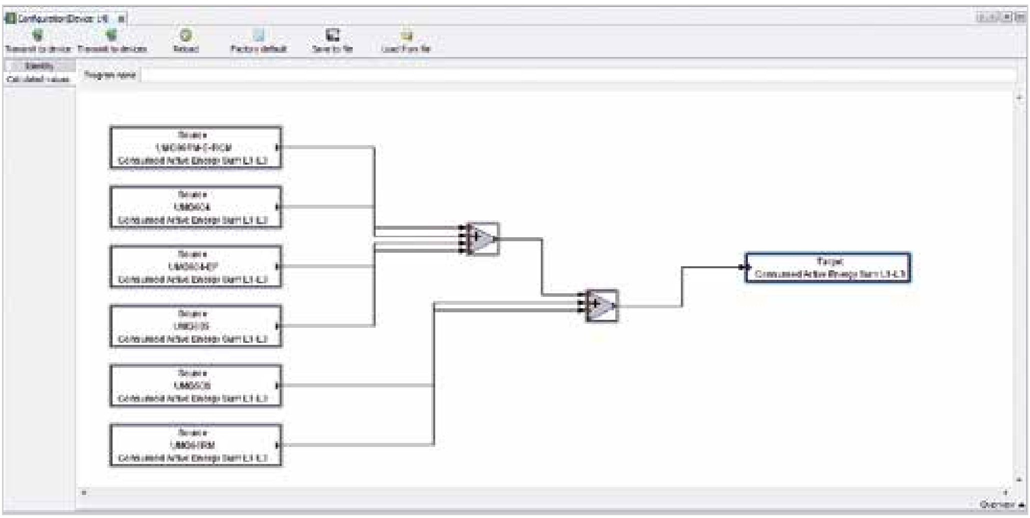


Fig.: Configuration of a virtual device: Here, the total of the active energy from 6 different measurement points

Power quality analysis

- In parallel to energy monitoring, GridVis® places the monitoring of the power quality in the foreground
- Defining of threshold values via GridVis®
- Automatic recording of events, including the period immediately before and after, such as over-voltage or under-voltage, short-term interruptions, over-current and transients
- Preconfigured parameter lists for recordings per EN 50160 and EN 61000-2-4 available

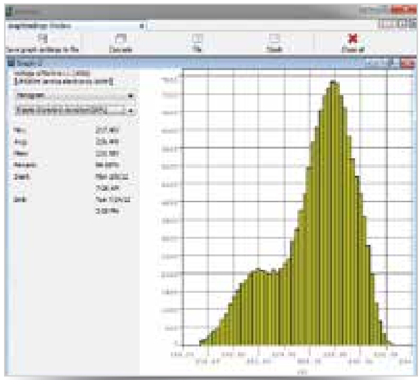


Fig.: Statistical function with histogram, e.g. with triple deviation (99%) for the evaluation of the voltage fluctuation at a defined measurement point over time

GridVis® provides a series of features for the power quality analysis:

- Oscilloscope function for the live wave forms of current and voltage
- Topological view with threshold value monitoring of online values
- Transients and events overview in the measurement devices' dashboard
- Graph sets with freely configurable measurement parameters
- Automatic creation of PQ reports per time plans
- PQ reports for various different standards: NeQual, EN 50160, EN 61000-2-4, IEEE 519
- Comprehensive statistical functions
- ITI (CBEMA) curve
- Event browser via lists and graphical display for detailed analysis
- Transient browser via lists and graphical display for detailed analysis

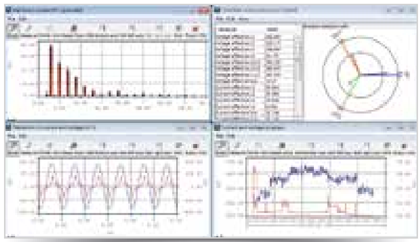


Fig.: Graph set with freely configurable PQ measurement values

Events and transients

- Events are short-term increases in voltage, dips in voltage or short-term interruptions (e.g. through bird strike or short circuits)
- Identification and analysis of the causes for fluctuations in power quality with the help of user-friendly tools
- Event and transients browsers are helpful tools for the determination and assignment of various different processes
- Call-up, expanding, reducing, printing out or exporting (PDF or Excel file) of the graph directly from the list
- Optimum utilisation of the UMGs' performance by GridVis®
- Secure acquisition and processing of events from 20 ms and transients from 50 µs duration with UMG 511 and UMG 605-PRO for example

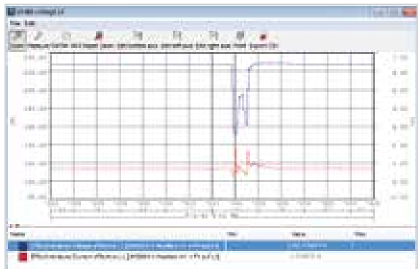


Fig.: The event browser provides a quick overview of the voltage dips with date and timestamps as well as the length and depth of the voltage dip.

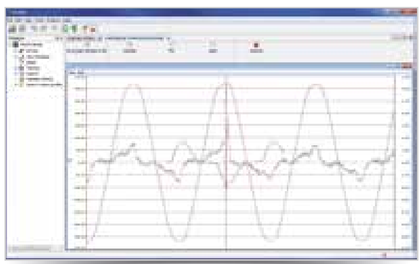


Fig.: Detailed analysis of a critical voltage dip

User management

Multifaceted user profiles

- Typically, a user (Admin) who will have no restrictions within the GridVis® is defined
- The Administrator can for example administer users and add or delete devices/topologies etc.
- Permits the specific assignment and deletion of each user's rights
- Defined access authorisations can be assigned through the rights
- Likewise, users are created and they are assigned rights or assigned to groups with this function
- The user administration can be agreed and set as an active function within a project
- Only one user administration can be defined for each project
- All users, passwords, roles and rights are held in one database (user directory).
- Multiple projects can be protected from one single user directory
- The individual rights of users are compiled in predefined roles (groups of entitlements)
- Roles (groups of rights) are cumulative, i.e. the rights of users from various roles are added together
- If a project is protected via the user administration, it is necessary to log in to gain access to the project
- Use of user administration within GridVis® is available in all editions (from GridVis® 4.0) except for the basic edition

Fig.: User administration overview

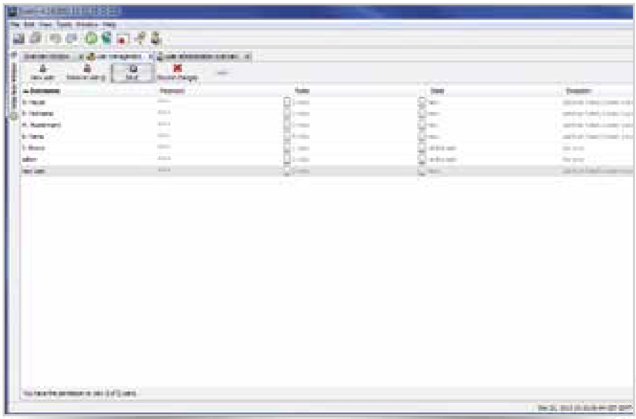


Fig.: User editor

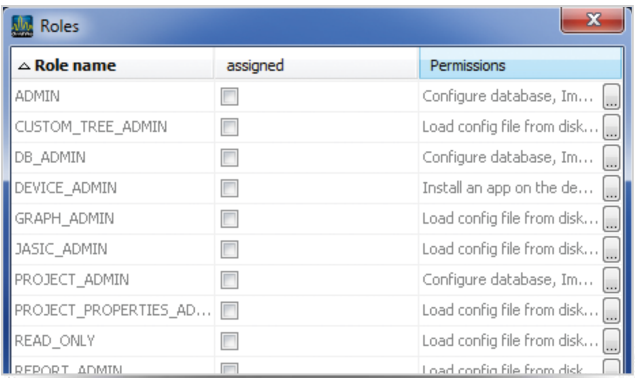


Fig.: Assignment of roles

Fig.: Graphical display of the energy values via the REST interface from GridVis®

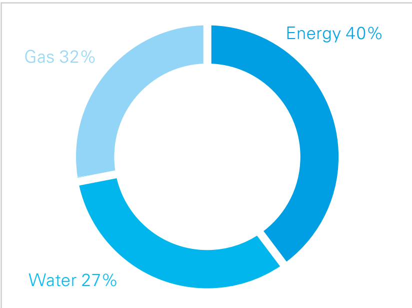


Fig.: Cost distribution

REST interface via GridVis®-Service

Online and historical data are supported

- Simple and rapid calculation of energy data
- The REST interface (Representational State Transfer) describes a standardised request for measured variables or further information via a URL address
- Various different methods can be used to integrate measurement data into software from other manufacturers due to very open system architecture
- Integration of data from GridVis® into other software environments, e.g. SCADA or BMS
- Further processing of the data, e.g. for the calculation of the key figures
- Results of the query via the URL are the page contents in JSON / XML with the queried measurement variables / information
- Extremely useful for the integration of measurement data into your own software solutions, visualisation systems or homepages
- Extraordinarily fast interface
- Querying and transfer of online and historical data
- REST interface only available via the "GridVis®-Service" edition of GridVis®

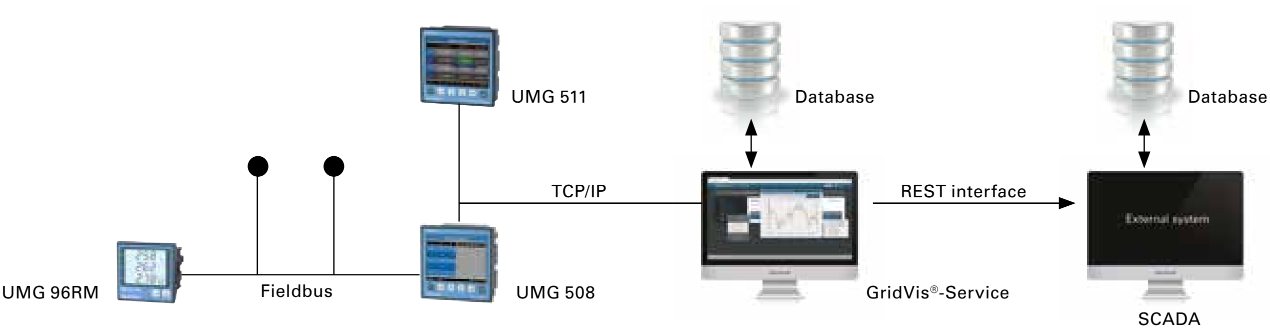


Fig.: Data transfer between GridVis®-Service and an external SCADA system via the REST interface

Alarm management

Intelligent alarm management system

- Systematic management of alarms in the field of energy-, RCM- and power quality monitoring
- Monitoring of all measurement parameters of the UMG measurement devices
- Powerful alarm management (from GridVis® Release 4.2, Edition GridVis®-Service)
- Rapid and reliable signalling of fault conditions
  (e.g. disconnected communications between measurement devices and measurement data servers, measured value exceedances, etc.)
- Fully automatic fault reporting immediately after the occurrence via various different channels to be transmitted to a multitude of different recipients
- Alarms are defined as events, which require an immediate reaction from the energy manager responsible or from the person responsible for operations
- An individual adaptation can be implemented, tailored to the particular requirements of the operator through the various options

Created	Updated	Name	Escalation Level	Acknowledged	Back to normal
1/27/14 2:26:32 PM'497	1/27/14 2:29:00 PM'044	Voltage monitoring	1	--	Back to normal
1/27/14 2:12:32 PM'475	1/27/14 2:13:24 PM'407	Power sag	2	--	Back to normal
1/27/14 2:08:37 PM'767	1/27/14 2:10:17 PM'579	Power sag	1	--	Back to normal
1/27/14 11:00:06 AM'485	1/27/14 2:05:44 PM'058	Voltage monitoring	1	--	Back to normal
1/27/14 10:56:03 AM'782	1/27/14 10:56:43 AM'596	Email power sag	0	--	Open
1/27/14 10:46:09 AM'783	1/27/14 10:47:49 AM'598	Voltage monitoring	1	--	Back to normal
1/27/14 10:41:53 AM'302	1/27/14 10:44:33 AM'131	Power sag	1	--	Back to normal
1/27/14 10:38:53 AM'366	1/27/14 10:39:33 AM'108	Power sag	1	--	Back to normal
1/27/14 10:12:32 AM'366	1/27/14 10:13:24 AM'108	Voltage monitoring	1	--	Back to normal

Extensive range of services

- Direct, rapid and secure information for the service personnel responsible
- Convenient administration of employees and actions
- Acknowledge function
- Escalation management; in the event of there being no feedback the next employee is informed
- Log book function, alarm list with open and acknowledged alarms
- Sorting and filtering functions

Effective monitoring facilities

- Online values: Monitoring threshold values (absolute values, consumption values over time)
- Historical values: Monitoring threshold values (absolute values, consumption values over time)
- Monitoring the availability of the measurement points (UMGs) in terms of data communication
- Monitoring of the last point in time for synchronised data

PQ reports

Freely configurable limits, annual report acc. EN50160, heat map and evaluation functions

- 4 new reports (heat map, matrix, device sheets and table) similar configuration structure
- Output in PDF or XLS data, also special format incl. company logo and own signature
- Template function for set of threshold values
- Optimized monthly and annual reports
- EN50160-2-4 and EN61000-2-4 conform template

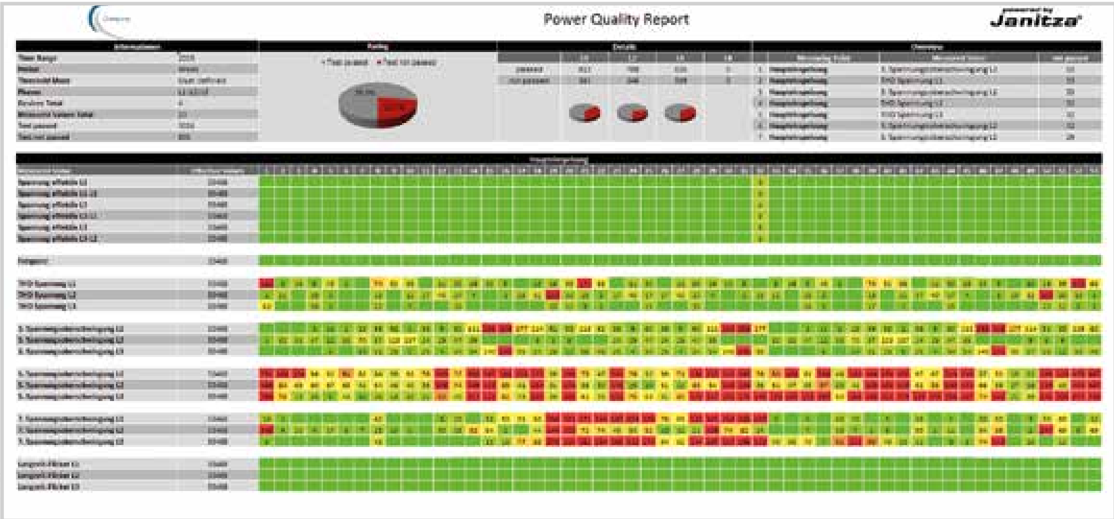


Fig.: PQ report heat map

RCM report

Analyze and evaluate differential current failures

- 4 limit values
- Support of dynamic limits (RCM measuring device)
- Optimized for differential currents
- Varity of 2 different report designs
- Light function
- Optical highlighting of the results
- Output in PDF and XLS data

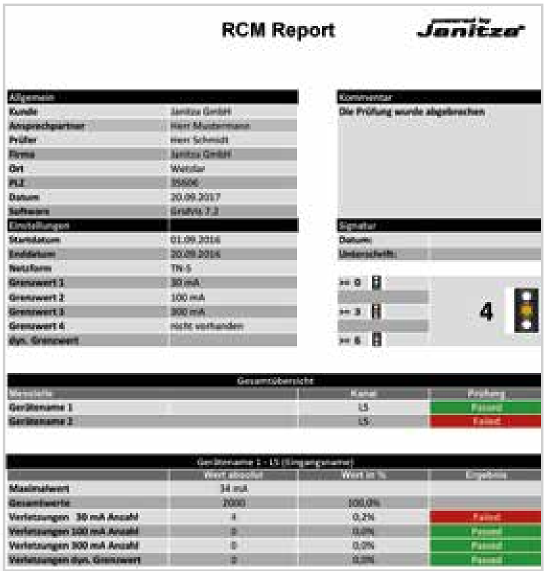


Fig.: RCM report

GridVis® editions – a multitude of possibilities

GridVis®-Ultimate 51.00.190

As GridVis®-Service, but with the following additional features:

NEW: GridVis®-Energy web interface

- Expanded user management
- Dashboards (customized creation of an unlimited number of pages)
- Widgets
- Key Performance Indicator (KPIs)
- Sankey diagram for energy flow analysis
- Device overview with graph function
- Image manager

GridVis®-Service 51.00.180

As GridVis®-Professional, but with the following additional features:

- Service (background process) for automatic data logging in the background
- Online logging of measurement data
- REST interface
- Comprehensive alarm management
- Excel export
- Generic Modbus
- Automatic reports
- Cost centers
- Scheduling time periods
- PQ reports

GridVis®-Professional 51.00.160

As GridVis®-Basic, but with the following additional features:

- No restriction in number of measurement devices
- MySQL / MS SQL DB support
- Automatic read-out of the measurement devices
- Virtual measurement devices
- User management (for assigning user rights)

GridVis®-Basic – free basic variant 51.00.116

- Maximum of 5 devices
- Comprehensive graph screen
- Manual reports
- Topology view
- Janitza DB

*1 Some functions are only available in conjunction with GridVis® installation on the desktop.

NEW: Web visualization GridVis®-Energy with the software variant GridVis®-Ultimate **Item no. 51.00.190**

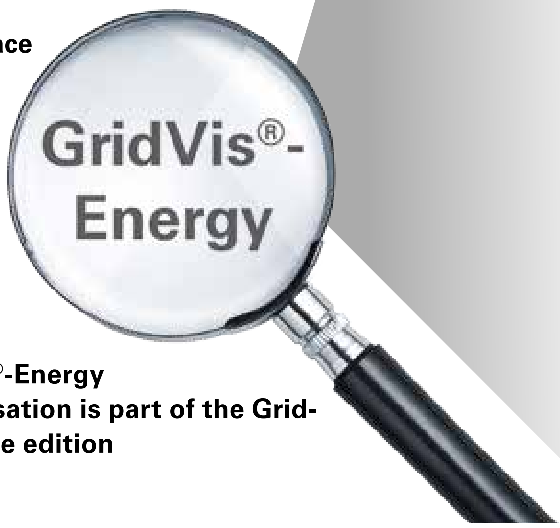
Log and display energy data, reduce costs

- Tailored web solution for energy management and visualising the energy data
- Highest standards for transparency and flexibility in allocating your company's resources
- Comparing energy data based on Key Performance Indicator or mass flow diagrams
- Comprehensive and easy to handle configuration of all Janitza measurement devices
- Monitoring energy flows and power quality
- Graphs, tables, diagrams, key figures, Sankey diagrams etc. can be created and freely positioned on so-called "dashboards"
- Transparency for your energy consumption or generation
- Realtime monitoring, or display of historical measured values possible at any time via a web browser
- User administration
- Intuitive operating

A convincing list of features

Ultimate edition

- Alarm management (automated monitoring and notification tool)
- Report functions (automated & manual), outputs to formats .xls, .csv, .pdf
- Read-out devices (automated & manual)
- Database management (automated & manual)
- Measurement device management (direct access to settings and memory of the measurement devices)
- Cost centre management (virtual devices allow you to view cost centres)
- Power quality monitoring (EN 50160 & EN 61000-2-4)
- Service (background process optimised for server)
- Online logging (log measured values permanently, even for devices with no memory function)
- REST interface (web API for direct access to historical and live values)
- **Web interface**



The GridVis®-Energy Web Visualisation is part of the GridVis®-Ultimate edition

Detailed functional overview GridVis®-Energy web interface

- Web-based visualisation software
- KPIs (key figures & benchmarking)
- Sankey (graphical representation of mass flows)
- TÜV-certified according to ISO 50001 (energy audit & EnMS)
- Comparison & benchmarking of locations & facilities (gauge the potential for optimisations)
- Analysis of energy & measurement data (simple & complex analyses are possible)
- No restriction on data points (free & unlimited access to all measurement data)
- Access your visualisations regardless of location (no client installation necessary, access them directly via a web browser)
- Dashboard configurator (create overviews to meet your own particular demands, clear & simple engineering effort)
- User management (manage user access rights)
- Evaluation of live & historical measured values (direct access to measurement devices & database)
- Animated widgets (charts, diagrams, tables, KPIs, Sankey & many more)
- Image manager (simple management of graphics & images)

Dashboards

Individual web pages design with 17 different widgets

- 17 Widgets
- Custom web pages
- Dashboard Editor
- Links
- Zoom
- Print function
- Grouping
- Templates

Key Performance Indicator (KPIs)

Comparability of consumption, economic figures, or quantities

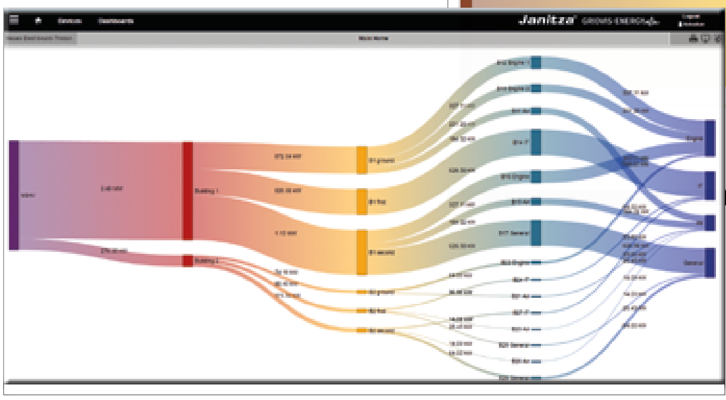
- Key Performance Indicator
- Evaluation
- Comparison
- Widget
- Trend

GRIDVIS-ENERGY

Sankey diagram

Graphical representation of mass flows

- Mass flows
- Freely configurable
- Widget
- Live values
- Historical values
- Accompanying values
- Loss indication



User management

Individual access rights and simple user management

- Intuitive
- User rights
- User profile
- Status indicator
- User management

Device overview

Structured and tabular device overview list

- Structured
- Table
- Information
- Template

Image manager

Administration of its own images, icons and graphics

- Incorporate your own images, icons and graphics into the application
- All common graphics formats are accepted
- SVG format recommended

Overview of GridVis® editions

Attribute	Basic	Professional	Service	NEW Ultimate
Installations (desktop)	1	3	5	5
Installations (service / virtual server)	0	0	2	2
Number of devices	5	Unlimited	Unlimited	Unlimited
Update period	Unlimited	1 year	1 year	1 year
Telephone support	Unlimited	Unlimited	Unlimited	Unlimited
Graphs	•	•	•*2	•*2
Janitza DB / Derby DB database	•	•	•	•
Manual reports	•	•	•*2	•*2
Graphical programming	•	•	•*2	•*2
Topology	•	•	•*2	•*2
MS SQL / MySQL database support*1	-	•	•	•
Automatic read-out	-	•	•	•
Virtual device	-	•	•	•
User administration	-	•	•	•
Scheduling points in time	-	•	•	•
CSV data import	-	•	•	•
RCM report	-	•	•	•
Scheduling time periods	-	-	•	•
PQ reports	-	-	•	•
Automatic Excel export	-	-	•	•
Generic Modbus	-	-	•	•
Graphical programming module (read / write Modbus)	-	-	•*2	•*2
Automatic reports	-	-	•*2	•*2
Online logging	-	-	•	•
Service	-	-	•	•
Alarm management	-	-	•	•
REST interface	-	-	•	•
GridVis®-Energy web Visualisation	-	-	-	•
Item number	**51.00.116**	**51.00.160**	**51.00.180**	**51.00.190**
Item number for update extension (per year)	**-**	**51.00.161**	**51.00.181**	**51.00.191**
Item number for upgrade to next higher suite	**-**	**51.00.162**	**51.00.182**	**-**

*1 SQL database is not included in the scope of deliverables.
*2 This function is only available in conjunction with GridVis® installation on the desktop.

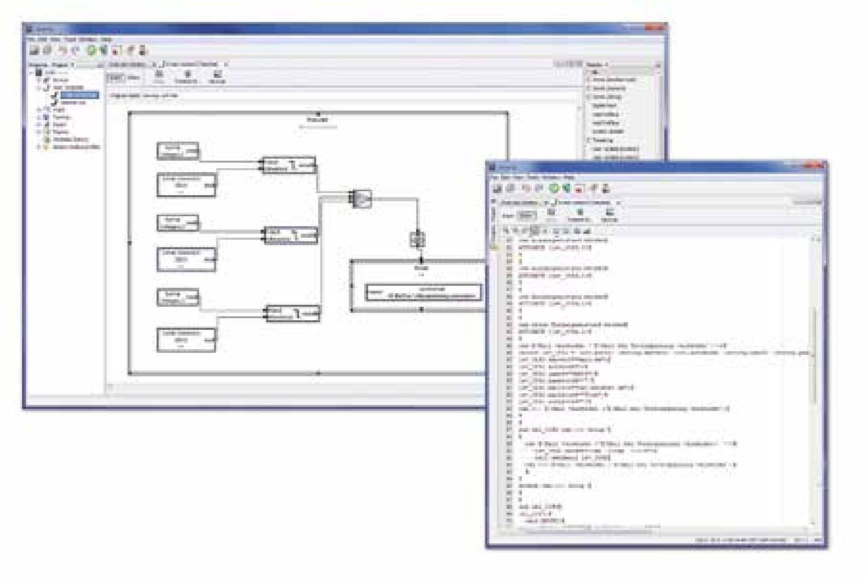
Number of devices: Max. number of simultaneously loaded devices (e.g. within the basic version: a project with 5 devices or 5 projects with one device).

Update period: Time period in which new versions can be installed free of charge.

Automatic read-out: Device read-out in accordance with freely configurable time plans.

Online logging: Measurement data from devices without memory will be averaged in the GridVis® software.

Service: The GridVis® software runs in the background and will be started automatically. Devices can be readout time-independent and automatically. For configuration and data processing the desktop installation is required.



EN 50160 / ISO 50001
Made in Germany

Jasic® programming language

Manifold programming options

- Special programming / script language for the measurement devices UMG 604-PRO / UMG 605-PRO / UMG 508 / UMG 509-PRO / UMG 511 and UMG 512-PRO
- The user is no longer restricted to the functionalities integrated in the measurement device, but rather the device can be expanded to suit the individual's requirements
- Graphical programming supports the creation and configuration of mathematical functions and logical links
- The devices' own digital outputs can be set
- Digital inputs can be easily evaluated
- The processing and writing of registers belonging to external devices can be implemented via the Modbus
- Free configuration of threshold value infringements, timer functions or recording of special values can be implemented
- Programs created can be stored as files or transferred directly to the measurement device
- There are 7 memory spaces available, each with 128 kByte, for the saving of the programs
- Simultaneous operation of these 7 programs possible
- User-friendly, graphical programming
- Free programming of the Jasic® source code by the user

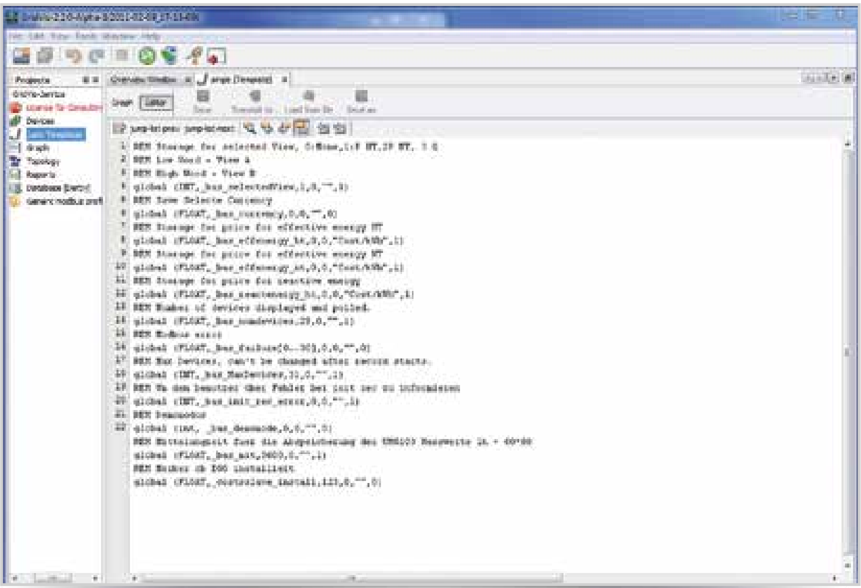


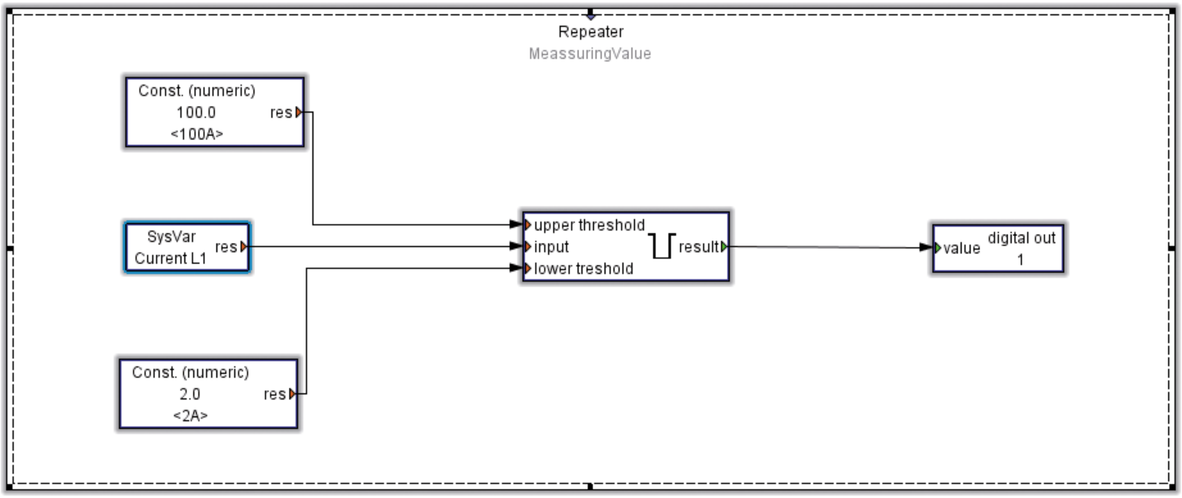
Fig.: Jasic® source code

Graphical programming: Examples

Example of threshold value monitoring (comparator)

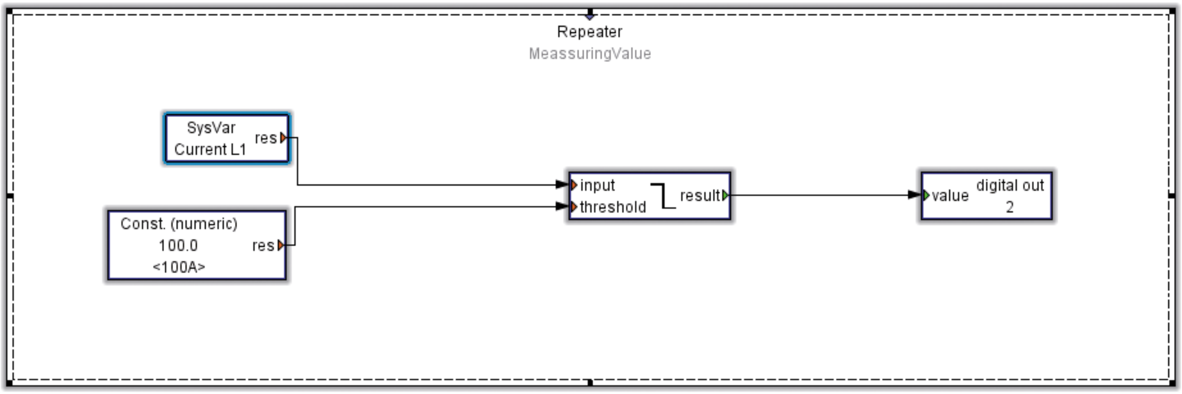
Example 1

- Monitoring of current L1: Determination of the threshold value by means of constants, lower level 2 A, upper level 100 A
- Digital output 1 signals the exceedance of the predefined values



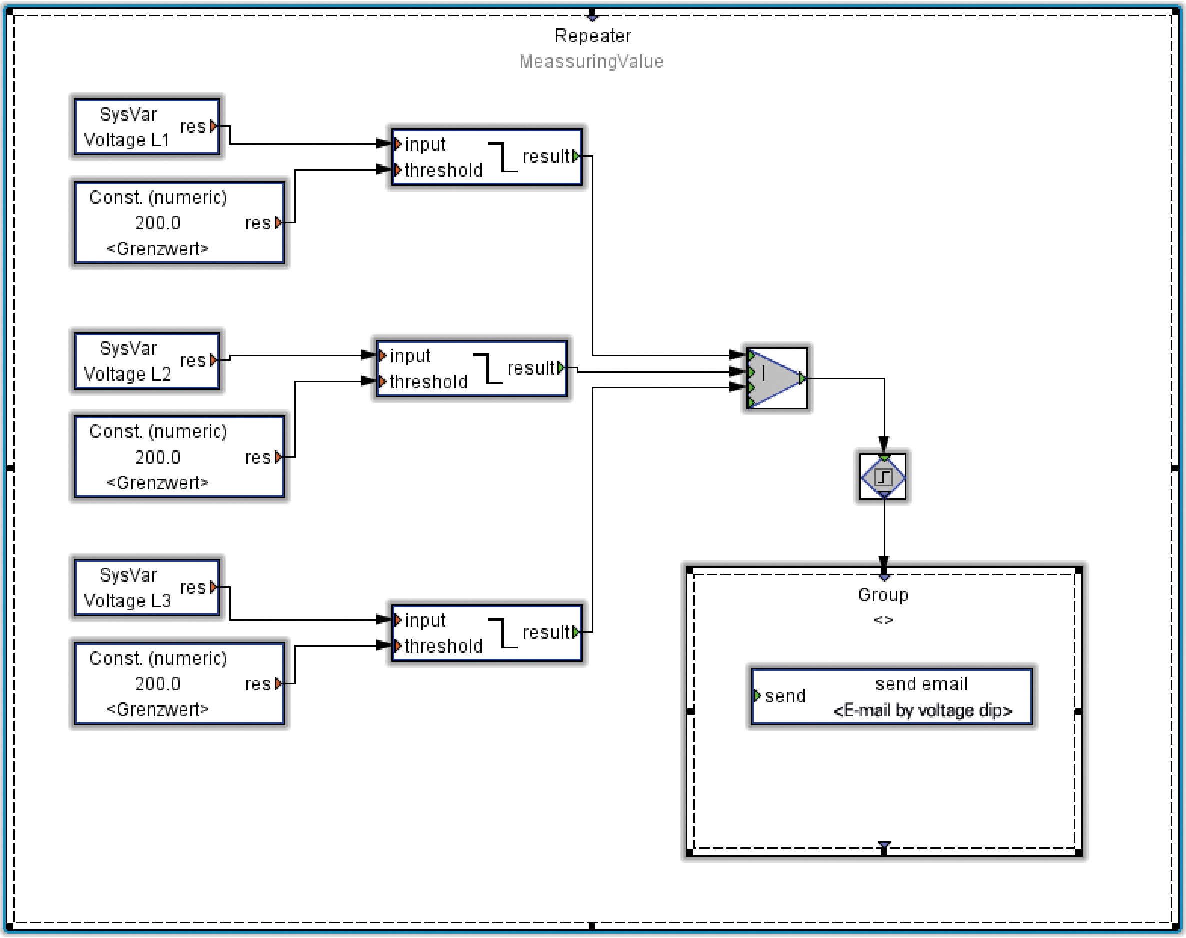
Example 2

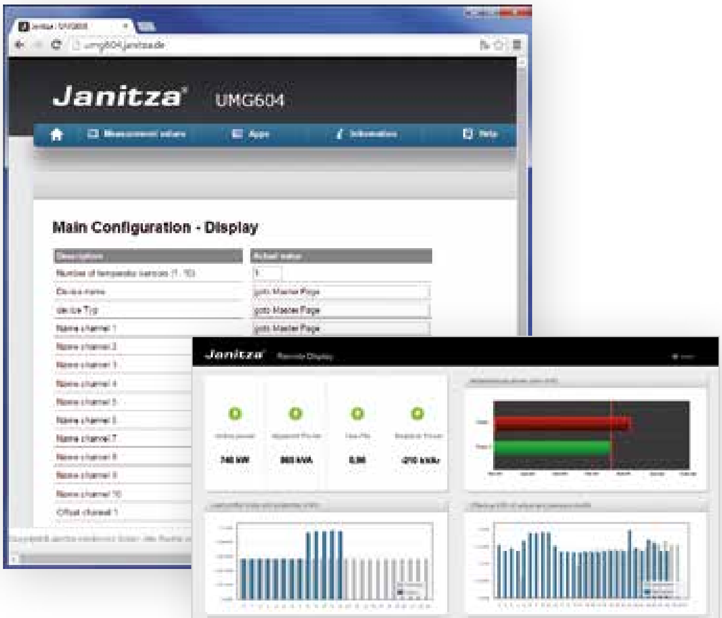
- Works with only one lower threshold (in this case 100 A)
- In the event of the current dropping below 100 A, digital output 2 will be activated



Example 3

- An email will be sent in the event of the value dropping below the predefined setting
- In this example the email will be sent with an under-voltage of < 200 V in phases L1, L2 or L3
- Additional information: Voltage values from the 3 phases at the time of the undervoltage





APPs – expansions with know-how

Software based expansions for the measurement devices

- Functions integrated in the UMG device can be expanded, controlled and visualised via APPs
- Depending on the application, consisting of several Jasic®, Flash and homepage files (administration and installation implemented via GridVis® software)
- The programming language for creating APPs is Jasic®
- Alternatively, the programming can also be implemented graphically with the GridVis®
- Development of further APPs for the measurement devices by the user and third parties possible
- The creation of APPs requires programming knowledge of Jasic®, JAVA Script, JSON, AJAX or Action Script depending on the application

Overview of product variants		
Description	Suitable for	Item number
Alert Messenger*6 Configurable Jasic® program for sending fault messages by email	UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series	**51.00.209**
EN50160 Watchdog*6 Integrated "Watchdog"-function for continuous monitoring per EN 50160	UMG 605 / UMG 512	**51.00.264**
FBM10PT1000*2 Up to 10 additional thermistor inputs can be implemented via the RS485 interface by means of hardware expansion	UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series	**51.00.211**
Humidity & Temperature JFTF-I*3 Processing and recording of up to 8 temperature / moisture sensors possible	UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series	**15.06.337**
GPS Sync Synchronization of the device time via digital input. For usage of the APP the GPS receiver, item no.15.06.240, is required	UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 and PRO series	**51.00.291**
IEC61000-2-4 Watchdog*6 Integrated "Watchdog"-function for continuous monitoring per IEC 61000-2-4	UMG 605 / UMG 512	**51.00.265**
IEC61000-2-4 Watchdog Light*6 Integrated "Watchdog"-function for continuous monitoring per IEC 61000-2-4	UMG 604 / UMG 509	**51.00.309**
Messwertmonitor*4 *6 Display of current and historical measured values in the form of diagrams on the device's own homepage	UMG 96RM-E	**51.00.246**
Multitouch*1 Reading out of 30 measured values and max. 31 slave devices via RS485	UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series	**51.00.207**
Push Service*5 *6 Sending data directly from the measurement device to a server without any additional software with 10 slave devices	UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512	**51.00.238**
Push Service + UMG 20CM*5 *6 Sending data directly from the measurement device to a server without any additional software For UMG 20CM queries over: UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 und PRO-Serie	UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series	**51.00.285**
SNMP Threshold monitoring with alarm function (SNMP-Trap)	UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series	**51.00.310**

*1 Also needed for BACnet, if slave devices have to be visualized via RS485.
*2 Free APP for item-no. 15.06.077.
*3 Free APP for item-no. 15.06.074.
*4 No APP installation; device activation required
*5 The APP Push Service is integrated in the firmware of the measuring device UMG 96RM-EL (unencrypted).
*6 Serial number is needed

APP Fault message **Item no. 51.00.209**

- Configurable Jasic® program for sending fault messages by email
- Depending on configuration, sending of fault messages with the following events: Total harmonic distortion voltage exceeded, short-term interruption detected, transient detected
- Saving the meter readings for the event and transient messages in the Modbus register
- Option to monitor additional measured values via an interface (not included)
- Emails*1 with consumption values for day, week and month can be sent (a non-encrypted mail server is required)
- Serial number is needed

Suitable for: UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series

APP FBM10 PT1000 **Item no. 51.00.211**

- Up to 10 additional thermistor inputs can be implemented via the RS485 interface
- Hardware expansion FBM10 PT1000 – a DIN rail module with 10 PT1000 inputs – necessary for this APP

Suitable for: UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series

Fig.: Measured value display via the devices' homepage

APP Humidity & Temperature JFTF-I **Item no. 15.06.337**

- Can process and record the measured values from up to 8 temperature/ moisture sensors (item no. 15.06.074)
- In doing so the display of the measured values is implemented via a homepage after installing the APP, or via global variables in the GridVis®
- Measured values can be saved in a second Jasic® program via the graphical programming
- Delivers two analogue 4 – 20 mA output signals, which will be processed by the function module FBM DI8AI8 (item no. 15.06.079)

Suitable for: UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series

Fig.: Humidity / temperature sensor JFTF -I

APP EN 50160 Watchdog

Item no. 51.00.264 & 51.00.305

Integrated “Watchdog” function for continuous monitoring of the power quality per EN 50160. The power quality on the supply side should comply with EN 50160. This standard describes various power quality parameters for the distribution of electrical power on public power grids. EN 50160 pertains to mains voltage, i.e. the voltage measured at the mains connection point. With power quality monitoring per EN 50160, all the algorithms (including for 95% and 100% values) are integrated in the measurement device itself.
The auxiliary voltage of the device should be buffered to ensure that power failures can be reliably detected as events.

- Integrated watchdog function
- No need to transmit large volumes of measured data from the measurement device to a host system
- Save on communications costs for applications with remote consumers
- Simple analysis possible thanks to integrated colour display based on a “traffic light” system
- Possible to perform power quality analyses even with no particular knowledge on the topic
- No alarm functionality
- Serial number is needed

Item no. 51.00.264 suitable for: UMG 605 and UMG 512
Item no. 51.00.305 suitable for: UMG605-PRO and UMG 512-PRO

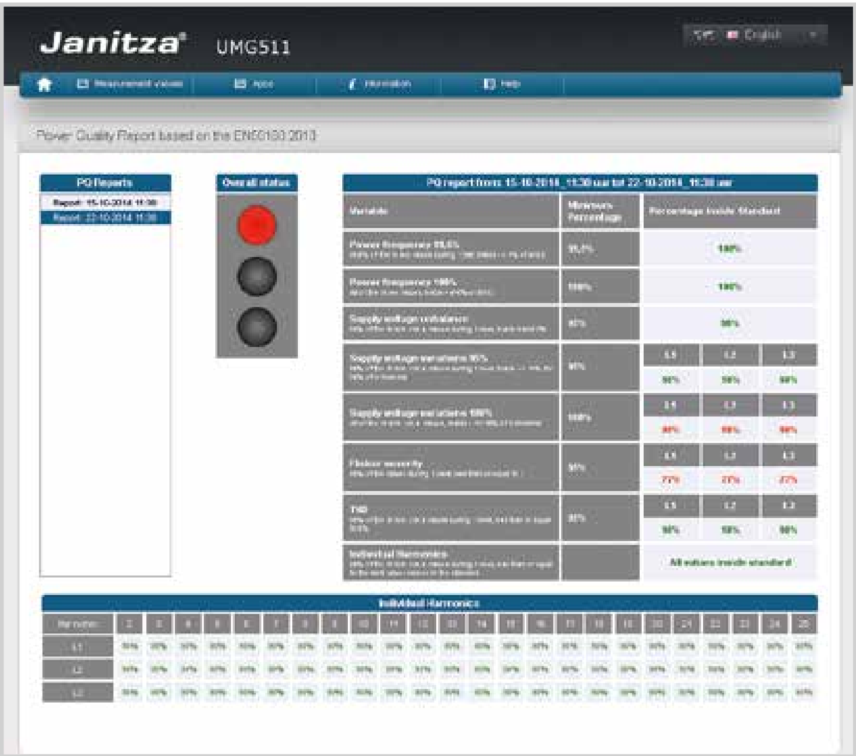


Fig.: APP Power Quality Report based on the EN 50160

APP IEC 61000-2-4 Watchdog

Item no. 51.00.265 / 51.00.306 / 51.00.309 / 51.00.308

Integrated "Watchdog" function for continuous monitoring of the power quality per IEC 61000-2-4. The standard IEC 61000-2-4 defines numerical limits for industrial and private power distribution systems at rated voltages up to 35 kV. For the consumer, the standard IEC 61000-2-4 should be applied with reference to power quality. Therefore the power quality in all technical systems must be continuously monitored in accordance with IEC 61000-2-4, in order to ensure fault-free operation of the installed system.
The auxiliary voltage of the device should be buffered to ensure that power failures can be reliably detected as events.

- Integrated watchdog function accordance with standard IEC 61000-2-4
- No need to transmit large volumes of measured data from the measurement device to a host system
- Save on communications costs for applications with remote consumers
- Simple analysis possible thanks to integrated colour display based on a "traffic light" system
- Possible to perform power quality analyses even with no particular knowledge on the topic
- No alarm functionality
- Serial number is needed

Item no. 51.00.265 suitable for: UMG 605 and UMG 512
Item no. 51.00.306 suitable for: UMG 605-PRO and UMG 512-PRO
Item no. 51.00.309 suitable for: UMG 604 and UMG 509
Item no. 51.00.308 suitable for: UMG 604-PRO and UMG 509-PRO

Fig.: APP Power Quality Analyse acc. to IEC 61000-2-4

APP Measurement monitor **Item no. 51.00.246**

The “Measured value monitor” APP allows you to display current and historical measured values, in the form of diagrams, on the homepage of a Janitza UMG device. User-friendly controls mean you can create diagrams quickly and easily.

- Fully web-based, you only need a web browser
- Can be run on desktops, laptops, tablets etc.
- Access the most important current and historical measured values
- Easy operation with drag & drop
- Up to 6 measured values in a diagram (2 Y-axes)
- Up to 60,000 data points in a diagram (10,000 per measured value)
- Serial number is needed

Suitable for: UMG 96RM-E

Fig.: APP Measurement monitor

APP Multitouch **Item no. 51.00.207 & 51.00.293**

- Reads out 30 measured values (fixed default value) from up to 31 slave devices (configurable) via RS485
- Filing of the measured values in the master in global variables or on BACnet data points
- Display of the measured values is implemented via the JPC35 touch panel or via the device homepage (browser with FLASH plug-in necessary)
- Expansion for live value display
- Integrated BACnet gateway function (option, item no. 52.16.083)
- The BACnet-ID can be changed via the homepage
- Program installs a control program
- Possible communications fault (RS485-Bus) directly visible via a status display
- The number of devices and device descriptions can be configured via the master devices homepage
- The master device is automatically recognised and entered in the "Device type" field
- The BACnet configuration is likewise implemented via the master device homepage
- Each device can be assigned its own BACnet-ID
- EDE file for the import of the BACnet data points in a BACnet-GLT is included in the scope of deliverables for the APP

Item no. 51.00.207 suitable for: UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series
Item no. 51.00.293 suitable for UMG 20CM queries via: UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series

Fig.: Multitouch APP: Slave measurement devices overview on the master device homepage, e.g. up to 31 UMG Modbus slaves can be displayed via a UMG 604-PRO master device

Fig.: Display of measured values for an individual slave device

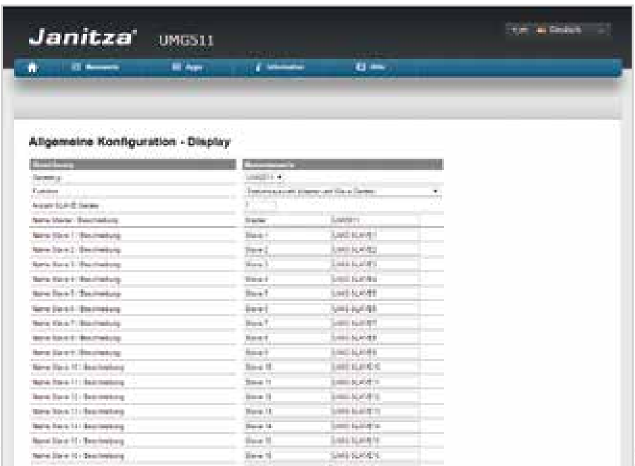


Fig.: General configuration of the monitoring master/slave devices

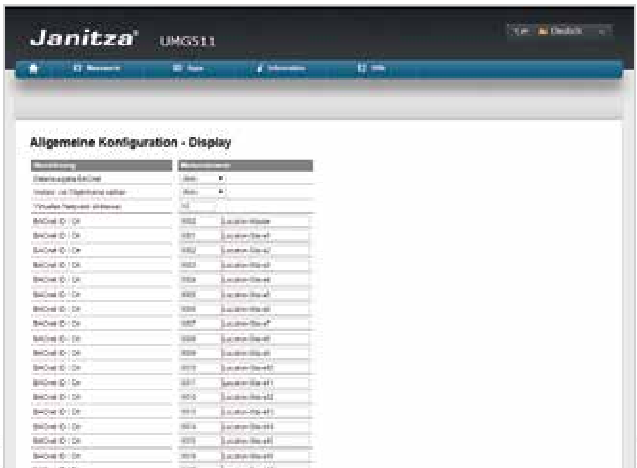


Fig.: General BACnet configuration

APP Push Service 2.0 **Item no. 51.00.238 & 51.00.307**

Applications

- Sending data directly from the device to the energy portal (without additional software)
- The delivery of data is implemented via port 80
- Data can be saved in a MySQL database automatically
- Data can be visualised via a web server by means of a web browser
- An APP must be installed on each device
- Only Jasic-capable devices are supported (UMG 604-PRO / UMG 605-PRO / UMG 508 / UMG 509-PRO / UMG 511 / UMG 512-PRO)
- UMG 96RM-EL with integrated Push App function is supported
- Prodata and UMG 20CM – only via Jasic®-capable devices

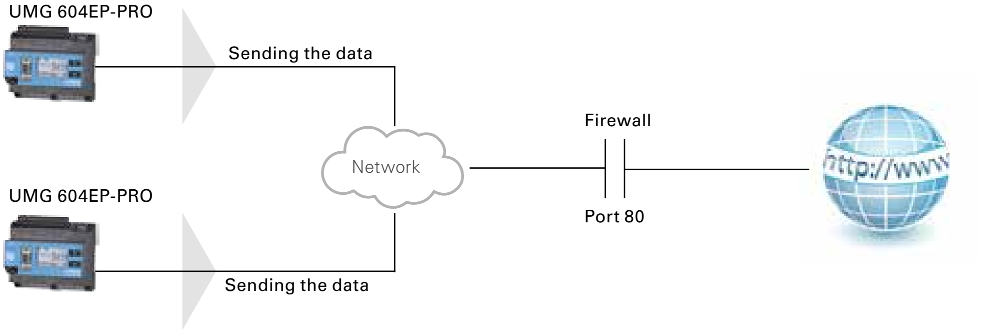


Fig.: Sending the content of the memory for the web application

Properties

- Sending of up to 25 measured values is possible simultaneously
- Delivery of the last mean values from the ring buffer
- APP automatically detects which data in the ring buffer is saved with which averaging time, and presents these for selection
- The measured values to be sent can be selected via the homepage
- Mean values are automatically synchronised to the device time
- The transmission time can be adjusted for the transmission buffer. In the event of the network connection failing, there are no gaps in the data so long as the failure is shorter than the transmission buffer time
- View of a status display on the homepage with the last data transmitted
- Setting of a daily status email to verify a successful sending process (optional)

Advantages

- Less data traffic
- Multiple devices can send data simultaneously
- The transmission string can be easily modified to suit individual requirements
- Thus there is an option to send data from external software
- The sending of data is implemented via port 80 (generally enabled with firewalls)
- Decentralisation and thus less susceptible to interference
- The transmission of data can be implemented as randomly controlled, so that there will be no overlapping
- Simple configuration

Overview of the main features of the APP Push Service 2.0

- Sending of up to 25 measured variables to a "software as a service" program
- Time intervals adjustable via port 80 (via HTTP/Json)
- Configuration implemented via the device website
- APP will be delivered, encrypted, linked to an individual serial number of the UMG device (provision of the serial number necessary)
- Serial number is needed

Item no. 51.00.238 suitable for: UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 and UMG 512

Item no. 51.00.307 suitable for: UMG 604-PRO / UMG 605-PRO / UMG 509-PRO and UMG 512-PRO

Fig.: Push Service 2.0 UMG 604-PRO

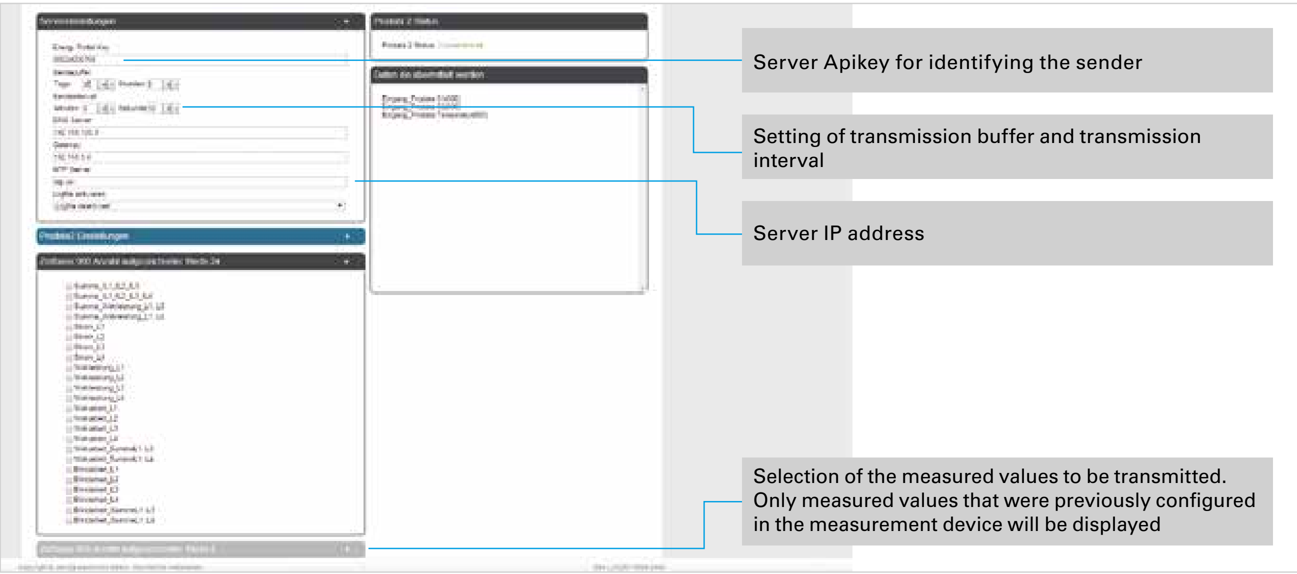


Fig.: Convenient configuration of the APP Push Service 2.0

GPS Sync **Item no. 51.00.291**

- Synchronisation of the device time via digital input
- No NTP server required
- Easy installation
- Accuracy +/-1 s per GPS synchronization
- A GPS receiver (item no. 15.06.240), available as an accessory, is required
- This APP is not required for the UMG 512-PRO because the GPS receiver can be connected to the digital input 1 without an APP on the UMG 512-PRO

Suitable for: UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 and PRO series

SNMP **Item no. 51.00.310**

- The "Limit value alarm via SNMP" application monitors the settings made on the weg page and in GridVis® and sends an SNMP trap when it is exceeded.
- Freely adjustable trap number
- Until two hosts setable

Suitable for: UMG 604 / UMG 605 / UMG 508 / UMG 509 / UMG 511 / UMG 512 and PRO series

Fig.: Configuration page on an UMG **without** RCM functionality

Fig.: Configuration page on an UMG **with** RCM functionality

Device homepage

Power management and power quality analysis online

The device-specific homepage for the measuring devices is ideal for users or target groups within a company, who do not wish to install the GridVis® software or do not require it. For access to this, the user simply requires a conventional web browser and an Ethernet connection (or a local patch cable). The screens have been graphically revised and have now been made even more user-friendly. Each measuring device has an integrated web server, which makes a separate, password-protected homepage available. It is possible to operate the device just as comprehensively via this, as via the device display. Furthermore, extensive online and historic measuring data (standard power consumptions), including the power quality analysis, can also be called up. It is even possible to control the measuring device remotely and configure it via the display indications. Because a multitude of PQ measured values can be displayed in addition to the countless standard electrical values, for many users the measuring device homepage constitutes the basic configuration for a monitoring system.

- Access to the powerful meter-homepage via web browser
- No software installation necessary
- Real-time data, historical data etc. directly accessible via the meter home page
- Function extension via APPs possible
- Remote control of device display via homepage
- Password protection possible

Fig.: IEC 61000-2-4 analysis with traffic-light principle

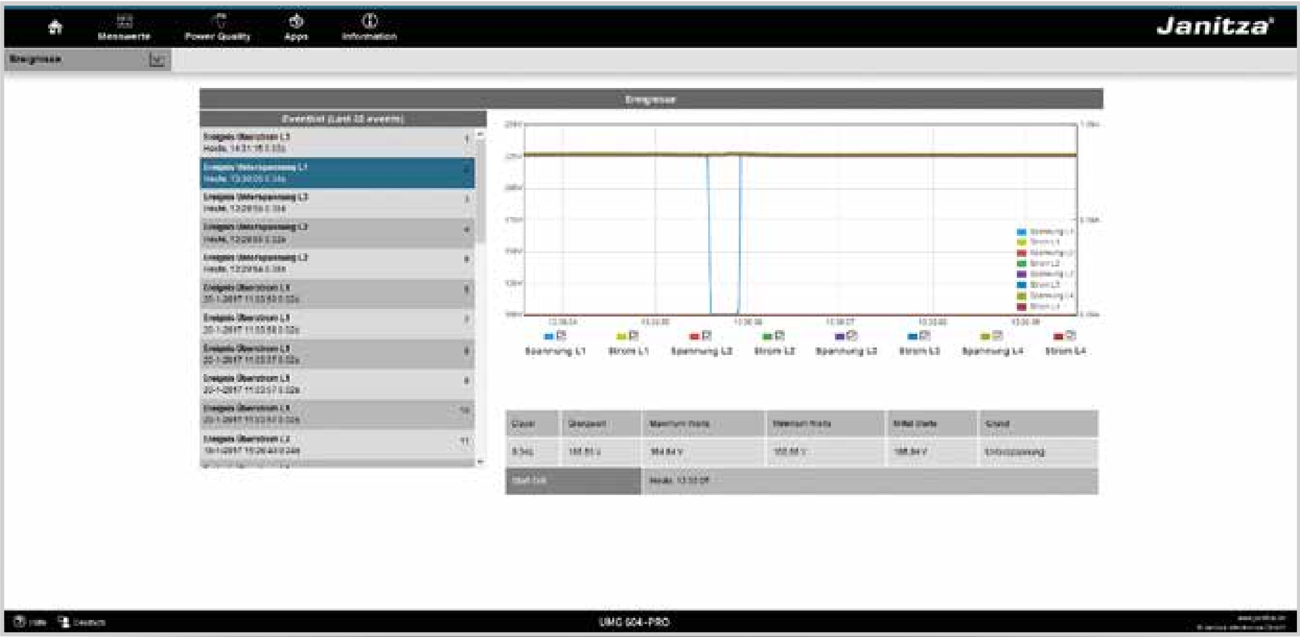


Fig.: PQ display – under-voltage event

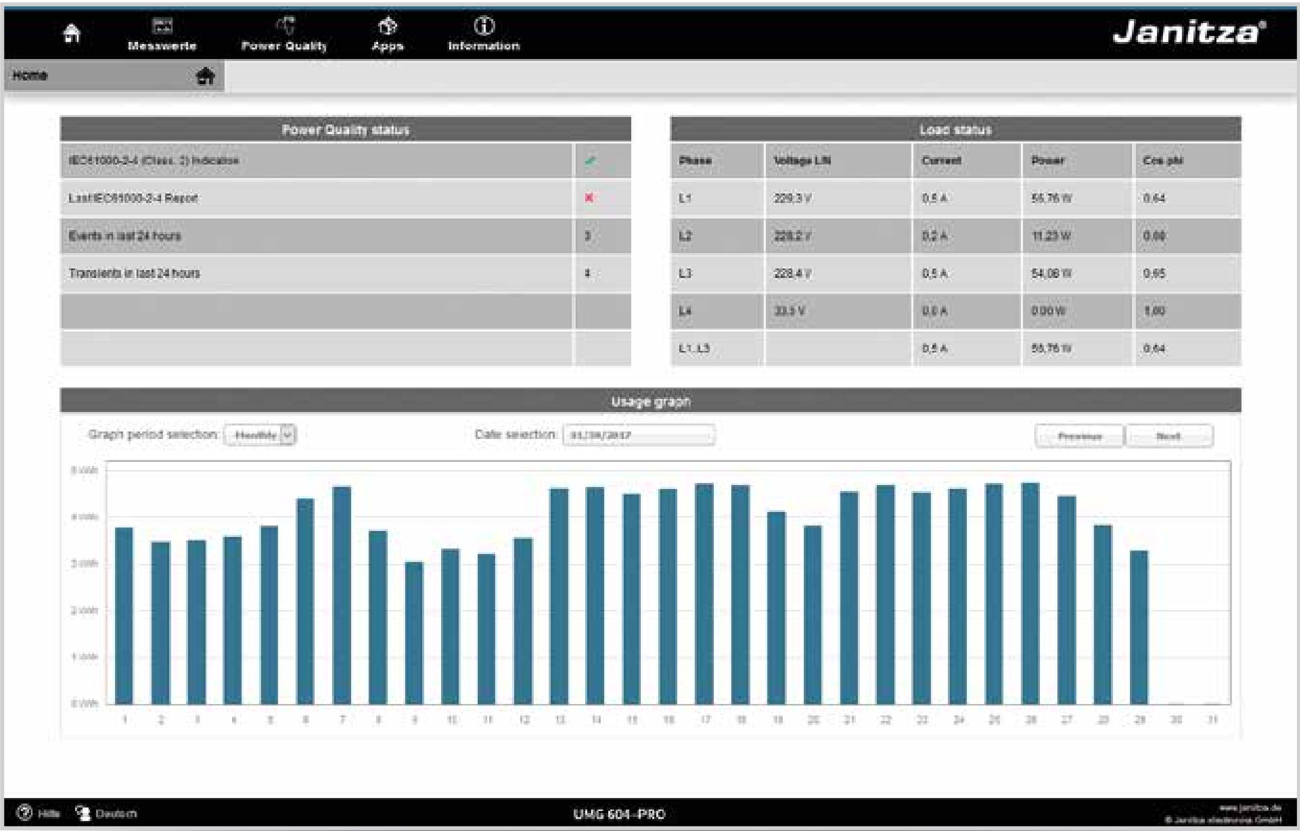


Fig.: Power quality status overview

www.Energy-Portal.com

Energy-Portal

The cloud solution for energy management

- Cloud solution especially designed for energy data
- Access from anywhere in the world via the PC or tablet under www.energy-portal.com
- Evaluating and displaying energy data from the UMG measurement devices without requiring an IT infrastructure or expensive software
- The energy data can be pushed directly into the Energy-Portal from one location or from severeal locations.
- Measured values are captured at the same time from various locations
- Saves high acquisition and operating costs for software, database, server, commissioning and software maintenance
- Intuitive operation
- Data is extremely secure (HTTPS)
- Extremely cost-effective and convenient solution
- Lower data volume due to the push function

APP Push Service 2.0 charateristics

- Up to 25 measured values per measuring device can be sent simultaneously
- After installing the APP and configuring the device's memory, the measured values that are to be sent can be selected on the measurement device homepage.
- Up to 50 measurement devices can be managed per account.
- Up to 25 measured values per measurement device can be sent simultaneously
- Mean values ≥ 10 minutes can be selected.
- Up to 100 dashboards are possible per account
- The APP Push Service 2.0 sends the measured data automatically to the "www.energy-portal.com" hosting server in cycles. The APP Push Service 2.0 sends the measured data automatically to the "www.energy-portal.com" hosting server in cycles.
- The measured data can then be evaluated from anywhere in the world using any web browser.
- Transferring the last measured values from the UMG ring buffer
- The APP automatically detects which measured data in the UMG ring buffer is saved with which averaging time, and presents it for selection
- The measured values to be sent can be selected via the UMG measurement device's homepage
- Mean values are automatically synchronised to the device time
- The sending time can be adjusted for the transmission buffer (1 hour – 100 days). If the communication connection fails, there are no gaps in the data as long as the failure is shorter than the transmission buffer time
- The transmission interval is adjustable (1 second – 30 minutes)
- Status indicator on the homepage shows the last measured data transmitted

What does the solution include?

- Server capacities, processing power (IaaS)
- Database storage capacities
- Data backup
- APP Push Service 2.0 to be installed on the UMG measurement devices
- Software as a service (SaaS): Provision of appropriate standardised visualisation software for energy consumption evaluation
- Quick and simple summarization of all energy data from different locations

Fig.: Example of a dashboard with a line chart (load profile) and the power value displayed using an analogue pointer display.

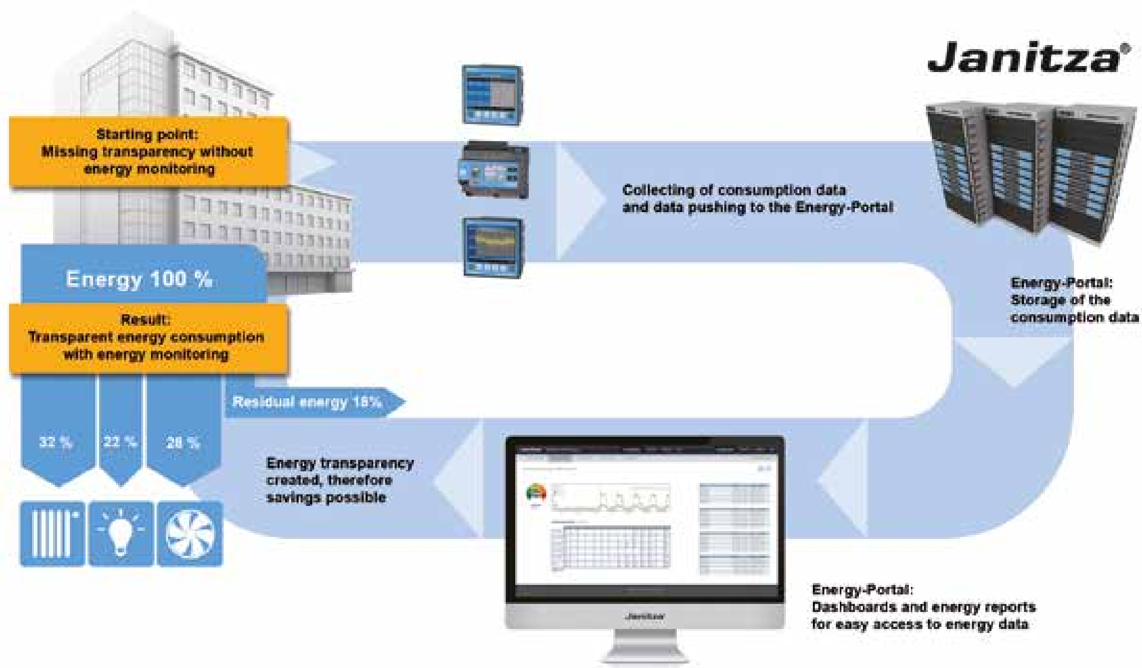
Fig.: Benchmark for the production sites with level displays.
The limit values can be adjusted individually for each of the locations.

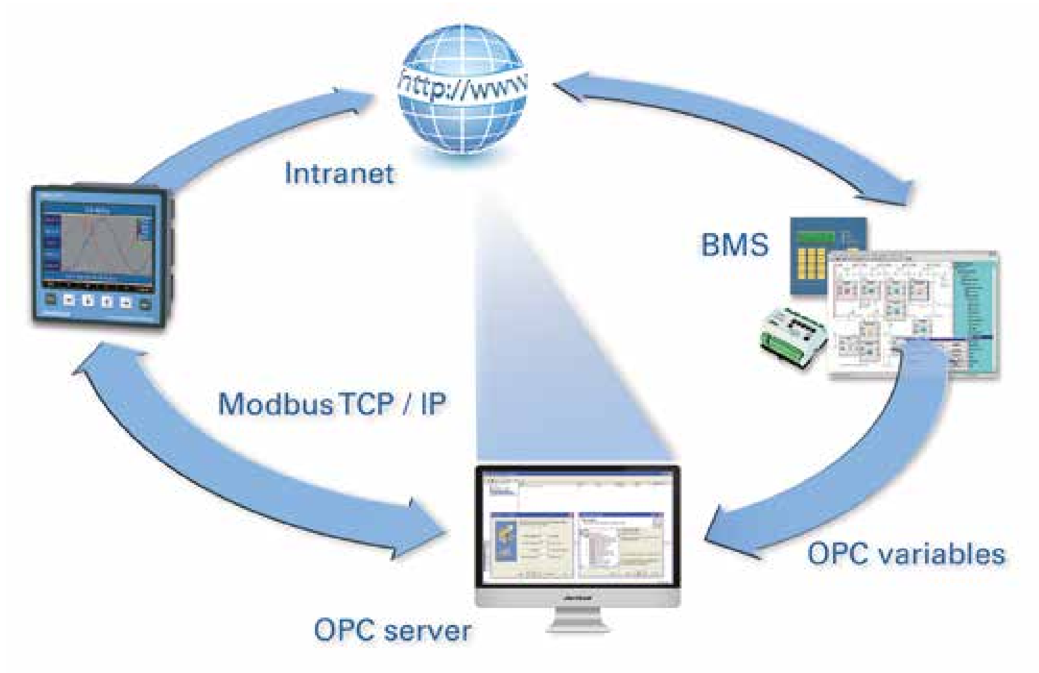
Fig.: Heat map (spectral analysis) to determine peak loads that drive costs.
The scroll bar in the chart's header area can be used to adjust the threshold values individually.

Fig.: Dashboard example with two bar charts to compare el. energy values from the current day with the previous day or the current week with the previous week.

Description		Item no.
APP Push Service 2.0[*1] (per measuring device)	– Transmits data (up to 25 measuring values from master device to Energy Portal www.energy-portal.com) via Port 80 (HTTP/Json) in adjustable time intervals. – Additionally 12 more metered values are sent (current L1, L2, L3; PF L1, L2, L3; THD L1, L2, L3; apparent power total; active power total and active energy from up to 10 Slave devices). he averaging time is 15 minutes. – The configuration is done on the website of the device. – The counterpart station (SaaS = Software as Services) is not included inside scope of delivery. – The APP is delivered encrypted. (Please provide the serial number) Applicable for master UMGs: 604-PRO / 605-PRO / 508 / 509-PRO / 511 / 512-PRO Applicable for slave: ProData2, UMG 96RM, UMG 96RM-E, UMG 103-CBM, MID energy meters	**51.00.238**
	– Transmits data (up to 25 measuring values from master device to Energy Portal www.energyportal.com) via Port 80 (HTTP/Json) in adjustable time intervals. – Additionally 128 measuring values are sent (current input 1..20, active power 1..20, reactive energy 1..20, voltage L1/N, L2/N, L3/N, frequency up to 2 slave devices UMG 20CM) The averaging time is 15 minutes. – The configuration is done on the website of the device. – The counterpart station (SaaS = Software as Services) is not included inside scope of delivery. – The APP is delivered encrypted. (Please provide the serial number) Applicable for master UMGs: 604-PRO / 605-PRO / 508 / 509-PRO / 511 / 512-PRO Applicable for slave: UMG 20CM	**51.00.285**
Janitza Energy Portal (Software as a Service) hosting solution	– Analysis of energy data via the internet – A Software-as-a-Service contract is concluded between the Contractor (Janitza electronics GmbH) and the Customer. The „Energy Portal Software as a Service" agreement can be requested by specifying document number 2.353.010.0 – Data archiving: 3 years (optionally 5 years, 51.00.258) – Price per year - up to 50 UMG measuring devices - up to 100 UMG measuring devices - up to 150 UMG measuring devices - up to 200 UMG measuring devices - up to 250 UMG measuring devices - up to 300 UMG measuring devices - from 300 UMG measuring devices	**51.00.255 51.00.xxx 51.00.xxx 51.00.xxx 51.00.xxx 51.00.xxx 51.00.xxx**
Creation of customer-specific dashboards	– Creation of customer-specific dashboards from the available display modules – Linking of the display modules to the measurement variables – The scope of delivery does not include the programming of new display modules – The Contractor will verify in advance whether it is possible to present the DASHBOARD to the Customer's specifications – Price per hour	**51.00.256**
Extension of data archiving duration from 3 to 5 years	– Extension of data archiving duration from 3 to 5 years – Data more than 5 years old will be deleted automatically	**51.00.258**

*1 The APP Push Service 2.0 is integrated in the firmware of the measuring device UMG 96RM-EL (unencrypted).




http://www
Intranet
BMS
Modbus TCP / IP
OPC variables
OPC server


EN 50160 / ISO 50001
Made in Germany

OPC server

OPC server

Significance of OPC

- OPC stands for "OLE for Process Control"
- Standardised interface in the field of automation technology
- Benefits: Universal possibility of optimal communication between industrial bus systems and protocols
- User-friendly and simple integration of OPC drivers in control and monitoring systems of an arbitrary size

The wide world of automation

- Integration of UMG measured values in UMG visualisation systems via OPC server
- OPC drivers therefore offer standardised interfaces for simple data exchange without precise knowledge of the communication possibilities of the "counterpart"
- Linking of measurement data with the data from other works as well as archiving of data in the database structures of the building management system
- OPC-drivers for building management systems are available from almost all manufacturers of building automation systems

Modbus Suite TOP Server item no. 51.00.150

- Janitza electronics GmbH recommends the proven OPCTop Server
  with Modbus Suite available to purchase from Toolbox (www.software-toolbox.com)
- Provision of support in conjunction with the UMG measurement devices by
  Janitza electronics GmbH is guaranteed in this case

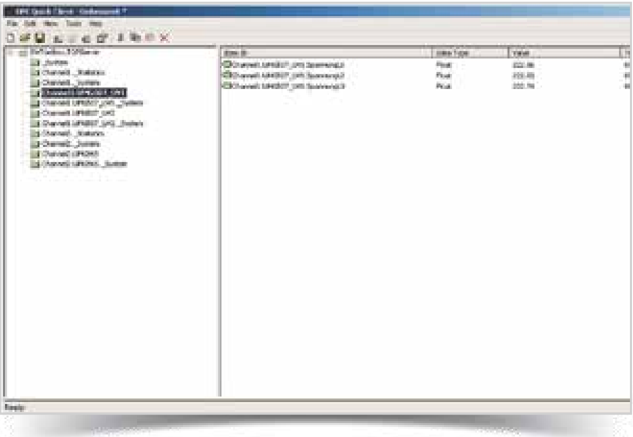


Fig.: OPC Quick Client

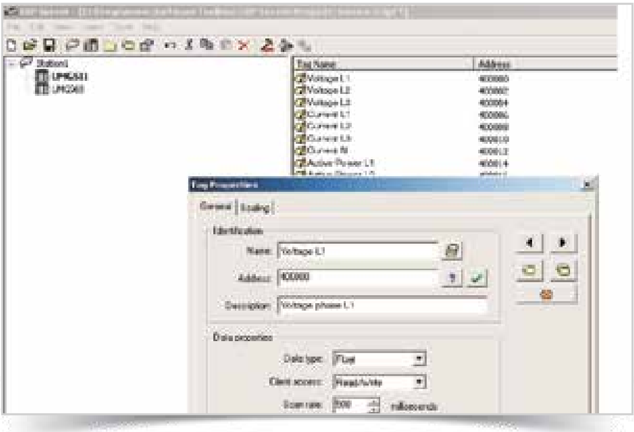


Fig.: Stipulation of the OPC variables

Functionality of the OPC server

- OPC is a software driver and must be installed on a PC in the network
- The installation is guaranteed if:
  - The operating system is compatible with the OPC
  - The available automation software exhibits sufficient performance reserves
  - This software operates seamlessly on the computer
- The OPC server also works on systems where GridVis® is already installed (assuming appropriate system resources are available)
- The software driver contains a TCP/IP mode or Modbus over TCP/IP master and an OPC server
- Data is read out via the Ethernet interface (Port 502 or Port 8000) and forwarded on to an OPC server
- Transfer of the data to the OPC client of the external program
- Simultaneous access for up to 4 software applications on port 502 of the UMG 604E-PRO / UMG 604EP-PRO
- Simultaneous access for an additional 2 applications on downstream measurement devices (via RS485)
- Measurement data can thus be read out synchronously with the GridVis® and the OPC server

Configuration of the OPC server

- Adjustments are implemented via a convenient user interface
- Knowledge in the field of data types (Word, Float etc.) and Bus technology required
- Individual adaptation of the communications settings for each channel
- The following data types are supported: Char, Byte, Long, Float, Word, Double (as Big-Endian and Little-Endian)
- Rapid online checking of the data via OPC Quick Client
- Automatic adoption and display of the data from the configuration table
- Statistical functions provide support during fault-finding

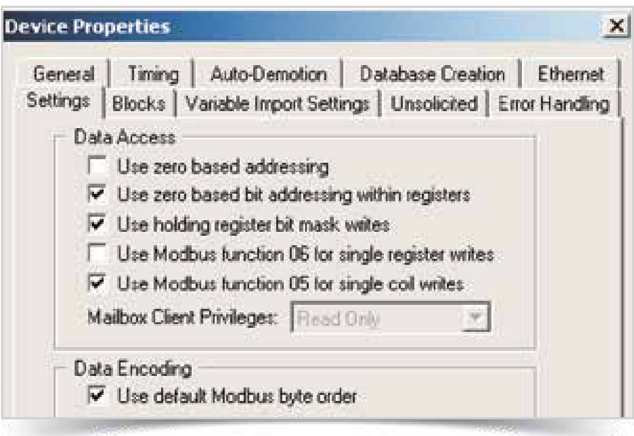


Fig.: Communications settings

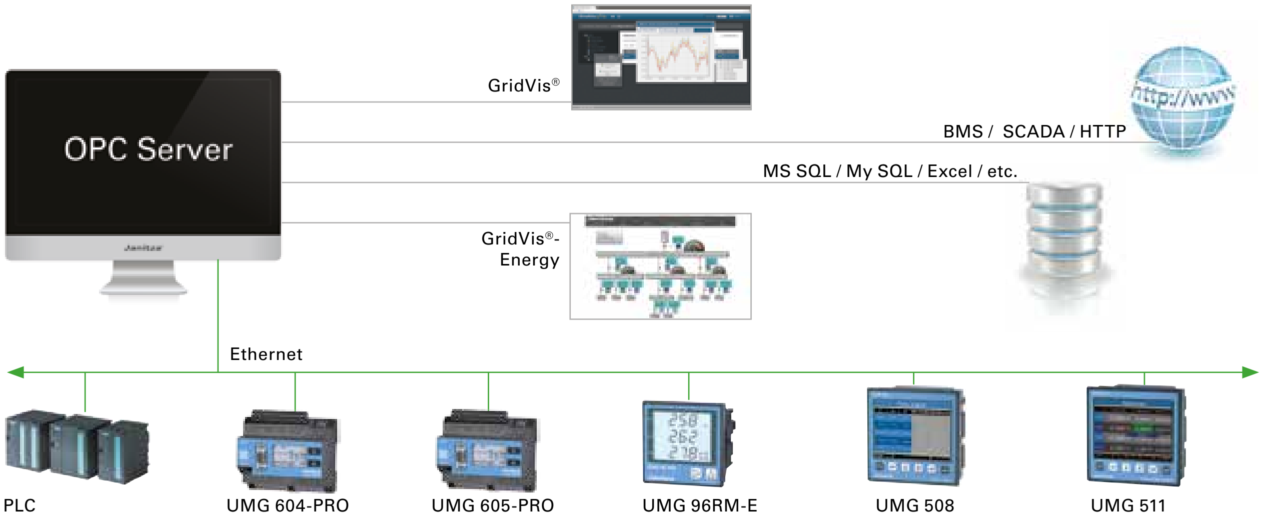


Fig.: Application example for an OPC environment

Database server

Database server

Comprehensive monitoring and analyses require powerful server solutions

- Janitza electronics GmbH offers a powerful server as a complete solution
- Trouble-free and immediate use is guaranteed
- Simple and rapid integration of the pre-configured server into the existing network
- GridVis® software is already installed on the database server
- Available databases: Janitza DB, MS SQL or MySQL
- Application of a powerful tower or rack server from Dell
- The Dell PowerEdge server offers high quality and reliability with maximum expandability
- A RAID-10 system with hot-plug hard drives guarantees a high standard of data security

Fig.: Server (tower)

Guaranteed all-round service

- Access to the database server thanks to Janitza maintenance diagnostics and fault rectification (only with authorisation)
- Rapid diagnostics and rectification of problems possible
- Highest level of security: Use of common remote maintenance solutions with three-stage encryption per industry standards

Fig.: Server (rack)

For larger projects we currently recommend the following configuration:

- Current Intel processor
- 16 GB RAM
- RAID controller
- RAID 10 with 4 hard drives, 1 TB capacity each
- DVD-ROM drive
- Windows 2008 Server with 5 CALs, 64 Bit (German or English version)
- Installation of GridVis® software and the database driver for SQL servers
- MySQL / MS SQL databases should be provided by the client
- The integration of the server into the company's own network must be implemented by the customer's own administration

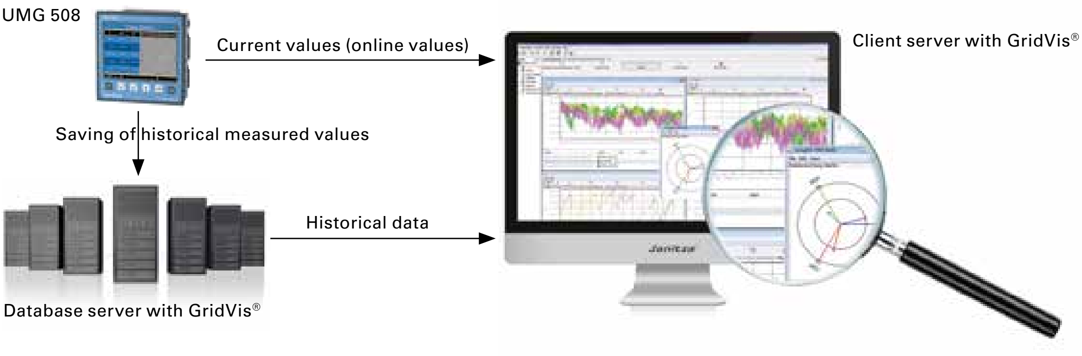


Fig.: The UMG 508, for example, currently has 6 communication ports. Of these, two are designed as gateways (port 8000) for downstream RS485 devices.

Areas of application

- With extensive monitoring systems with a large number of measurement devices
- For applications that require a high degree of data security and maximum performance
- With companies whose systems must be scalable and expandable

Application

- GridVis® runs as a service on the server
- Log-in of a user not required for automatic data logging
- For measured value analysis the client computer accesses the server directly via the network
- Access to measurement data within the database by any number of client systems possible
- Display of online measurement values dependent of the number of ports per device, i.e. visualisation of historical data via the database, online measurement values available direct from the UMG device

Product overview		
Description		**Item no.**
Server (tower)	• Current Intel processor • 16 GB RAM • RAID controller • RAID 10 with 4 hard drives, 1 TB capacity each • DVD-ROM drive • Incl. mouse and keyboard with german layout • Windows 2012 Server with 5 CALs, 64 Bit (German or English version) **Note:** • GridVis® software and database driver for SQL server • MySQL / MS SQL databases should be provided by the customer • The integration of the server into the company's own network must be implemented by the customer's own administration • Warranty from Dell GmbH	**15.06.352** (Windows version, German) **15.06.353** (Windows version, English)
Server (rack)	• Current Intel processor • 16 GB RAM • RAID controller • RAID 10 with 4 hard drives, 1 TB capacity each • DVD-ROM drive • Windows 2012 Server with 5 CALs, 64 Bit (German or English version) **Note:** • GridVis® software and database driver for SQL server • MySQL / MS SQL databases should be provided by the customer • The integration of the server into the company's own network must be implemented by the customer's own administration • Warranty from Dell GmbH	**15.06.354** (Windows version, German) **15.06.355** (Windows version, English)
Setup package 1 for MS SQL	• Install hard drives • Install operating system • RAID configuration (RAID 10) • Install updates • Install MS SQL Server* • Install GridVis®	**51.01.018**
Setup package 2 for My SQL	• Install hard drives • Install operating system • RAID configuration (RAID 10) • Install updates • Install MySQL Server* • Install GridVis®	**51.01.019**
Setup package 3 for JanDB	• Install hard drives • Install operating system • RAID configuration (RAID 10) • Install updates • Install JanDB • Install GridVis® • Install RTP user	**51.01.023**

* The MS SQL or MySQL database should be provided by the customer. GridVis® software and database drivers are separate items. The integration of the server into the company's own network must be implemented by the customer's own administration. Hardware warranty from Dell GmbH.

Fig.: Server (tower)

Fig.: Server (rack)

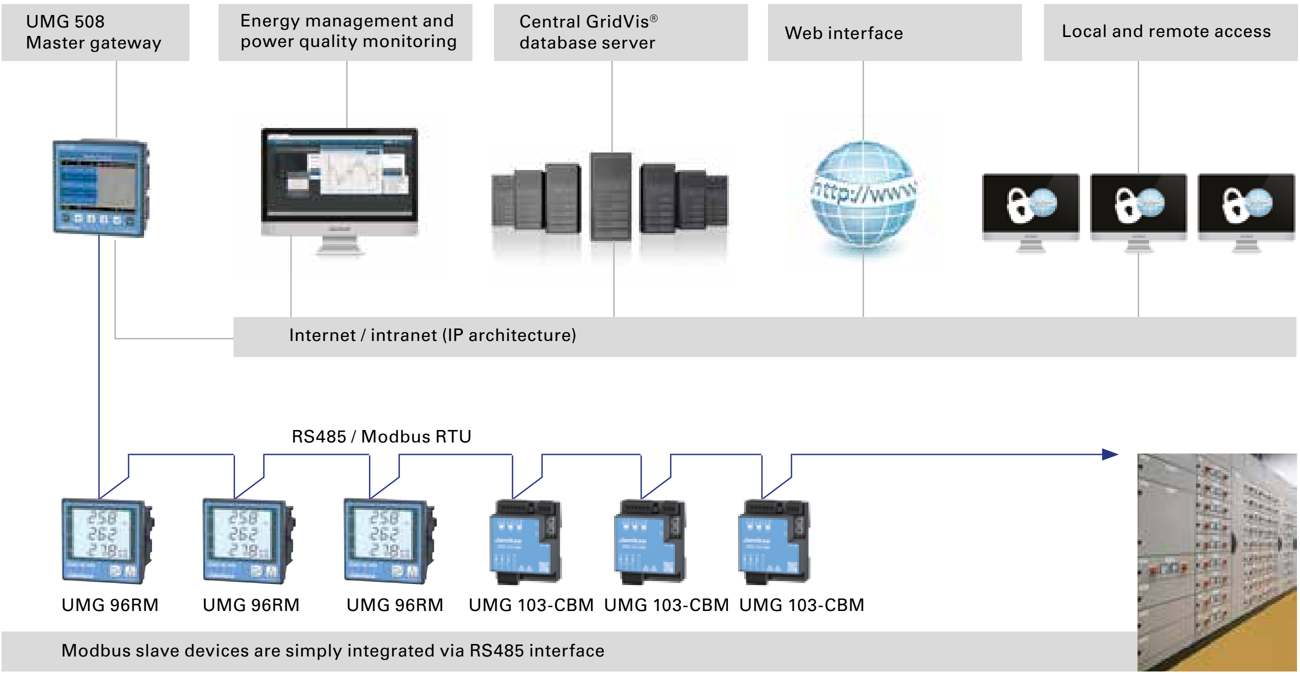


Fig.: Master-Slave communication architecture

05 Industrial data communication

Industrial data communication

Mobile communication modem EasyGateway

Data connection and simple commissioning

- Communication Gateway for wireless and hard-wired communication
- The EasyGateway EG400 connects the UMG measuring devices with Ethernet interface with the PC via mobile network
- The system software GridVis® includes a driver, which enables the simple establishment of a connection with the measuring devices via the EG400
- Connection of the EasyGateway to the measuring device
- Setting up the measuring device in GridVis® and selection of the EasyGateway communication
- Activation of the connection via GridVis® necessary
- Suitable for: UMG 604-PRO, UMG 605-PRO, UMG 96RM-E, UMG 508, UMG 509-PRO, UMG 511 und UMG 512-PRO

Managed Service – Connect-2-Control*1

- Connect-2-Control (C2C) is a simple and secure managed solution
- Simple access to the measuring device (location-independent) is guaranteed via public IP networks (internet, mobile data networks, company networks)
- Certificate-protected security (SSL)
- SSL-encrypted from the PC to the Gateway
- No VPN tunnel required
- Managing static IP addresses

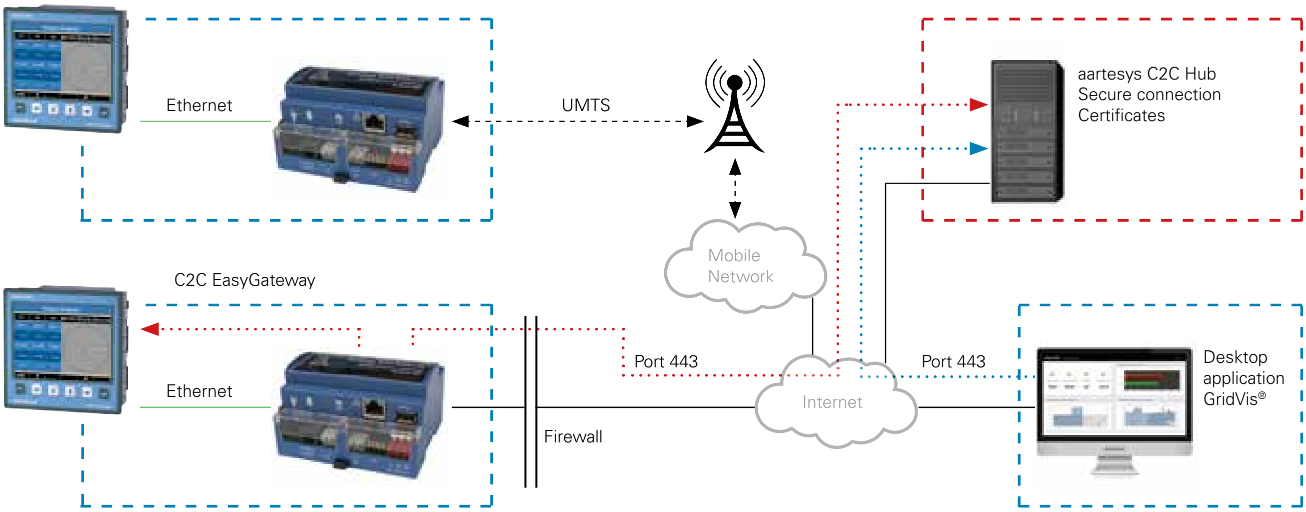


Fig.: Secure SSL-encrypted measurement data transfer

*1 Needs to be ordered separately when placing an order for an EasyGateway EG400.

Technical data

Communication Gateway for wireless and hard-wired communication	
Item number	**15.06.088**
Supply voltage	85 – 264 V AC (integrated power supply)
Frequency	44 – 440 Hz
Interfaces	
Ethernet 10 / 100 Base-TX	RJ45 (for hard-wired communication)
Communication	
UMTS / HSPA6+	yes (for fast internet connection via mobile network)
Integrated security module for secure, certificate-protected communication	yes
General data	
Operating system	Embedded LINUX
Processor	ARM 9
Cycle rate	400 MHz
Memory (RAM)	256 MB
Memory (Flash)	256 MB
Hardware	Watchdog and temperature monitoring
Screw-on antenna or external antenna via SMA antenna connector	yes
SIM card slot	integrated
Power supply	standard AC
Mechanical data	
Installation	35-mm DIN top-hat rail
Integrated wall fastening	yes
Housing	closed 3-part plastic housing
Protection class	IP20
LED indications	4 units (2-colour for commissioning and operating display)
Weight	280 g
Dimensions in mm (H x W x D)	63 x 106 x 90

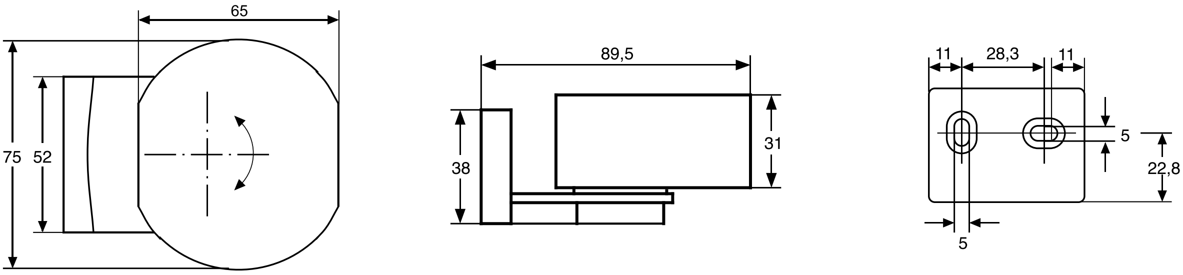
Accessories	Item number
AMR rubber antenna, 2 m cable	**15.06.089**
Extension cable, 5 m	**15.06.091**
Extension cable, 10 m	**15.06.092**
Angled antenna	**15.06.093**
INOX antenna mounting bracket	**15.06.094**
Administration charge (per case)	**15.06.095**

GPS radio receiver

Main features

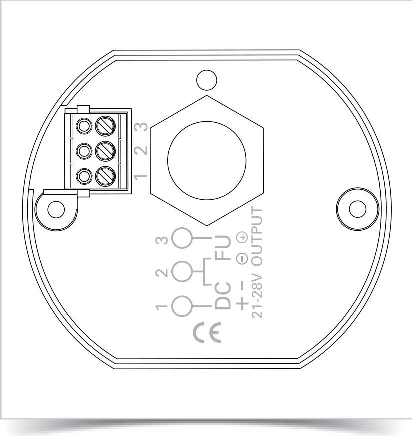
- Works worldwide
- Receive and process the GPS time signal (GMT)
- For time synchronisation of the measuring devices UMG 604-PRO*1, UMG 605-PRO*1, UMG 508*1, UMG 509-PRO*1, UMG 511 und UMG 512-PRO
- 1 digital connection controls up to four UMGs
- Wall mounted
- Small, compact construction
- Easy to install, housing screws into mounting bracket
- Check LED on the housing
- Connection using three-wire shielded cable
- Connection voltage 21 – 28 V / DC
- External power supply necessary

Dimension diagrams



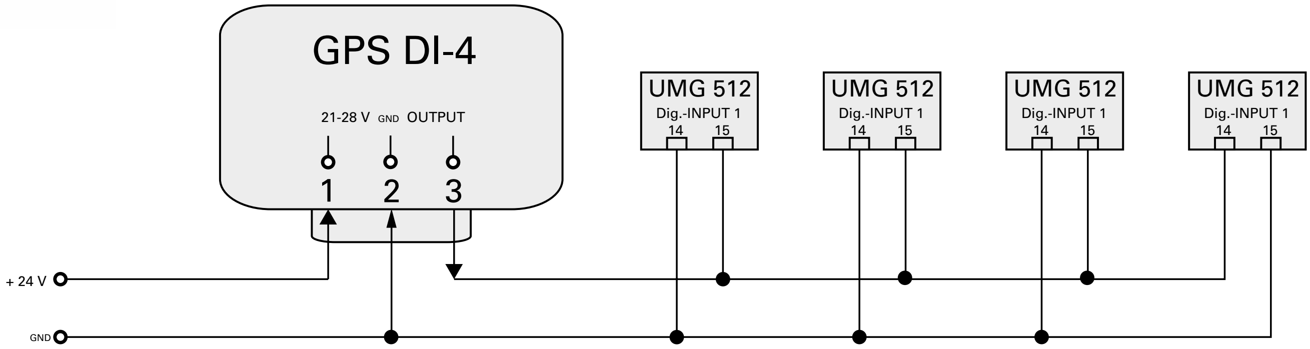
Technical data

Technical data	
Item number	**15.06.240**
Synchronization accuracy with the UMG 512-PRO	20 ms (compared to the UTC time)
Synchronization accuracy with the UMG 604-PRO, UMG 605-PRO, UMG 508, UMG 509-PRO and UMG 511[*1]	1 s (compared to the UTC time)
Connection voltage	21 – 28 V / DC Supply = External
Power consumption	Ø up to 100 mA
Output signal	GPS time synchronous pulse signal Adjustable via DIP switches Pulse for minutes (1 sec.) and/or hours (5 sec.) I_{max} 50 mA
Protection class	IP 54 acc. to DIN EN 60529
Ambient temperature	-30 °C to 55 °C
Regulations /Test marks	EN 60730 / CE
Housing	Self-extinguishing thermoplastic
Installation type	Wall mounted with mounting bracket
Recommended cable(s)	Shielded/cable section 0.33 to 2.5 mm²



[*1] **Please note:** For the measuring devices UMG 604, UMG 605, UMG 508, UMG 509 and UMG 511 the APP GPS TIMESYNC (21.00.291) is needed.

Typical connection



Gateway MBUS-GEM

M-Bus Gateway on Modbus TCP

- Communication interface for the integration of consumer meters in GridVis®.
- Connection at control level
- Standard per IEC6115
- Supply voltage: 24 V DC +/- 5%, screw-type terminal
- M-Bus per EN 13757-2, screw-type terminal
- Ethernet 100 MBit, RJ45 socket, screened
- High-performance driver for the connection of up to 80 standard loads
- Highly compact design (W x H x D in mm) 35 x 89 x 58
- Spatial requirements 2TE wide for mounting on DIN rail 35 mm
- Galvanic separation from the M-Bus and RJ45
- Suited for use in industrial areas

Commissioning by Janitza is recommended.
For more detailed information please refer to chapter 9.

Technical data

MBUS-GEM Gateway	
Item number	**15.06.108**
Architecture	Controller-based gateway
Supply	24 V DC, < 300 mA, max. 2.5 mm²
M-Bus connections	Screw-type terminal, max. 2.5 mm²
Ethernet connection	100 MBit, RJ45, screened
Dimensions	35 x 89 x 58 (W x H x D in mm)
Assembly	DIN mounting rail 35 mm, IP40
Max. Baud rate	300, 2400 or 9600 bps
Number of slaves	max. 80 standard loads
IP address	freely configurable or by DHCP
TCP port	freely configurable

PowerToStore

Buffer power supply with capacitors

- Typically serves to bridge short term interruptions
- Operates with integrated ultra-capacitors for energy storage
- With a supply voltage interruption, the stored energy of the ultra-capacitors is released on a regulated basis
- A buffer module feeds the load up to full discharge
- The buffer time is dependent on the charge status of the capacitor and the height of the discharge current
- Can be used only with 24-V UMG devices

Main features

- Lifelong maintenance-free
- Compact housing
- Deep-discharge proof consequently unlimited storage time
- Operation possible under extreme temperature conditions
- No gas generation, therefore installation in hermetically-sealed housings possible
- Rapid availability because short charging time after discharging

Technical data

PowerToStore (PTS)	
Item number	**15.06.405**
Input	
Nominal input voltage	115 – 230 V AC
Stored energy in Ws	1,000
Output	
Output voltage in buffer operation	24 V DC constant
Nominal output current	3 A
Current limiting	1.05 … 1.2 x INom
Degree of efficiency Ua = 23.5 V DC, Ia = INom	> 90 %
General data	
Connection type input U_E	2.5 mm² cable cross section
Connection type output U_A	2.5 mm² cable cross section
Connection type I/Os	1 mm² cable cross section
Protection class	IP20
Type	PTS2403
Storage temperature	-40 … +60 °C
Ambient temperature	-40 … +60 °C
Weight	1.2 kg
Dimensions in mm (H x W x D)	153 x 72 x 130

Note:
The power quality analysers UMG 604-PRO / UMG 605-PRO / UMG 96RM are supplied during short term interruptions of up to 225 sec. by the buffer device (item no. 15.06.405). With the power quality analysers UMG 508 / UMG 509-PRO / UMG 511 / UMG 512-PRO, the expansion unit (item no. 15.06.406) is additionally required. With this configuration short term interruptions lasting up to 256 sec can be bridged.

Industrial DIN rail Ethernet switch NS-208

Main features

- Ethernet switch for DINI rail installation in a plastic housing
- In order to connect Ethernet UMG devices in the distribution panel
- Speed: 8 x 10/100 Mbps Ethernet ports
- Screened RJ-45 connections
- Automatic setting of the transfer rate
- Compatible with IEEE 802.3, 802.3u and 802.3x
- Temperature range from -40 to +75 °C
- Ideally suited for use in industrial areas

Technical data

Industrial DIN rail Ethernet switch NS-208	
Item number	**15.06.041**
Switch	8 x RJ45, 10 / 100 MBit/s
Bandwidth	2.0 Gbps
ESD protection	8 kV direct contact 15 kV discharge air gap
Network cable	10/100 Base-T (Cat 5 UTP cable; max. 100 m)
Supply voltage	10 to 30 V DC (mains adapter required separately)
Current consumption	approx. 0.15 A with 24 V DC; ±5 %
Installation	DIN rail
Housing	robust plastic housing
Operating temperature range	-40 ... +75 °C
Storage temperature	-40 ... +85 °C
Humidity	10 ... 90 % (non-dewing)
Weight	300 g
Dimensions in mm (H x W x D)	approx. 118 x 64 x 98

D-SUB bus connector

Main features

- For RS485 (Modbus and Profibus) with the measurement devices UMG 508 and UMG 511
- D-sub connector, 9-pole
- With termination (switch on/off termination resistors)
- Axial design with two cable feeds
- Bus system: PROFIBUS DP up to 12 MBit/s
- Termination resistor can be switched in via Dip switch
- Pin assignment: 3, 5, 6, 8
- Screw-type terminal connection
- With UMG 508 / UMG 511 also for Modbus required

Fig.: SUBCON-PLUS-PROFIB/AX/SC
(item no. 13.10.539)

Technical data

D-SUB bus connector	
Item number	**13.10.539**
Item number	**13.10.543***
Nominal voltage	50 V
Rated current	100 mA
Termination resistor	390 Ω – 220 Ω – 390 Ω (can be switched in)
Bus system	PROFIBUS DP
Max. number of plugin cycles	> 200
Connection	D-SUB plug-in connection
Number of poles	9
Connection	Print connection
Connection type	Screw terminal
Cable diameter max.	8.4 mm
Cable diameter min.	7.6 mm
Operating temperature range	-20 ... +75 °C
Storage / transport temperature range	-25 ... +80 °C
Weight	38.6 g
Dimensions in mm (H x W x D)	17 x 31.5 x 58.2
Housing material	ABS, metallized
Pin assignment:	3, 5, 6, 8

* 90° bent version

Fig.: SUBCON-PLUS-PROFIB/SC2, 90° bent version
(item no. 13.10.543)

K-7510: RS485 repeater, isolated

Main features

- One RS485 input and output respectively for the expansion of an RS485 network by a further 32 UMG devices and by a further 1.2 km transfer length
- Twin and four-wire operation RS485
- Galvanic separation up to 3 kV DC
- Automatic direction detection
- Automatic Baud rate detection
- Insulated interface
- Suitable for: UMG 103-CBM, UMG 104, UMG 604-PRO, UMG 605-PRO, UMG 96RM, Prophi®, ProData®
- Separate power supply required

Fig.: Figure similar

Technical data

RS485 repeater, isolated	
Item number	**15.06.024**
RS485 network expansion	by a max. length of 1.2 km and by 32 modules
Support	up to 256 RS485 devices
Max. number of repeaters per network	8
Insulation	up to 3,000 V DC
Power consumption	1.2 W
Interface connections	with screw-type terminals
Installation	DIN rail or wall mounting
Operating temperature range	-25 ... +75 °C
Weight	157 g
Dimensions in mm (H x W x D)	121 x 72 x 25

Note: Repeater is not suitable for Profibus.

K-7513: RS485 to 3 x RS485 Hub

Main features

- 1 x RS485 input and 3 x RS485 output for a RS485 star type network
- Galvanic separation up to 3 kV DC
- DIN rail or wall mounting
- Suitable for: UMG 103-CBM, UMG 104, UMG 604-PRO, UMG 605-PRO, UMG 96RM, Prophi®, ProData®
- Separate power supply required

Fig.: Figure similar

Technical data

RS485 to 3 x RS485 Hub	
Item number	**15.06.035**
Input	1 x RS485, twin wire (D+, D-)
Output	3 x RS485, twin wire (D+, D-)
Transmission rate	300 to 115.2 kbps
Insulation	up to 3000 V DC
Supply voltage	10 to 30 V DC
Power consumption	2.2 W
Connections	detachable screw-type terminals
Installation	DIN rail or wall mounting
Operating temperature range	-25 ... +75 °C
Weight	157 g
Dimensions in mm (H x W x D)	121 x 72 x 33
Miscellaneous	each I/O interface is equipped with its own line driver, max. 1.2 km line length per interface

K-7563: USB to 3 x RS485 Hub

Main features

- USB converter to 3 times RS485
- For star type RS485 network
- Galvanic separation up to 3 kV DC
- DIN rail or wall mounting
- Operating systems Windows XP, Windows 7
- Suitable for: UMG 103-CBM, UMG 104, UMG 604-PRO, UMG 605-PRO, UMG 96RM, Prophi®, ProData®
- Use of system software GridVis® possible

Fig.: Figure similar

Technical data

USB to 3 x RS485 Hub	
Item number	**15.06.025**
Input	USB 1.1 and USB 2.0 compatible
Output	3 x RS485, twin wire (D+, D-)
Transmission rate	300 to 115.2 kbps
Insulation	up to 3,000 V DC
Supply voltage	10 to 30 V DC
Power consumption	2.2 W
Connections	detachable screw-type terminals
Installation	DIN rail or wall mounting
Operating temperature range	-25 ... +75 °C
Weight	approx. 120 g
Dimensions in mm (H x W x D)	120 x 72 x 33
In the scope of supply	USB connection cable
Miscellaneous	each I/O interface is equipped with its own line driver, max. 1.2 km line length per interface

1-phase SMPS type power supply

Main features

- Nominal power: 24 W
- Output voltage: 24 V DC +/- 1 %
- Wide range input voltage: 115 V AC to 230 V AC
- Certification: CSA and cULus approval

Technical data

1-phase SMPS type power supply	
Item number	**16.05.002**
Input	
Frequency input	50 / 60 Hz
Voltage input	115 … 230 V AC, 120 … 300 V DC
Current input at 115 V AC	460 mA ± 20 %
Current input at 250 V DC	120 mA ± 20 %
Input fuse	2 A slow blow fuse (internal)
Output	
Power output	24 W
Voltage output	24 V DC ± 1 %
Current output	1 A
Parallel operation possible	yes, max. 2
Overload protection	overcurrent / thermal switch-off
General information	
Galvanic separation output–ground	0.5 kV
Galvanic separation input–output	3 kV
Connection	screw-type terminal
Installation	horizontal, DIN rail
Operating temperature range	-20 ... +50 °C
Weight	169 g
Dimensions in mm (H x W x D)	90.5 x 52 x 62.5

Industrial power supply TCL for DIN rail mounting

Main features

- For applications in industrial, office and residential areas
- Ultra-compact plastic housing
- Pluggable screw-type terminal block
- DIN rail mounting
- Adapter for wall mounting
- Universal mains input 100 – 240 V AC, 50/60 Hz
- Output voltage 24 V DC
- DC-OK signal
- Low residual ripple
- Overload and short circuit protection
- Parallel operation possible
- Worldwide safety approvals: CB-Report (IEC 60950-1), UL approval, CSA certificates, BG certificates (SIQ)

Technical data

Industrial power supply TCL for DIN rail mounting	
Item number	**16.05.004**
Input	
Frequency	47 – 63 Hz
Voltage	100 … 240 V AC, 85 … 375 V DC
Current at full load (115 V AC)	2 A
Current at full load (230 V DC)	1 A
Fuse	5 A (characteristic C or slow blow fuse)
Output	
Power	120 W
Voltage (adjustable via potentiometer on the front side)	24 – 28 V DC
Current	5 A
Parallel operation possible	yes, max. 5
Overvoltage protection (trigger point at)	< 40 V DC
DC-OK signal	switching point: > 22 V output signal (reference: – Uoff): 22.0 V ±2.0 V / 30 mA max.
General information	
Switching frequency	55 – 180 kHz depending on the load (pulse frequency modulation)
Protection class	1
Degree of protection	IP20
Installation	DIN rail 35 mm or wall mounting (adapter enclosed)
Operating temperature range	-10 ... +70 °C
Storage temperature range	-25 ... +85 °C
Weight	440 g
Dimensions in mm (H x W x D)	75 x 85 x 100

Isolating transformer for auxiliary supply

Main features

- For protecting UMG meters in case of heavily distorted supply voltages
- Exceptional good temperature changing behaviour
- Maximum safety and longevity
- High voltage tolerance
- Self-extinguishing plastic materials
- Individually tested with test certificate

Technical data

Isolating transformer for auxiliary supply	
Item number	**03.02.036**
Input	
Frequency input	50/60 HZ
Voltage input	230 V (1 – 3 terminals)
Current input	0.05 A
Input fuse	2 A
Output	
Power output	10 VA
Voltage output	185 V (4 – 5 terminals)
Current output	0.06 A
General information	
Protection class	2
Protection class	IP20
Installation	DIN rail
Operating temperature range	-10 ... +55 °C
Weight	470 g
Dimensions in mm (H x W x D)	approx. 82 x 58 x 59

Touch panels – user-friendly visualisation of measured values without PC, directly at site

Effective, sustainable observation and operation

- Visualisation of process and energy data at site
- Embedded systems in form of touch panels serve the monitoring of electrical data
- JPC35 is equipped with an RS485 or RS232 interface
- Use of compact flash memory cards
- Due to use of special processors and cooling elements cooling fans could be avoided
- Dust, dirt and moisture are not a problem thanks to high front side protection class
- Standard application available for the visualisation of up to 32 measurement points[*1] (Multi Touch)

JPC35 "Multi Touch"

- Equipped with a 3.5" touch panel
- Alignment and configuration possible for various applications
- Presentation of measurement values up to 32 measurement devices[*1] on one display
- User-friendly, intuitive configuration and menu guidance
- Clear assignment of the measured values through specific naming of each measurement point
- Display mode is variable and can be configured directly on the display
- UMG 604-PRO or UMG 605-PRO can be connected as the master
- RS232 interface serves the communication between master and JPC35
- JPC35 "Multi Touch" requires the free APP (expansion) "Multi Touch" (item no. 15.00.207) on the UMG measurement device

The JPC "MultiTouch" visualises the following measured values for one master and up to 31 slave devices:		
Measured values	**Display range**	**Unit**
Voltage: L1, L2, L3 / L1–L2, L2–L3,L1–L3	0...999999.9 V	V
Current: L1, L2, L3, current in N	0...999999.9 A	A
Active power: L1, L2, L3, sum	0...999999.9 kW	kW
Apparent power: Sum	0...999999.9 kVA	kVA
Reactive power: Sum	0...999999.9 kvar	kvar
Cosphi: L1, L2, L3, sum	0.00 cap – 0.00 ind	-
THD: UL1, UL2, UL3	0 – 100 %	%
Frequency	45 – 65 Hz	Hz
Rotating field	left / right	-
Current averaging	0...999999.9 A with overline	Active
Active energy sum	0...99999999 kWh	kWh
Reactive energy inductive sum	0...99999999 kvarh	kvarh
Measurement points text input	max. 15 characters	-

[*1] slave devices and one master device

JPC35 remote display

- Equipped with a 3.5" touch panel
- Can be used for measured value indication of a measurement point
- The measurement point name is freely configurable
- Switching between measured value list and measured value indication possible within the display mode
- Connection and communication takes place via an RS232 or RS485 interface
- No expansion (APP) is required for the application on the measurement device

Info: The measurement device address of the JPC35 remote display RS485 is always established at 1.

Application example JPC 35

Efficient variant diversity of the JPC35

JPC35 "MultiTouch" Box, item no. 15.06.313

Requisite components

- JPC35 (item no. 15.06.313)
- 1 master (UMG 604 / UMG 605)
- 0 to 31 slave(s) (UMG 103-CBM, UMG 104, MG 604-PRO, UMG 605-PRO and UMG 96RM)
- 1 mains adapter 24 V (e.g. item no. 16.05.002)
- APP "MultiTouch" (item no. 51.00.207)

Information

- Connection via RS232 (max. 15 metre distance to the master)
- APP "MultiTouch" must be installed on the UMG 604 / UMG 605
- The display mode can be configured directly via the display
- Number of measurement points can be configured directly via the display
- Measurement point names (max. 15 characters) are configured directly via the display
- Language selection (German, English, Spanish)
- Communication monitoring of the slave devices
- Configuration assistant

Display of measured value / Modbus

- Real value display of the following values: UL1, UL2, UL3, ULL1, ULL2, ULL3, I1, I2, I3, ISUM, P1, P2, P3, PSUM, SSUM, QSUM, Cosphi1, Cosphi2, Cosphi3, CosphiSum, THDU1, THDU2, THDU3, Hz, rotation field, AVG_I1, AVG_I2, AVG_I3, KWH, kvarh
- Mode setting: Standard, station selection, security measurement, energy list

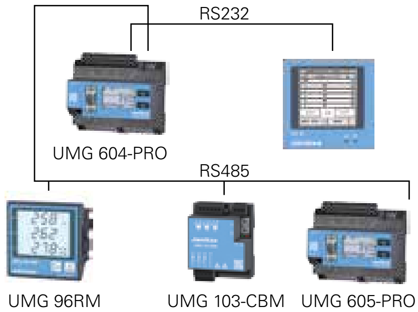


Fig.: Modbus station selection

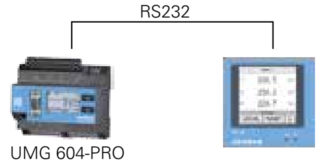


Fig.: Modbus standard

JPC35 Remote Display Box (RS232), item no. 15.06.314

Requisite components

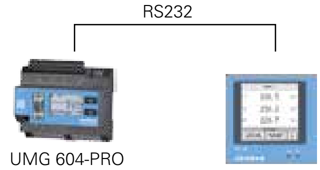
- JPC35 (item no. 15.06.314)
- UMG 604-PRO, UMG 605-PRO, UMG 104
- 1 mains adapter 24 V (e.g. item no. 16.05.002)

Information

- Remote display via RS232 (max. 15 metre distance)
- No device APP installation required
- Measurement point names (max. 15 characters)
- Language selection (German, English, Spanish)
- Configuration assistant

Display (Measured value / Modbus)

- Real value display of the following values: UL1, UL2, UL3, ULL1, ULL2, ULL3, I1, I2, I3, ISUM, P1, P2, P3, PSUM, SSUM, QSUM, Cosphi1, Cosphi2, Cosphi3, CosphiSum, THDU1, THDU2, THDU3, Hz, rotation field, AVG_I1, AVG_I2, AVG_I3, KWH, kvarh
- Modbus selection: Device matrix display, measured value list



Note: Not usable for the UMG 96RM, UMG 508 and UMG 511, because these devices do not possess an RS232 interface.

JPC35 Remote Display Box (RS485), item no. 15.06.315

Requisite components

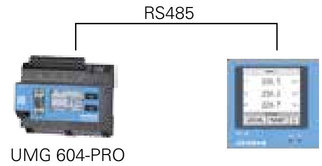
- JPC35 (item no. 15.06.315)
- UMG 604-PRO, UMG 605-PRO, UMG 104, UMG 509-PRO, UMG 511, UMG 512-PRO, UMG 96RM
- 1 mains adapter 24 V (e.g. item no. 16.05.002)
- Side angled D-SUB-9 connector (item no. 13.10.514)

Information

- Remote display via RS485 (max. 1,200 metre distance)
- No device APP installation required
- Measurement point names (max. 15 characters)
- Language selection (German, English, Spanish)
- Configuration assistant

Display (Measured value / Modbus)

- Real value display of the following values: UL1, UL2, UL3, ULL1, ULL2, ULL3, I1, I2, I3, ISUM, P1, P2, P3, PSUM, SSUM, QSUM, Cosphi1, Cosphi2, Cosphi3, CosphiSum, THDU1, THDU2, THDU3, Hz, rotation field, AVG_I1, AVG_I2, AVG_I3, KWH, kvarh
- Modbus selection: Device matrix display, measured value list



Note: The JPC35 functions in this variant as RS485 master. The RS485 / Ethernet Gateway function of the UMG 604-PRO can no longer be used in this case.

Overview of devices

Types	JPC35 "MultiTouch"	JPC35 remote display RS232	JPC35 remote display RS485
Item number	15.06.313	15.06.314	15.06.315
			
Front panel			
Resolution (Pixel)	240 x 240	240 x 240	240 x 240
Brightness (cd/m²)	110	110	110
Number of colours	16 greyscale	16 greyscale	16 greyscale
Input	resistive touch	resistive touch	resistive touch
Screen diagonal	3.5"	3.5"	3.5"
General technical data			
Supply voltage (external)	24 V DC ± 15 %	24 V DC ± 15 %	24 V DC ± 15 %
Weight	0.21 kg	0.21 kg	0.21 kg
Operating temperature range	0 ... +50 °C	0 ... +50 °C	0 ... +50 °C
Storage temperature range	-10 ... +60 °C	-10 ... +60 °C	-10 ... +60 °C
External dimensions in mm (H x W x D)	96 x 96 x 40.6	96 x 96 x 40.6	96 x 96 x 40.6
Installation dimensions in mm (H x W)	89.3 x 89.3	89.3 x 89.3	89.3 x 89.3
Protection class front	IP65	IP65	IP65
CPU			
Processor (MHz)	32 Bit RISC	32 Bit RISC	32 Bit RISC
Communication			
Interfaces			
RS485	no	no	yes
RS232	yes	yes	no
Protocols			
Modbus RTU	yes	yes	yes
Applications (optional)			
Visualisation of measured values of the slave devices possible	yes	no	no
Expansion required (APP)	yes	no	no

06 Current / voltage transformers and sensors

Current / voltage transformers and sensors

Current transformer overview

		Moulded case current transformer (feedthrough type) class 1 and 0,5 ... / 5 A*1						Calibratable moulded case current transformer class 0,5 ... / 5 A			
											
Type		**IPA 40**	**IPA 40.5**	**6A315.3**	**7A412.3**	**8A512.3**	**9A615.3**	**EIPA30.5**	**E6A315.3**	**E7A412.3**	**E9A615.3**
Round conductor in mm		30	30	28	33	42	53	23	28	33	53
Primary bus bar in mm		40 x 10 30 x 15 25 x 20	40 x 10 30 x 15 25 x 20 20 x 20	30 x 15 20 x 20	40 x 12 2 x 30 x 10	50 x 12 2 x 40 x 10	63 x 15 2 x 50 x 10	30,5 x 10,5 25,5 x 25,5 10,5 x 30,5	33 x 16 23 x 23 16 x 33	40,5 x 13 31 x 31 13 x 40,5	64 x 16 54 x 32 42 x 42 32 x 54 16 x 64
Primary current in A	35										
	50	■	■					■			
	60										
	64										
	75	■	■					■			
	100		■	■				■			
	125										
	150		■	■							
	200			■					■		
	250			■					■		
	300			■					■		
	400			■					■		
	500			■					■		
	600			■					■		
	750										
	800				■					■	
	1000				■					■	
	1250					■					
	1500					■	■				■
	1600						■				
	2000						■				
	2500						■				
Details: Page		**228**						**230**			

■ = 1 A ■ = 5 A

*1 Other variants on request

Calibratable moulded case current transformer class 0,5 ... / 5 A	Calibratable moulded case current transformer class 0,2S / 0,5S... / 5 A									
										
E13A1030.3	**ERM60-E2A**	**ERM60-E3A**	**ERM60-E3A**	**ERM60-E3A**	**ERM70-E4A**	**ERM70-E4A**	**ERM70-E4A**	**ERM70-E4B**	**ERM70-E4B**	**ERM85-E6A**
85	22,7	24,5	24,5	24,5	30,5	30,5	30,5	30,5	30,5	30,6
101 x 31 84 x 64 54 x 81	20 x 10	30 x 10	30 x 10	30 x 10	40 x 10	40 x 10	40 x 10	40 x 10	40 x 10	60 x 10
230	232									

■ = 1 A ■ = 5 A

[*1] Other variants on request

Summation current transformer overview

Summation current transformer[*1] for cable type split core current transformers

Type		STS20	STS30	STS40	STS50	STS60	STS21	STS31	STS41	STS51	STS61
Transformation ratio		1+1	1+1+1	1+1+1+1	1+1+1+1+1	1+1+1+1+1+1	Customer-specific	Customer-specific	Customer-specific	Customer-specific	Customer-specific
Primary in A	1										
	5										
Details: Page		235									

Summation current transformer for moulded case feedthrough and split core current transformers

Type		IPS20	IPS30	IPS40	IPS21	IPS31	IPS41
Transformation ratio		1+1	1+1+1	1+1+1+1	Customer-specific	Customer-specific	Customer-specific
Primary in A	1						
	5						
Details: Page		234					

		DIN rail current transformer		Current transformer ... / 1 A		Three-phase CTs	Cable type split core current transformers (to be used with isolated cables)						
Type		35 / 1 A	64 / 1 A	CT27-35	CT27-64	ASRD 14	KUW 1 / 30	KUW 1 / 40	KUW 2 / 40	KUW 4 / 60	KUW 4.2 / 60	KBU 58	KBU 812
Round conductor in mm		-	-	7.5	7.5		18	18	28	42	2 x 42	-	-
Primary bus bar in mm		-	-	-	-		-	-	-	-	-	85 x 55	125 x 85
Primary current in A	35												
	50												
	60												
	64												
	75												
	100												
	125												
	150												
	200												
	250												
	300												
	400												
	500												
	600												
	750												
	800												
	1000												
	1250												
Details: Page		231		232		230	226					229	

■ = 1 A ■ = 5 A

[*1] Other variants on request

Current transformers

Moulded case CT, class 1 and 0.5 … / 5 A

Increased reliability
- Both halves of the housing overlap rather than butting up against one another
- Break-proof plastic housing made from polyamide
- Non-combustible per UL 94 VO and self-extinguishing

Protective caps for primary bus bar fastening screws
- Fixing screws pins for the primary rail can be insulated by means of protective caps, available as an option
- Safeguard to prevent accidental contact

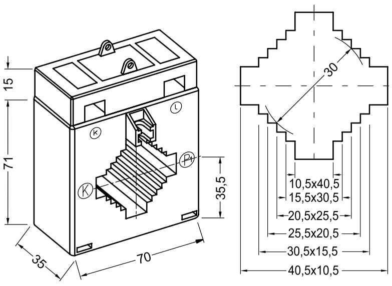
Secondary connections
- Feeding of the secondary connections to the connection terminals through the rectangular opening in the front and rear sides
- Secondary connection by means of cable lugs through the side slots

Expanded secondary terminal covering
- In addition to the normal terminal covering, extra protective hoods are available
- Locking of the front and rear feed to the secondary terminals

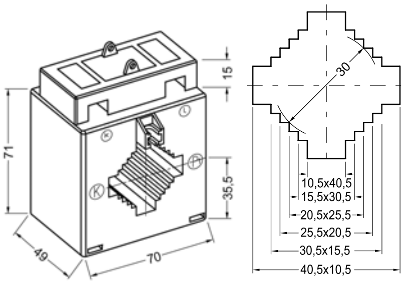
Dimension diagrams

All dimensions provided in mm

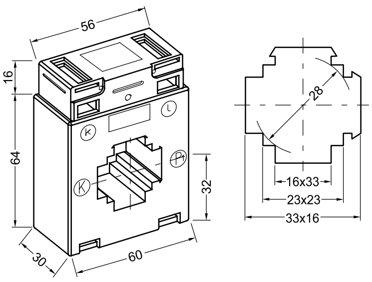
IPA40



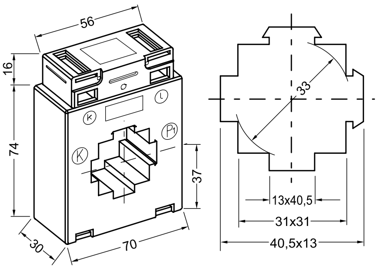
IPA40.5



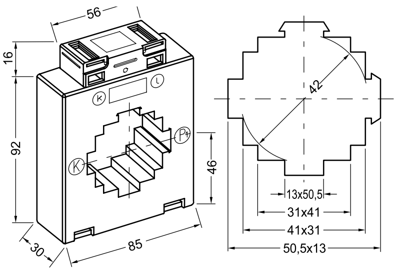
6A315.3



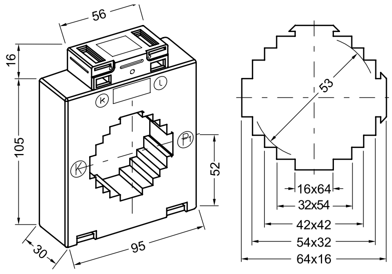
7A412.3



8A512.3



9A615.3



General mechanical properties

- Nominal frequency 50 – 60 Hz
- Insulation class E (other classes on request)
- Thermal rated short-term current Ith = 60 x IN/1s
- Rated surge current Idyn = 2.5 x Ith, min., however 100 kA
- Highest voltage for operating equipment Um = 0.72 kV
- Rated insulation level (test voltage) 4 kV / 1 min (per EN 61869-2)
- Over-current limit factor FS5 or FS10
- Harmonics currents up to 50th harmonic

Technical data

Device overview, moulded case current transformer, class 1 … / 5 A Secondary current*

Type	Primary current in A	Power in VA	Primary conductor (bus bars)	Round conductor in mm	Width in mm	Weight (kg)	Item no.
IPA40	50	2.5	40 x 10; 30 x 15; 25 x 20	30	70	0.4	**09.05.110**
IPA40	75	2.5	40 x 10; 30 x 15; 25 x 20	30	70	0.4	**09.05.112**
6A315.3	100	2.5	30 x 15 ; 20 x 20	28	60	0.3	**09.00.404**
6A315.3	150	5	30 x 15; 20 x 20	28	60	0.3	**09.00.452**
6A315.3	200	5	30 x 15, 20 x 20	28	60	0.3	**09.00.424**
6A315.3	250	5	30 x 15; 20 x 20	28	60	0.3	**09.00.425**
6A315.3	300	5	30 x 15; 20 x 20	28	60	0.3	**09.00.426**
6A315.3	400	5	30 x 15; 20 x 20	28	60	0.3	**09.00.427**
6A315.3	500	5	30 x 15; 20 x 20	28	60	0.3	**09.00.428**
6A315.3	600	5	30 x 15; 20 x 20	28	60	0.3	**09.00.429**
7A412.3	800	5	40 x 12; 2 x 30 x 10	33	70	0.4	**09.00.981**
7A412.3	1,000	5	40 x 12; 2 x 30 x 10	33	70	0.4	**09.00.982**
8A512.3	1,250	5	50 x 12; 2 x 40 x 10	42	85	0.5	**09.01.412**
8A512.3	1,500	5	50 x 12; 2 x 40 x 10	42	85	0.5	**09.01.413**
9A615.3	1,500	5	63 x 15; 2 x 50 x 10	53	95	0.5	**09.01.900**
9A615.3	1,600	10	63 x 15; 2 x 50 x 10	53	95	0.5	**09.01.901**
9A615.3	2,000	10	63 x 15; 2 x 50 x 10	53	95	0.5	**09.01.902**
9A615.3	2,500	10	63 x 15; 2 x 50 x 10	53	95	0.5	**09.01.903**

Device overview, moulded case current transformer, class 0.5 … / 5 A Secondary current*

Type	Primary current in A	Power in VA	Primary conductor (bus bars)	Round conductor in mm	Width in mm	Weight (kg)	Item no.
IPA40.5	50	2.5	40 x 10; 30 x 15; 25 x 20	30	70	0.6	**09.05.250**
IPA40.5	75	2.5	40 x 10; 30 x 15; 25 x 20	30	70	0.6	**09.05.252**
IPA40.5	100	5	30 x 15 ; 20 x 20	30	70	0.5	**09.05.234**
IPA40.5	150	10	30 x 15; 20 x 20	30	70	0.6	**09.05.236**
6A315.3	200	3.75	30 x 15, 20 x 20	28	60	0.3	**09.00.360**
6A315.3	250	5	30 x 15; 20 x 20	28	60	0.3	**09.00.361**
6A315.3	300	5	30 x 15; 20 x 20	28	60	0.3	**09.00.362**
6A315.3	400	5	30 x 15; 20 x 20	28	60	0.3	**09.00.363**
6A315.3	500	5	30 x 15; 20 x 20	28	60	0.3	**09.00.364**
6A315.3	600	5	30 x 15; 20 x 20	28	60	0.3	**09.00.365**
7A412.3	800	5	40 x 12; 2 x 30 x 10	33	70	0.4	**09.00.887**
7A412.3	1,000	5	40 x 12; 2 x 30 x 10	33	70	0.4	**09.00.888**
8A512.3	1,250	5	50 x 12; 2 x 40 x 10	42	85	0.4	**09.01.339**
9A615.3	1,500	5	63 x 15; 2 x 50 x 10	53	95	0.5	**09.01.820**
9A615.3	1,600	10	63 x 15; 2 x 50 x 10	53	95	0.5	**09.01.821**
9A615.3	2,000	10	63 x 15; 2 x 50 x 10	53	95	0.5	**09.01.822**
9A615.3	2,500	10	63 x 15; 2 x 50 x 10	53	95	0.5	**09.01.823**

Accessories

Mounting clip	for DIN rail EN 50022-35, suitable for 9A615.3, IPA40 style, 1 pair	0.01	**09.09.000**
Mounting clip	for DIN rail EN 50022-35, suitable for 6A315.3, 7A412.3, 8A512.3 and 9A615.3 style, 1 pair	0.01	**09.09.001**
Mounting clip	for DIN rail EN 50022-35, suitable for IPA40.5 style, 1 pair	0.01	**09.09.002**

* Secondary current transformer … / 1 A as well as other types on request.

Moulded case current transformer for billing purposes class 0.5 … / 5 A

Increased safety
- Both halves of the housing overlap rather than butting up against one another
- Burst-resistant plastic housing made from polyamide
- Non-combustible per UL 94 VO and self-extinguishing

Protective caps for primary rail fastening screws
- Screw-in pins for the primary rail terminals can be insulated by means of protective caps, available as an option
- Safeguard to prevent accidental contact

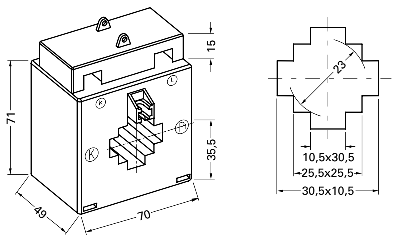
Secondary connection feed
- Feeding of the secondary connection to the connection terminals through the rectangular opening in the front and rear sides
- During installation, e.g. behind the safety strip, the secondary connection is implemented by means of cable lugs through the side slots

Expanded secondary terminal covering
- In addition to the normal terminal covering, extra protective hoods are available
- Locking of the front and rear feed to the secondary terminals

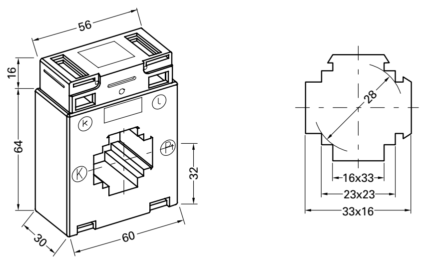
Dimension diagrams

All dimensions in mm

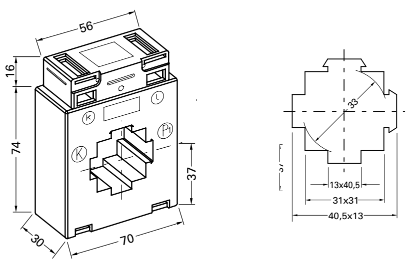
EIPA30.5



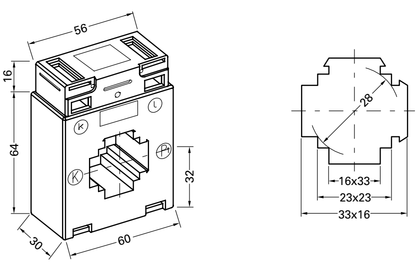
E6A315.3



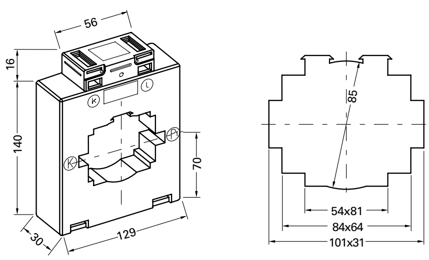
E7A412.3



E9A615.3



E13A1030.3



General mechanical properties

- Nominal frequency 50 – 60 Hz
- Insulation class E (other classes on request)
- Thermal rated short-term current Ith = 60 x IN/1s
- Rated surge current Idyn = 2.5 x Ith, however min. 100 kA with all plug-in current transformers
- Highest voltage for operating equipment Um = 0.72 kV
- Rated insulation level (test voltage) 4 kV / 1 min (per EN 61869-2)
- Over-current limit factor FS5 or FS10
- Harmonics current up to 50th harmonic

Technical Data

Device overview, calibratable plug-in current transformer, class 0.5 … / 5 A Secondary current*							
Type	**Primary current in A**	**Power in VA**	**Primary conductor (bus bars)**	**Round conductor in mm**	**Width in mm**	**Weight (kg)**	**Item no.**
EIPA30.5	50	1.25	30.5 x 10.5; 25.5 x 25.5; 10.5 x 30.5	23	70	0.4	**09.14.810**
EIPA30.5	75	2.5	30.5 x 10.5; 25.5 x 25.5; 10.5 x 30.5	23	70	0.4	**09.14.812**
EIPA30.5	100	2.5	30.5 x 10.5; 25.5 x 25.5; 10.5 x 30.5	23	70	0.3	**09.14.811**
E6A315.3	200	2.5	33 x 16; 23 x 23, 16 x 33	28	60	0.3	**09.10.340**
E6A315.3	250	5	33 x 16; 23 x 23, 16 x 33	28	60	0.3	**09.10.367**
E6A315.3	300	5	33 x 16; 23 x 23, 16 x 33	28	60	0.3	**09.10.366**
E6A315.3	400	5	33 x 16; 23 x 23, 16 x 33	28	60	0.3	**15.02.907**
E6A315.3	500	5	33 x 16; 23 x 23, 16 x 33	28	60	0.3	**09.10.364**
E6A315.3	600	5	33 x 16; 23 x 23, 16 x 33	28	60	0.3	**09.11.365**
E7A412.3	800	5	40.5 x 13; 31 x 31, 13 x 40.5	33	70	0.3	**09.10.390**
E7A412.3	1.000	5	40.5 x 13; 31 x 31, 13 x 40.5	33	70	0.4	**09.10.888**
E9A615.3	1.500	5	64 x 16; 54 x 32; 42 x 42; 32 x 54; 16 x 64	53	95	0.4	**09.10.387**
E13A1030.3	1.600	5	101 x 31; 84 x 64; 54 x 81	85	129	0.5	**09.12.887**
E13A1030.3	2.000	5	101 x 31; 84 x 64; 54 x 81	85	129	0.5	**09.12.888**
E13A1030.3	2.500	5	101 x 31; 84 x 64; 54 x 81	85	129	0.5	**09.12.889**

Description	Item no.
Conformity declaration with corrigendum	09.50.011

*These transformers are not on stock and will be ordered to customer order, products are excluded from return.
Transformers with other primary or secondary currents on request.

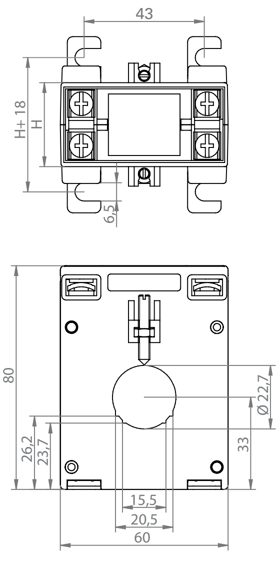
Moulded case current transformer for billing purposes Class 0,2S / 0,5S

Billing current transformer
The current transformer for billing with a constantly sufficient load. In short, with which the valid regulations for kWh measurement devices are fulfilled. Each current transformer is individually measured and the test reports can be called up online. Flexibility, the compact design and safety are unique selling features of the line. All transformers are equipped with an integrated lockable terminal cover, produced from polycarbonate. The current transformers are supplied with a fastening tool, for mounting on rails, cables or assembly plates. The transformers can be optionally ordered with clips, which enable mounting on a DIN rail.

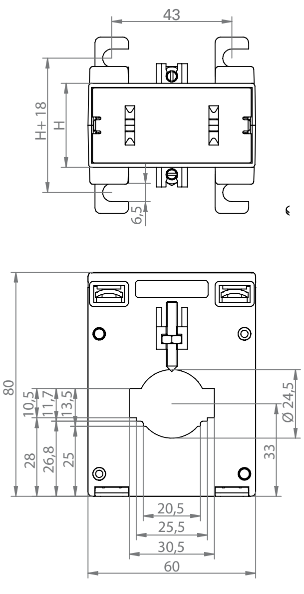
Dimension diagrams

All dimensions in mm

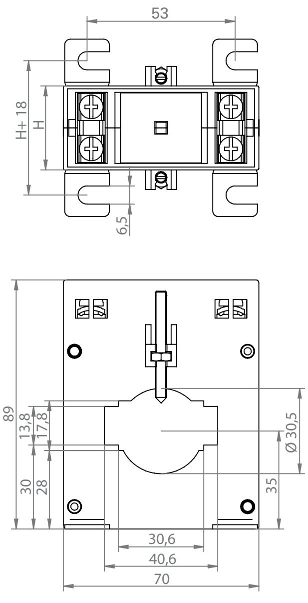
ERM60-E2A



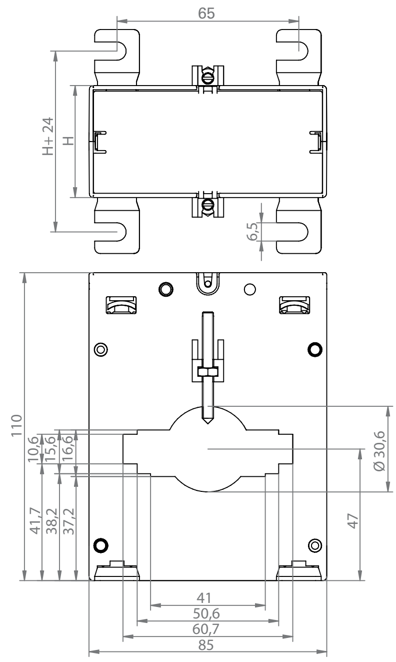
ERM60-E3A



ERM70-E4A



ERM85-E6A



General properties

- Nominal frequency 50 – 60 Hz
- Insulation class E
- Thermal rated short-term current I_{th} = 60 x I_N/1s
- Thermal continuous current 1.2 x I_N
- Rated surge current I_{dyn} = 2.5 x I_{th}, however min. 100 kA with all plug-in current transformers
- Highest voltage for operating equipment U_m = 0.72 kV
- Rated insulation level (test voltage) 3 kV / 1 min (per IEC 61869-2)
- Over-current limit factor FS5 with max. power or FS10 with min. power
- Harmonics current up to 50th harmonic
- Test report available
- Temperature range -25 to 55°C
- Other current transformer requirements on request

Technical data

Device overview calibratable moulded case current transformer, class 0,2S / 0,5S

Type	Primary current in A	Class	Power in VA	Transformation ratio	Primary conductor	Round conductor in mm	Width in mm	Weight (kg)	Item no.
ERM60-E3A	150	0.2S	0 – 1 VA	150/5 A	30 x 10	24,5	60	0,4	**09.06.212**
ERM60-E3A	200	0.2S	0 – 2 VA	200/5 A	30 x 10	24,5	60	0,4	**09.06.213**
ERM60-E3A	250	0.2S	0 – 2,5 VA	250/5 A	30 x 10	24,5	60	0,4	**09.06.214**
ERM70-E4A	300	0.2S	0 – 2,5 VA	300/5 A	40 x 10	30,5	70	0,4	**09.06.215**
ERM70-E4A	400	0.2S	0 – 5 VA	400/5 A	40 x 10	30,5	70	0,4	**09.06.216**
ERM70-E4A	500	0.2S	0 – 5 VA	500/5 A	40 x 10	30,5	70	0,4	**09.06.217**
ERM70-E4B	600	0.2S	0 – 5 VA	600/5 A	40 x 10	30,5	70	0,5	**09.06.218**
ERM70-E4B	750	0.2S	0 – 5 VA	750/5 A	40 x 10	30,5	70	0,5	**09.06.219**
ERM85-E6A	1000	0.2S	0 – 5 VA	1000/5 A	60 x 10	30,6	85	0,6	**09.06.220**

Fees for calibration certificate

Description	Item no.
Calibration fee for transformer class 0.2S / 0.5S	09.06.209
Calibration certificate for transformer class 0.2S / 0.5S	09.06.210

Summation current transformer, class 1 and 0.5 for feedthrough and split core

Potential-free measurement

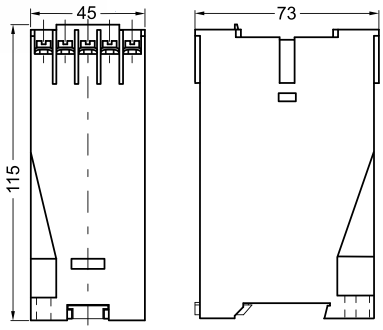
- Summation of the secondary currents from multiple main CTs
- Thus measuring of multiple feeders by just one meter
- Standardised measurement signal available at the output
- Alongside the addition of the input currents, the total is also divided by the number of inputs
- Distinction for similar and dissimilar main transformers

General mechanical properties

- Break-proof plastic housing made from ABS, IP40
- Non-combustible per UL 94 VO, self-extinguishing
- Nickel-plated terminals with Plus-Minus screws
- Integrated electric shock protection, IP10
- Nominal frequency 50 – 60 Hz
- Insulation class E (other classes on request)
- Thermal rated short-term current Ith = 60 x IN/1s
- Rated surge current Idyn = 2.5 x IN
- Maximum operating voltage Um = 0.72 kV *1
- Rated insulation level (test voltage) 3 kV / 1 min*1
- Over-current limit factor FS5 or FS10
- Maximum conductor cross-section: 2.5 Ø solid, 1.5 Ø flexible

Dimension diagrams

All dimensions in mm



Technical data

Summation current transformer, class 1							
Type	**Primary current in A**	**Secondary current in A**	**Power in VA**	**Transformation ratio**	**Dimensions in mm (H x W x D)**	**Weight (kg)**	**Item no.**
IPS20	5+5	5	15	1:1	115 x 45 x 73	0.4	**15.02.510**
IPS30	5+5+5	5	15	1:1:1	115 x 45 x 73	0.4	**15.02.515**
IPS40	5+5+5+5	5	15	1:1:1:1	115 x 45 x 73	0.5	**15.02.520**
IPS20	1+1	1	15	1:1	115 x 45 x 73	0.5	**09.05.306**
IPS30	1+1+1	1	15	1:1:1	115 x 45 x 73	0.5	**09.05.316**
IPS40	1+1+1+1	1	15	1:1:1:1	115 x 45 x 73	0.5	**09.05.326**
IPS21	5+5	5	15	as required	115 x 45 x 73	0,4	**15.02.526**
IPS31	5+5+5	5	15	as required	115 x 45 x 73	0,4	**15.02.521**
IPS41	5+5+5+5	5	10	as required	115 x 45 x 73	0,5	**15.02.525**

Summation current transformer, class 0.5							
Type	**Primary current in A**	**Secondary current in A**	**Power in VA**	**Transformation ratio**	**Dimensions in mm (H x W x D)**	**Weight (kg)**	**Item no.**
IPS20	5+5	5	15	1:1	115 x 45 x 73	0.5	**15.02.511**
IPS30	5+5+5	5	15	1:1:1	115 x 45 x 73	0.5	**15.02.516**
IPS40	5+5+5+5	5	15	1:1:1:1	115 x 45 x 73	0.5	**15.02.519**

Not useable in combination with cable split core.
*1 Other currents on request.

Summation current transformer, class 1 for cable type split core current transformers

No-compromise, individual measurement

- High measurement accuracy
- User friendly spring-clamp technology
- Designed for use with the series KUW split core CTs

Technical data

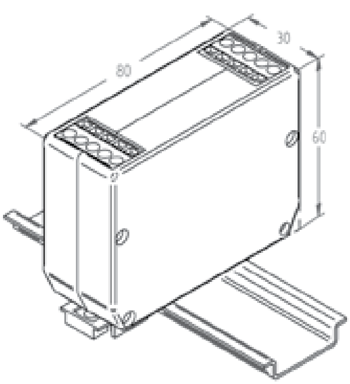
Summation current transformer, class 1							
Type	**Primary current in A**	**Secondary current in A**	**Power in VA**	**Transformer ratio**	**Dimensions in mm (H x W x D)**	**Weight (kg)**	**Item no.**
STS20	1+1	1	0.2	1:1	80 x 30 x 60	0.2	**15.02.560**
STS30	1+1+1	1	0.2	1:1:1	80 x 30 x 60	0.2	**15.02.561**
STS40	1+1+1+1	1	0.2	1:1:1:1	80 x 55 x 60	0.4	**15.02.562**
STS50	1+1+1+1+1	1	0.2	1:1:1:1:1	80 x 55 x 60	0.4	**15.02.563**
STS60	1+1+1+1+1+1	1	0.2	1:1:1:1:1:1	80 x 55 x 60	0.4	**15.02.564**
STS21	1+1	1	0.2	Customer-specific	80 x 30 x 60	0.2	**15.02.570**
STS31	1+1+1	1	0.2	Customer-specific	80 x 30 x 60	0.2	**15.02.571**
STS41	1+1+1+1	1	0.2	Customer-specific	80 x 55 x 60	0.4	**15.02.572**
STS51	1+1+1+1+1	1	0.2	Customer-specific	80 x 55 x 60	0.4	**15.02.573**
STS61	1+1+1+1+1+1	1	0.2	Customer-specific	80 x 55 x 60	0.4	**15.02.574**

With dissimilar main CTs, the ratio of the largest to the smallest primary current should not be lager than 10/1.

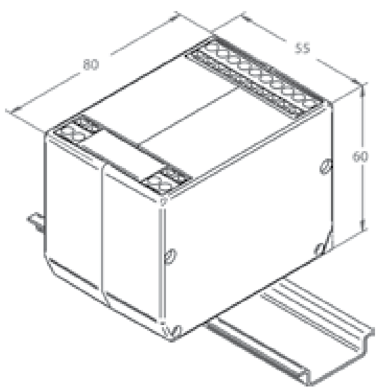
Dimension diagrams

All dimensions in mm

STS20 / STS30 / STS21 / STS31



STS40 / STS50 / STS60 / STS41 / STS51 / STS61



Cable split core current transformers

Innovative and reliable

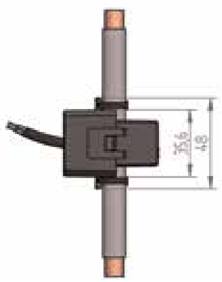
- Particularly well suited to digital measurement devices
- Especially fast installation
- For applications with insulated cable up to 2 x 42 mm max.
- Transformation ratio of 60 ... 1000 / 1 A or 150 ... 1,000 / 5 A
- Including color-coded secondary cables
- Additional fastening of the transformer with the two UV-resistant cable ties provided
- Especially suited for retrofitting, primary circuit must not be disconnected
- Ideal for use in very compact installation spaces

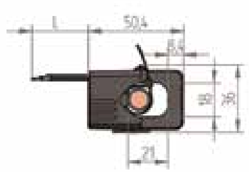
Fig.: Type KUW4.2/60

Dimension diagrams

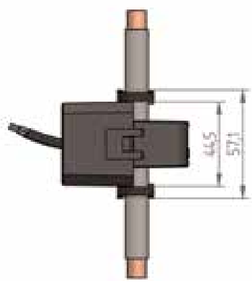
All dimensions in mm

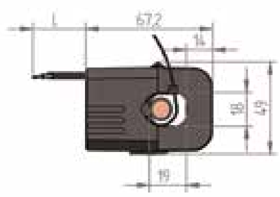
KUW1/30



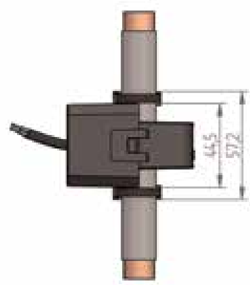


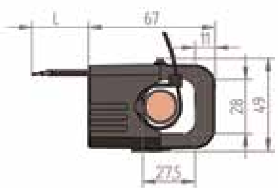
KUW1/40





KUW2/40

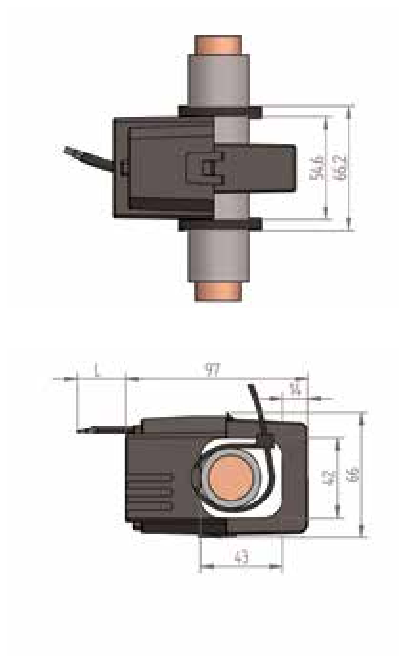




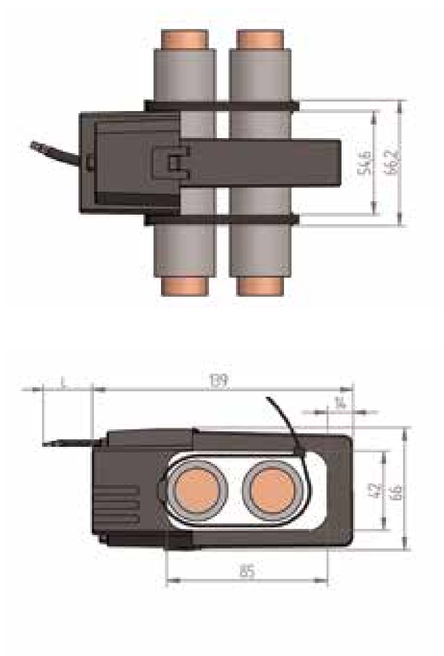
Technical data

Environmental conditions	
Position of installation	**For indoor usage, only for insulated cables**
Ambient temperature	-10 … +55 °C
Relative humidity	5 … 85 % (no condensation)
Protection class	IP20
Application conditions	
Standard	IEC 61869-2
Thermal short time rated current	60 x In / 1 s
Thermal continuous current	100 %
Rated isolation level	0.72 / 3 / kV
Rated frequency	50 / 60 Hz
Insulation class	E (120 °C)
Cable feed through window	For conductors max. Ø 18 / 28 / 42 or 2 x 42 mm
Secondary conductor	… / 1 A: 0.5 mm² … / 5 A: 1.5 mm²

KUW4/60



KUW4.2/60



Series KUW1 for insulated cable up to max. 18 mm diameter								
Type	Primary current in A	Secondary current in A	Power in VA (at the end of the wire)	Class	Cable length in m	Diameter Primary conductor in mm	Weight (kg)	Item no.
KUW1/30-60	60	1	0.2	3	3	18	0.3	**15.03.510**
KUW1/30-75	75	1	0.2	3	3	18	0.3	**15.03.511**
KUW1/30-100	100	1	0.2	3	3	18	0.3	**15.03.512**
KUW1/30-125	125	1	0.2	3	3	18	0.3	**15.03.513**
KUW1/30-150	150	1	0.2	3	3	18	0.3	**15.03.514**
KUW1/30-200	200	1	0.2	1	3	18	0.3	**15.03.515**
KUW1/30-250	250	1	0.2	1	3	18	0.3	**15.03.317**
KUW1/40-100	100	1	0.2	1	3	18	0.4	**15.03.320**
KUW1/40-125	125	1	0.2	1	3	18	0.4	**15.03.321**
KUW1/40-150	150	1	0.2	1	3	18	0.4	**15.03.322**
KUW1/40-200	200	1	0.2	0.5	3	18	0.4	**15.03.325**
KUW1/40-250	250	1	0.2	0.5	3	18	0.4	**15.03.326**
KUW1/40-150	150	5	1	1	0.5	18	0.4	**15.03.329**
KUW1/40-200	200	5	1	1	0.5	18	0.4	**15.03.330**
KUW1/40-250	250	5	1	0.5	0.5	18	0.4	**15.03.331**

Series KUW2 for insulated cable max. 28 mm diameter								
Type	Primary current in A	Secondary current in A	Power in VA (at the end of the wire)	Class	Cable length in m	Diameter Primary conductor in mm	Weight (kg)	Item no.
KUW2/40-200	200	1	0.2	1	3	28	0.3	**15.03.351**
KUW2/40-250	250	1	0.2	1	3	28	0.3	**15.03.352**
KUW2/40-300	300	1	0.2	1	3	28	0.3	**15.03.354**
KUW2/40-400	400	1	0.2	1	3	28	0.4	**15.03.356**
KUW2/40-500	500	1	0.2	0.5	3	28	0.4	**15.03.358**
KUW2/40-250	250	5	1	1	0.5	28	0.3	**15.03.353**
KUW2/40-300	300	5	1	1	0.5	28	0.3	**15.03.355**
KUW2/40-400	400	5	1	1	0.5	28	0.3	**15.03.357**
KUW2/40-500	500	5	1	1	0.5	28	0.3	**15.03.359**

Series KUW4/60 for insulated cable up to max. 42 mm diameter								
Type	Primary current in A	Secondary current in A	Power in VA (at the end of the wire)	Class	Cable length in m	Diameter Primary conductor in mm	Weight (kg)	Item no.
KUW4/60-250	250	1	0.5	1	5	42	0.6	**15.03.565**
KUW4/60-300	300	1	0.5	1	5	42	0.6	**15.03.566**
KUW4/60-400	400	1	0.5	0.5	5	42	0.6	**15.03.568**
KUW4/60-500	500	1	0.5	0.5	5	42	0.6	**15.03.570**
KUW4/60-600	600	1	0.5	0.5	5	42	0.6	**15.03.572**
KUW4/60-750	750	1	0.5	0.5	5	42	0.6	**15.03.574**
KUW4/60-800	800	1	0.5	0.5	5	42	0.6	**15.03.576**
KUW4/60-1000	1,000	1	0.5	0.5	5	42	0.6	**15.03.578**
KUW4/60-300	300	5	0.5	1	3	42	0.6	**15.03.367**
KUW4/60-400	400	5	0.5	1	3	42	0.5	**15.03.369**
KUW4/60-500	500	5	0.5	1	3	42	0.6	**15.03.371**
KUW4/60-600	600	5	0.5	0.5	3	42	0.5	**15.03.373**
KUW4/60-750	750	5	0.5	0.5	3	42	0.6	**15.03.375**
KUW4/60-800	800	5	0.5	0.5	3	42	0.6	**15.03.377**
KUW4/60-1000	1,000	5	0.5	0.5	3	42	0.6	**15.03.379**

Series KUW4.2/60 for insulated cable up to max. 2 x 42 mm diameter								
Type	Primary current in A	Secondary current in A	Power in VA (at the end of the wire)	Class	Cable length in m	Diameter Primary conductor in mm	Weight (kg)	Item no.
KUW4.2/60-250	250	1	0.5	1	5	42 x 84	0.7	**15.03.580**
KUW4.2/60-300	300	1	0.5	1	5	42 x 84	0.8	**15.03.581**
KUW4.2/60-400	400	1	0.5	0.5	5	42 x 84	0.7	**15.03.583**
KUW4.2/60-500	500	1	0.5	0.5	5	42 x 84	0.8	**15.03.585**
KUW4.2/60-600	600	1	0.5	0.5	5	42 x 84	0.7	**15.03.587**
KUW4.2/60-750	750	1	0.5	0.5	5	42 x 84	0.8	**15.03.589**
KUW4.2/60-800	800	1	0.5	0.5	5	42 x 84	0.8	**15.03.591**
KUW4.2/60-1000	1,000	1	0.5	0.5	5	42 x 84	0.8	**15.03.593**
KUW4.2/60-300	300	5	0.5	1	3	42 x 84	0.7	**15.03.382**
KUW4.2/60-400	400	5	0.5	1	3	42 x 84	0.8	**15.03.384**
KUW4.2/60-500	500	5	0.5	1	3	42 x 84	0.6	**15.03.386**
KUW4.2/60-600	600	5	0.5	0.5	3	42 x 84	0.7	**15.03.388**
KUW4.2/60-750	750	5	0.5	0.5	3	42 x 84	0.8	**15.03.390**
KUW4.2/60-800	800	5	0.5	0.5	3	42 x 84	0.8	**15.03.392**
KUW4.2/60-1000	1,000	5	0.5	0.5	3	42 x 84	0.8	**15.03.394**

Cable split core current transformer, type KBU

Features / benefits

- Ideal for retrospective installation in existing systems
- Simple and secure attachment - current transformer audibly latches
- Available with secondary current 5 A / 1 A
- Also available in accuracy class 0.5
- Four different configurations
- Working temperature range: -5°C < T < +50°C
- Storage temperature range -25°C < T < +70°C
- Therm. nominal continuous current I_{cth}: 1,0 x I_N
- Therm. nominal short-time current I_{th}: 60 x I_N, 1 sec.
- Max. supply voltage U_m: 0,72 kV
- Insulation test voltage: 3 kV, U_{eff}, 50 Hz, 1 min.
- Nominal frequency: 50 Hz
- Insulation class: E
- Applied technical standards: DIN EN 61869, part 1 + 2

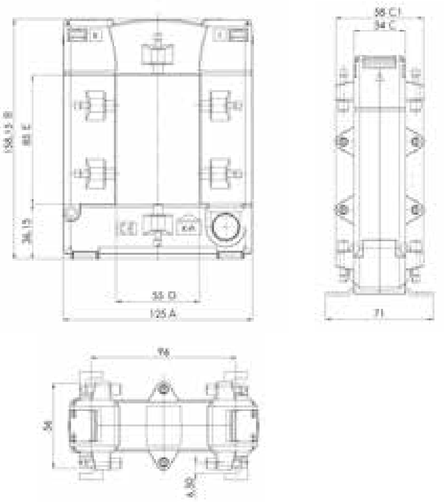
Technical data

Cable split core current transformer, type KBU											
Type	Primary current in A	Secondary current in A	Power in VA	Class	Dimensions in mm					Weight (kg)	Item no.
					A	B	C / C1	D	E		
KBU 58	250	5	1.5	1	125	158	34 / 58	55	85	0.9	**15.02.316**
KBU 58	400	5	1	0.5	125	158	34 / 58	55	85	0.9	**15.02.868**
KBU 58	500	5	2.5	0.5	125	158	34 / 58	55	85	0.9	**15.02.819**
KBU 58	600	5	2.5	0.5	125	158	34 / 58	55	85	1.0	**15.02.315**
KBU 58	1000	5	5	0.5	125	158	34 / 58	55	85	1.0	**15.02.320**
KBU 812	600	5	2.5	0.5	155	198	34 / 58	85	125	1.3	**15.02.869**
KBU 812	800	5	2.5	0.5	155	198	34 / 58	85	125	1.3	**15.02.870**
KBU 812	1000	5	5	0.5	155	198	34 / 58	85	125	1.3	**15.02.871**
KBU 812	1200	5	5	0.5	155	198	34 / 58	85	125	1.3	**15.02.872**

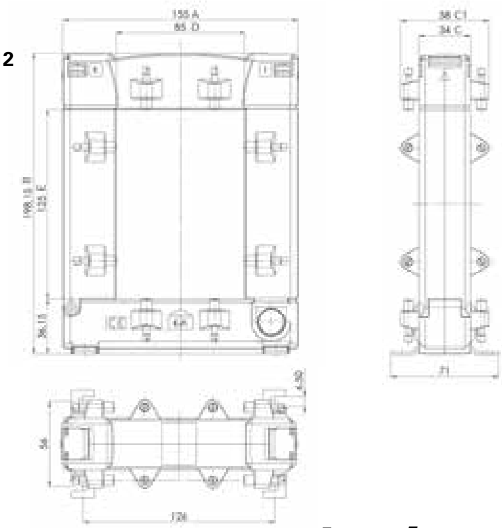
Dimension diagrams

All dimensions in mm

KBU 58



KBU 812



Three-phase current transformer type ASRD 14

Three-phase current transformer with 5 A secondary current

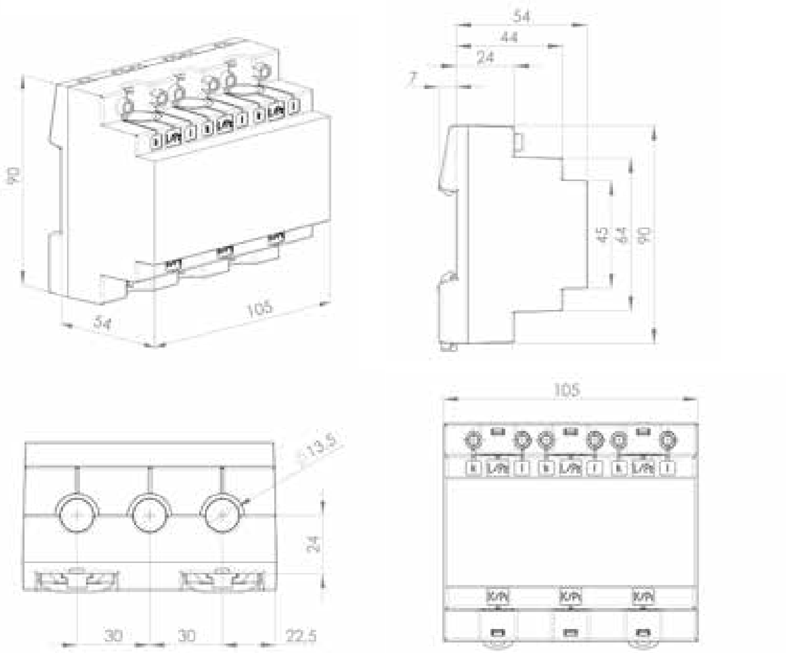
- Primary current 100 A
- Secondary current 5 A
- Conductor feed-through Ø 13.5 mm per phase
- For connection to current measuring systems with 5 A input

Technical data

Three-phase current transformer type ASRD 14								
Type	Primary current in A	Secondary current in A	Power in VA	Class	Round conductor in mm	Dimensions in mm (H x W x D)	Weight (kg)	Item no.
ASRD 14	50	5	1	1	13.5	105 x 90 x 54	0.5	**15.03.403**
ASRD 14	75	5	1.5	1	13.5	105 x 90 x 54	0.5	**15.03.404**
ASRD 14	100	5	2.5	1	13.5	105 x 90 x 54	0.5	**15.03.405**
ASRD 14	125	5	2.5	0.5	13.5	105 x 90 x 54	0.5	**15.03.406**
ASRD 14	150	5	2.5	0.5	13.5	105 x 90 x 54	0.5	**15.03.407**

Dimension diagrams

All dimensions in mm



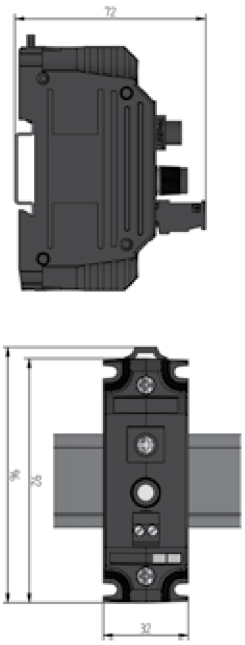
DIN rail current transformer with voltage tap and fuse

Save time and space

- For precise current and voltage measurement
- Integrated current transformer and fuse protected voltage tap
- Prevention of connection errors
- Specially developed for energy measurement up to 64 A
- Transformation ratios 35/1 and 64/1 A
- With test mark from KEMA-KEUR

Dimension diagrams

All dimensions in mm



Technical data

Technical data	
General	
Maximum voltage	690 V, Uimp 6 kV
Insulation voltage	1890 V / 50 Hz 1 min
Rated current	35 / 64 A
Max. current (16 mm²)	42 / 76 A
Protection class	E (max. 120 °)
Protection class	IP20
Ambient temperature	-5 … +40 °C
Housing	PA, 30 % glass proportion
Screw connection	cross head DIN 7962-H2
Terminal	
Standard	IEC 60947-7-1
Connection cross-section	1.5 mm² – 16 mm²
Voltage tap-off	
Short-circuit withstand capability	70 kA to 400 V / 50 Hz
Connection cross-section max.	4 mm²
Fuse type	5 x 25 mm (with notification) Max. 2 A SIBA DIN 41576-2
Current transformers	
Standard	IEC 61869-2
Maximum short term current	60 x In
Insulation voltage	3 kV / 50 Hz 1 min

DIN rail current transformer overview						
Type	Transformation ratio	Power in VA	Class	Dimensions in mm (H x W x D)	Weight (kg)	Item no.
CT 35/1A	35/1 A	0.2	1	72 x 32 x 96	0.2	**15.03.002**
CT 64/1A	64/1 A	0.2	0.5	72 x 32 x 96	0.2	**15.03.003**

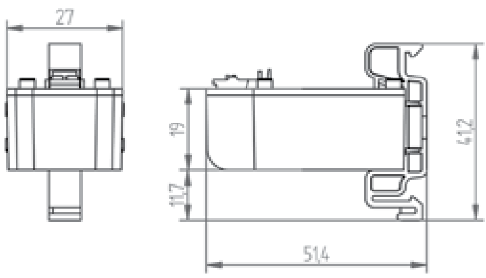
Current transformer CT27 – Class 1

Compact innovation

- Compact current transformer
- Particularly well suited to digital measurement devices
- Current transformer per IEC 61869-2
- Transformation ratios 35/1, 64/1 A, class 1
- Primary conductor feed-through window for insulated cable up to Ø 7.5 mm
- For use on a 3-phase circuit breaker with phase spacing of 17.5 mm
- DIN rail mounting (35 mm) via rail clamps (optional)
- Plug-in type CTs (Lego concept)

Dimension diagrams

All dimensions in mm



Technical data

Technical data	
Environmental conditions	
Position of installation	Indoor usage; only for insulated conductors
Ambient temperature	-10 … +55 °C
Relative humidity	5 … 85 % (no condensation)
Protection class	IP20
Application conditions	
Standard	IEC 61869-2
Thermal short time rated current	60 x In / 1 s
Thermal continuous current	100 %
Rated isolation level	0.72 / 3 / kV
Rated frequency	50 / 60 Hz
Insulation class	E (120 °C)
Cable feed through window	Ø 7.5 mm
Secondary conductor (spring clamps)	Wire cross section: 0.2 ... 1.5 mm²; rigid, flexible

Current transformer CT27 – Class 1							
Type	**Primary current in A**	**Secondary current in A**	**Power in VA (at the terminal)**	**Max. diameter, primary conductor in mm**	**Dimensions in mm (H x W x D)**	**Weight (kg)**	**Item no.**
CT27-35	35	1	0.2	7.5	46 x 27 x 23	0.05	**15.03.080**
CT27-64	64	1	0.2	7.5	46 x 27 x 23	0.04	**15.03.081**
Accessories							
Mounting clip	For DIN rail EN 50022-35, suitable for CT27-35 and CT27-64				14 x 41 x 27	0.001	**09.09.010**

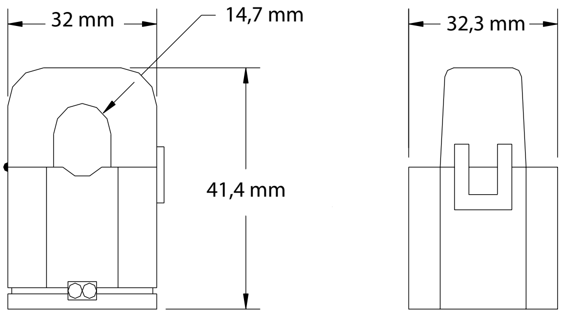
Split-core current transformer SC-CT-20

Innovative and flexible

- Compact, divisible, split-core current transformer
- Separable current transformer up to max. 63 A especially for retrofitting
- Transformation ratio 3,000/1
- Primary window can be used for insulated cable up to Ø 10 mm
- Special version for the UMG 20CM branch circuit monitoring device

Dimension diagrams

All dimensions in mm



Technical data

Environmental conditions	
Position of installation	Indoor usage; only for insulated conductors
Ambient temperature	-10 ... +55 °C
Protection class	IP20
Application conditions	
Measuring accuracy	1 %
Thermal continuous current	100 %
Insulation resistance	100 MOhm
Rated frequency	50 / 60 Hz
Max. frequency	20 – 1000 Hz
Secondary conductor	Wire cross section: 0.75 mm² Rigid, flexible

Split-core current transformer SC-CT-20								
Type	**Max. operating current (A)**	**Transformation ratio**	**Max. primary conductor diameter in mm**	**Class**	**Accuracy (%)**	**Dimensions in mm (H x W x D)**	**Weight (kg)**	**Item no.**
SC-CT-20*	63	3,000/1	10	1	1	41.4 x 32 x 32.3	0.04	**15.03.092**
Individual accessory (load is included the scope of the SC-CT-20 delivery)								
Burden (3.9 Ω) for operating current monitoring with the SC-CT-20 with 1.5 m ready-made connection cable and spring type terminal adapter								**15.03.086**

* Incl. ready-made connection cable; 1.5 m with burden and spring type terminal adapter for operating current measurement

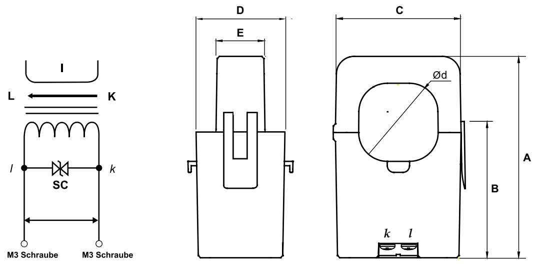
Split core operating current CTs up to 600 A

Fast installation – reliable measurement

- Snap-in technology make installation in existing equipment easier
- Secure latching in place
- High number of secondary windings
- Small size, low weight
- Suitable for UMG 20CM

Dimension diagrams

All dimensions in mm



Technical data

Technical data						
Type	**SC-CT-20-100**	**SC-CT-20-200**	**SC-CT-20-300**	**SC-CT-20-400**	**SC-CT-20-500**	**SC-CT-20-600**
Current ratio	120 A / 40 mA	200 A / 66,6 mA	300 A / 100 mA	400 A / 100 mA	500 A / 100 mA	600 A / 100 mA
Current range (50/60 Hz)	0,01 … 100 A (RL = 10 Ohm)	0,01 … 200 A (RL = 10 Ohm)	0,1 … 300 A (RL = 10 Ohm)	0,01 … 400 A (RL = 5 Ohm)	0,01 … 500 A (RL = 5 Ohm)	0,01 … 600 A (RL = 5 Ohm)
Position of installation	Indoor usage (any mounting position)					
Ambient temperature	-20 … +50 °C			-20 … +55 °C		
Storage temperature	-30 … +90 °C, rel. humidity <85 % (no condensation)					

Split core operating current transformer up to 600 A												
Type	**Operating mode**	**Max. operating current in A**	**Trans-formation ratio**	**Max. primary conductor diameter in mm**	**Accuracy (%)**	**Dimensions in mm (H x W x D)**					**Weight (kg)**	**Item no.**
						A	**B**	**C**	**D**	**E**		
SC-CT-20-100	Operating current measurement*¹	100	3000/1	16	1	55	41	29.5	31	19	ca. 0.075	**15.03.093**
SC-CT-20-200	Operating current measurement*¹	200	3000/1	24	1	74.5	52	45	34	22	ca. 0.2	**15.03.094**
SC-CT-20-300	Operating current measurement*¹	300	3000/1	24	1	74.5	52	45	34	22	ca. 0.2	**15.03.095**
SC-CT-20-400	Operating current measurement*¹	400	4000/1	36	0.5	91.4	57.0	57.1	40.2	21.1	ca. 0.3	**15.03.097**
SC-CT-20-500	Operating current measurement*¹	500	5000/1	36	0.5	91.4	57.0	57.1	40.2	21.1	ca. 0.3	**15.03.099**
SC-CT-20-600	Operating current measurement*¹	600	6000/1	36	0.5	91.4	57.0	57.1	40.2	21.1	ca. 0.3	**15.03.101**

Single accessory (burden is included the scope of the transformer delivery)	
Burden (2.2 Ω) for operating current transformer SC-CT-20-100 with 1.5 m ready-made connection cable and spring type terminal adapter	**15.03.087**
Burden (1.1 Ω) for operating current transformer SC-CT-20-200 with 1.5 m ready-made connection cable and spring type terminal adapter	**15.03.088**
Burden (0.8 Ω) for operating current transformer SC-CT-20-300/400/500/600 with 1.5 m ready-made connection cable and spring type terminal adapter	**15.03.085**

*¹ Incl. ready-made connection cable; 1.5 m with burden and spring type terminal adapter for operating current measurement

Flexible current transformer

Main features

- Set comprising 3 components: The 1A measurement transducer, a Rogowski coil with 300 or 600 mm length (depending on model) and 3 m pre-assembled connection cable.
- The diameter of the measurement coil is 95 or 190 mm once installed (depending on model).
- The Rogowski coil serves for AC current measurement for conductor rails and heavy current lines.

Description	Item no.	Diameter	Length	Weight
Flex-CT-1A-300mm (with measurement transducer)	**15.03.600**	95 mm	300 mm	190 g
Flex-CT-1A-600mm (with measurement transducer)	**15.03.601**	190 mm	600 mm	195 g
Rogowski coil 300mm (without measurement transducer)	**15.03.602**	95 mm	300 mm	190 g
Rogowski coil 600mm (without measurement transducer)	**15.03.603**	190 mm	600 mm	195 g

Technical data	
Measurement transducer supply	
Rated supply voltage	24 V DC -20% ... +25 %
Rated supply voltage range	19,2 V DC ... 30 V DC
Maximum power consumption	190 mA
Power consumption	4 W
Input data for measurement coil	
Frequency measuring range	10 Hz ... 5000 Hz
Position error	< 1 % (the measurement coil is located at a right angle to the live conductor) < 1.5 % (the measurement coil is positioned across the live conductor at an angle)
Linearity error	0,1 %
Input data for measurement transducer	
Metering ranges (current)	100 A, 250 A, 400 A, 630 A, 1000 A, 1500 A, 2000 A, 4000 A
Phase angle	< 1 °
Rated power	1,5 VA
Signal input for measurement transducer	
Input signal (at 50 Hz)	100 mV (1000 A)
Signal output for measurement transducer	
Burden	0 Ω ... 1,5 Ω
General data for measurement coil	
Length of the signal line	3000 mm
Conductor design for signal line	2 x 0.22 mm (signal (tin-plated)) 1 x 0.22 mm (shielding (tin-plated))
Rated insulation voltage	1000 V AC (rms CAT III) 600 V AC (rms CAT IV)

General data for measurement transducer	
Linearity error	< 0.5% (from the range final value)
Maximum transfer error	≤ 0.5% (from the range final value)
Frequency range	45 Hz to 65 Hz
Power consumption	< 190 mA (at 19.2 V)
Housing material	Polyamide
Protection class	IP20
Test voltage	1.5 kV AC (supply / input and output: 50 Hz, 1 min)
General data	
Standards/Regulations	IEC 61010-1, IEC 61010-031, IEC 61010-2-031, IEC 61010-2-032
Overvoltage category	III (1000 V, to the neutral conductor) IV (600 V, to the neutral conductor)
Connection data	
Connection name	Measurement transducer side
Min. conductor cross-section (flexible)	0,2 mm²
Max. conductor cross-section (flexible)	2,5 mm²
Min. conductor cross-section (rigid)	0,2 mm²
Max. conductor cross-section (rigid)	2,5 mm²
Dimensions	
Width	22,50 mm
Height	70,40 mm
Depth	85,00 mm
Environmental conditions	
Ambient temperature (during operation)	-30 °C to 80 °C (measurement coil) -20 °C to 70 °C (measurement transducer)
Ambient temperature (storage/transport)	-40 °C to 90 °C (measurement coil) -25 °C to 85 °C (measurement transducer)

FLEX-CLAMP bracket

Firm seating of the Rogowski coil

The optional holding fixture provides firm seating for the Rogowski coil on busbars with a thickness of 5 to 15 mm. During installation, the coil housing is pushed onto the flange of the holding fixture and locks into place automatically.

Type	Description	Dimensions in mm (W x H x D)	Weight (kg)	Item no.
FLEX-CLAMP	Holding fixture for Rogowski coil on busbar (15.03.600, 15.03.601, 15.03.602, 15.03.603)	Approx. 37 x 45 x 37	Approx. 0.5	**15.03.606**

Residual current transformer

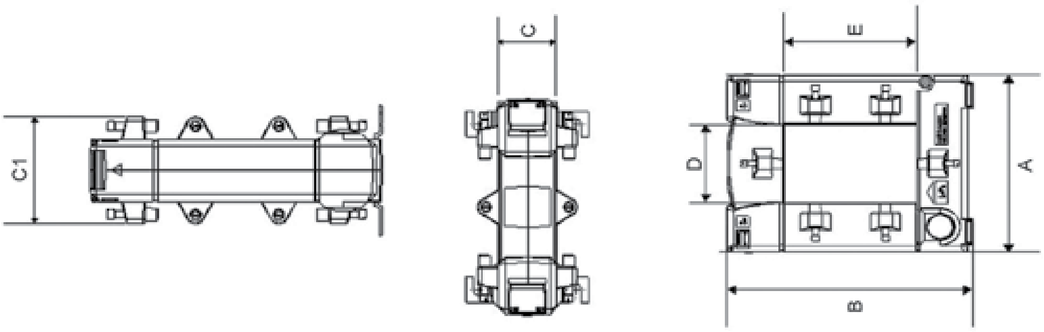
Split-core residual current transformer

Handy and compact

- Simple and economical installation, especially for retrofit
- Practical locking system: Separating of primary cable not required
- Available in various different sizes
- No interruption of operations
- Suitable for UMG 96RM-E, UMG 96RM-PN, UMG 20CM, UMG 509-PRO and UMG 512-PRO

Dimension diagrams

All dimensions in mm



Technical data

Technical data	
General	
Construction style	Conductor low voltage residual current transformer
Housing material	Polycarbonate, grey RAL 7035
Max. voltage for electrical equipment	Um < = 0.72 kV
Insulation test voltage	3 kV Ueff.; 50 Hz; 1 min
Rated frequency	50 Hz
Secondary connection	Brass profile, nickel plated, max. 4.0 mm^2
Nominal ratio Ipn / Isn	10 / 0.0167 A
Working frequency range	30 … 1000 Hz
Secondary rated apparent power	0.05 VA
Ambient temperature range	-5 … +45 °C
Max. temperature of the primary conductor	90 °C

Differential current transformer type A									
Type	Transformation ratio	Max. primary residual current in mA*	Dimensions in mm					Weight (kg)	Item no.
			A	B	C / C1	D	E		
KBU 23D	600/1	18000	93	106	34/58	20	30	0.7	**15.03.400**
KBU 58D	600/1	18000	125	158	34/58	55	85	1.1	**15.03.401**
KBU 812D	600/1	18000	155	198	34/58	85	125	1.5	**15.03.402**

* When using the analogue inputs of the UMG 96RM-E, UMG 96RM-PN, UMG 509-PRO and UMG 512-PRO.

Split-core residual current transformer

Main features

- Makes it possible, in conjunction with the UMG devices, to determine the residual current to earth of machines or systems
- Compact construction
- Detection of very small currents
- Designed to increase the sensitivity of residual current breakers (personal protection) and general circuit breakers
- Suitable for the UMG 96 RM-E, UMG 96RM-PN, UMG 509-PRO, UMG 512-PRO, UMG 20CM

Technical data

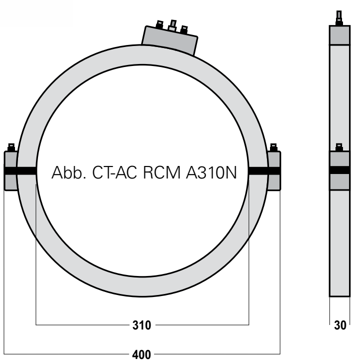
General data	
Insulation voltage	0,72 kV
Frequency	3 kHz
Operating temperature	-10 to +55 °C
Test voltage	3 kV RMS 50 Hz / 1 min.

Device overview – Plug-in residual current transformer type A			
Type	Transformation ratio	Max. primary residual current in mA*	Item no.
CT-AC RCM A110N	700/1	21000	**15.03.462**
CT-AC RCM A150N	700/1	21000	**15.03.465**
CT-AC RCM A310N	700/1	21000	**15.03.461**

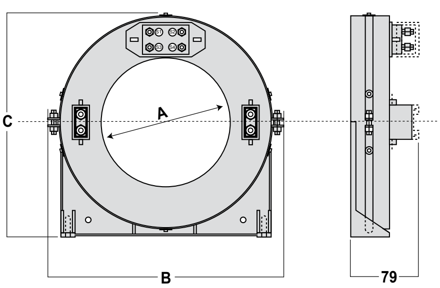
* When using the analogue inputs of the UMG 96RM-E, UMG 96RM-PN, UMG 509-PRO and UMG 512-PRO.

Dimension diagrams

All dimensions in mm



CT-AC RCM A110N/150N



Dimensions - Plug-in residual current transformer type A				
Type	Dimensions in mm			Weight (kg)
	A	B	C	
CT-AC RCM A110N	110	235	219	2,35
CT-AC RCM A150N	150	275	259	2,50
CT-AC RCM A310N	310	400	416	3,80

Feadthrough residual current transformer

Main features

- Makes it possible, in conjunction with the UMG devices, to determine the residual current to earth of machines or systems
- Compact construction
- Detection of very small currents
- Designed to increase the sensitivity of residual current breakers (personal protection) and general circuit breakers
- Suitable for the UMG 96 RM-E, UMG 96RM-PN, UMG 20CM, UMG 509-PRO, UMG 512-PRO

Technical data

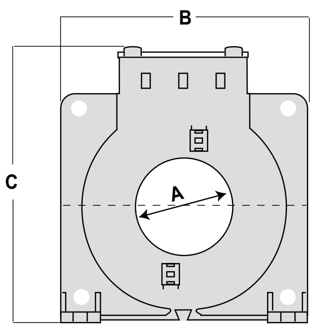
General data	
Insulation voltage	0,72 kV
Frequency	3 kHz
Operating temperature	-10 to +55 °C
Test voltage	3 kV RMS 50 Hz / 1 min.

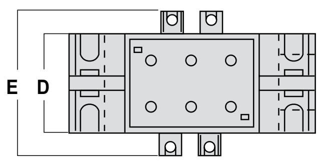
Device overview - Plug-in residual current transformer type A			
Type	Transformation ratio	Max. primary residual current in mA*	Item no.
CT-AC RCM 35N	700/1	21000	**15.03.458**
CT-AC RCM 80N	700/1	21000	**15.03.459**
CT-AC RCM 110N	700/1	21000	**15.03.463**
CT-AC RCM 140N	700/1	21000	**15.03.460**
CT-AC RCM 210N	700/1	21000	**15.03.464**

* When using the analogue inputs of the UMG 96RM-E, UMG 96RM-PN, UMG 509-PRO and UMG 512-PRO.

Dimension diagrams

All dimensions in mm





Dimensions - Plug-in residual current transformer type A						
Type	Dimensions in mm					Weight (kg)
	A	B	C	D	E	
CT-AC RCM 35N	35	92	113	36	56	0,25
CT-AC RCM 80N	80	125	160	36	56	0,35
CT-AC RCM 110N	110	165	198	36	56	0,50
CT-AC RCM 140N	140	200	234	36	56	0,70
CT-AC RCM 210N	210	290	323	44	64	1,20

Differential current transformer Type B+

Main features

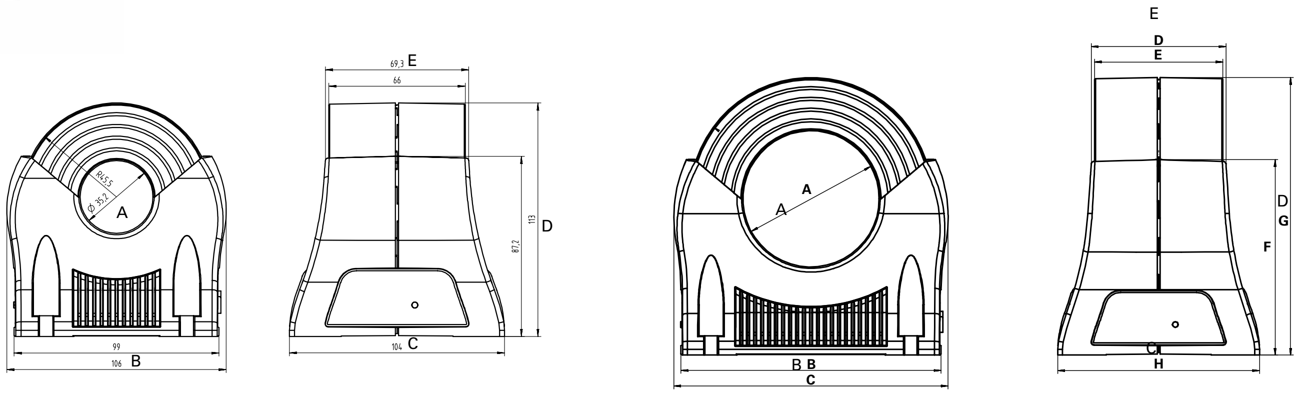
- Recording of type B+ residual currents (up to 300 mA)
- Prealarm in case of malfunction
- Standard interface 4–20 mA
- Continuous monitoring of residual currents
- Power supply voltage 24 V DC
- Compact, solid plastic housing
- Alternative to insulation measurement for testing of stationary electrical installations and equipments.
- Provisions for fire and facility protection can easily be implemented
- Decentralised, direct disconnection of equipment parts

Technical data

Overview of product variants									
Description	Operating voltage DC	Max. primary residual current in mA	Own consumption	Dimensions in mm					Item number
				A	B	C	D	E	
CT-AC/DC Typ B+ 35 RCM	24 V (21.6 ... 26.4 V)	0,3 A	max. 1.5 W	35	106	104	113	69	**15.03.469**
CT-AC/DC Typ B+ 70 RCM	24 V (21.6 ... 26.4 V)	0,3 A	max. 1.5 W	70	141	104	143	69	**15.03.468**
Accessories									
1-phase switching power supply in the installation housing prim. 115 – 230 V 50/60 Hz, sec. 24 V DC; 1 A Dimensions in mm (H x W x D): 90.5 x 52 x 62.5; weight: ca. 169 g									**16.05.002**

Dimension diagrams

All dimensions in mm



Current transformer, class 1, CT20

Precise and efficient

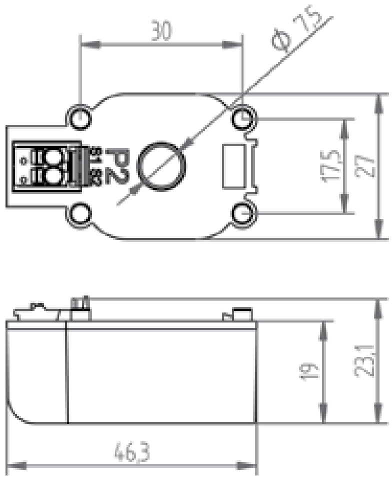
- Can be used with operational currents up to max. 63 A and for residual currents from 1 mA to 1,000 mA acc. type A
- Compact construction
- Ratio 700/1
- Primary window can be used for insulated cable Ø 7.5 mm (max.)
- For use on a 3-phase circuit breaker with a phase spacing of 17.5 mm
- DIN rail mounting (35 mm) via rail clamps (optional)
- Special version for the monitoring device UMG 20CM

Technical data

Current transformer CT-20	
Environmental conditions	
Position of installation	Indoor usage; only for insulated conductors
Ambient temperature	-10 ... +55 °C
Relative humidity	5 ... 85 % (no condensation)
Protection class	IP20
Application conditions	
Measuring accuracy	1 %
Thermal short time rated current	60 x In / 1 s
Thermal continuous current	100 %
Rated isolation level	0.72 / 3 / kV
Rated frequency	50 / 60 Hz
Insulation class	E (120 °C)
Cable feed through window	Ø 7.5 mm
Secondary conductor	Wire cross section: 0.2 ... 1.5 mm² Rigid, flexible, spring type terminal

Dimension diagrams

All dimensions in mm



Current transformer CT-20 – operating or differential current transformer type A								
Operating or residual current CT type A	Max. operating current in A	Residual current in mA	Transformation ratio	Max. diameter, primary conductor in mm	Class	Dimensions in mm (H x W x D)	Weight (kg)	Item no.
CT-20	63 (with burden)	10 ... 1000	700/1	7.5	1	46 x 27 x 23	0.05	**15.03.082**
Accessories								
Mounting clip	For DIN rail EN 50022-35, suitable for type CT-20					14 x 41 x 27	0.001	**09.09.010**
Ready-made connection cable	1.5 m with burden (0,8 Ω) and spring type terminal adapter for operating current measurement							**15.03.085**

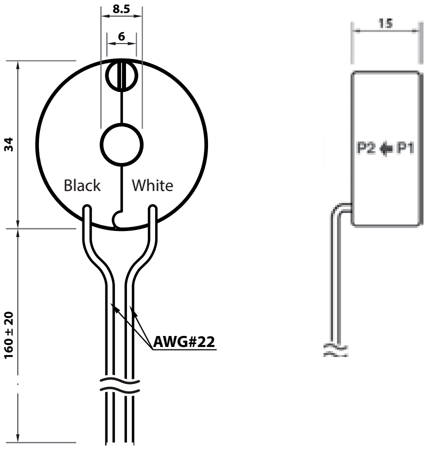
Split-core current transformer SC-CT-21

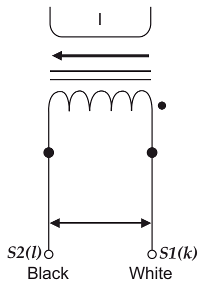
Micro-fine and high-precision

- Compact, divisible, split-core current transformer
- Suitable for residual current measurement (10 ... 1000 mA)
- High measurement accuracy
- Simple installation thanks to clip technology
- UL and EN 61010-1 certified
- Specially designed for use with the UMG 20CM

Dimension diagrams

All dimensions in mm





Technical data

Technical data	
Measuring accuracy	1 %
Current measurement range	0.01 ... 1 A
Max. continuous current	35 A
DC resistance	33 Ohm ±10 %
Insulation category	CAT III
Environmental conditions	
Position of installation	Indoor usage
Ambient temperature	-20 ... +50 °C
Storage temperature	-30 ... +90 °C
Relative humidity	< 85 % (no condensation)
Protection class	IP20

Split-core current transformer SC-CT-21								
Type	Residual current (mA)	Transformation ratio	Max. primary conductor diameter in mm	Class	Accuracy (%)	Dimensions in mm (H x W x D)	Weight (kg)	Item no.
SC-CT-21	10 ... 1,000	700/1	8	1	1	35 x 35 x 16	0.05	**15.03.084**

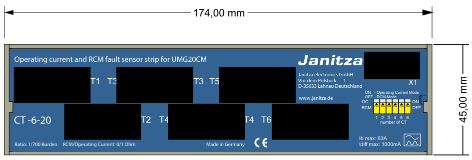
6-fold DIN rail current transformer CT-6-20

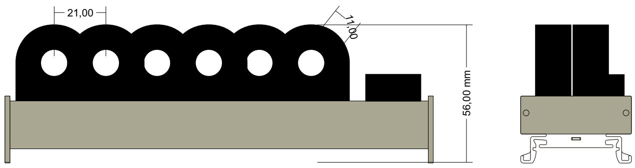
Monitor, detect and treat

- For operational current – as well as RCM-monitoring suitable
- Residual current acquisition with integrated current transformers (residual currents per IEC 60755 type A)
- 6 measurement channels
- Compact construction
- Parallel acquisition and processing of measured values
- Use in distribution outputs for consumers and systems
- Special version for the monitoring device UMG 20CM

Dimension diagrams

All dimensions in mm





Technical data

General data	
Number of measuring channels	6 (current transformers integrated)
Monitoring	Parallel, real effective value measurement ("True RMS")
Evaluation	Residual – or operating – currents (configurable as required in the individual application)
Rated isolation level	4 kV
Transformer rated voltage	max. 720 V AC
Transformer rated frequency	50 ... 60 Hz
Therm. rated short-term current	60 x In / 1 sec.
Therm. Continuous current	100%
Ambient temperature	-10 ... +55 °C
Class	1
Protection class	E
Protection class	IP20

6-fold DIN rail current transformer CT-6-20 (operating and residual current transformer type A)

Type	Operating mode*1	Operating current with load in A	Residual current in mA	Number of measuring channels*2	Trans-formation ratio	Measurement accuracy	Max. primary conductor diameter in mm	Dimensions in mm (H x W x D)	Weight (kg)	Item no.
CT-6-20	Residual or operating currents	0 ... 63	10 ... 1,000	6	700/1	1	11	45 x 174 x 56	0.30	**14.01.630**

Accessories	
Ready-made connection cable 1.5 m twisted, shielded with connector	**08.02.440**

*1 Pre-configurable as needed via DIP switch *2 Measurement transformer integrated.

Accessories

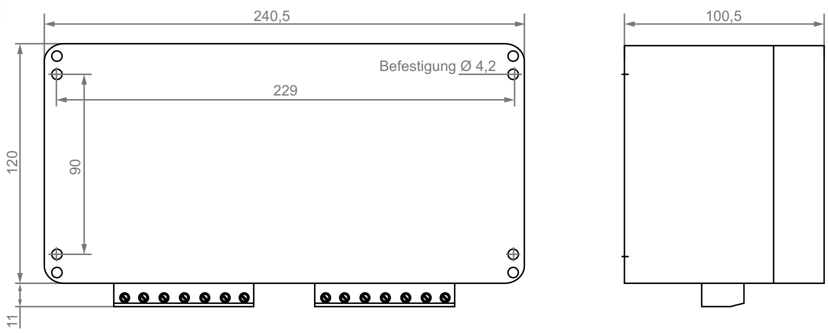
Voltage transformer

Powerful and precise

- Input, 3-pole
- Output is 3-pole + N
- Use in IT networks without neutral line
- For reducing the measurement voltage for the UMG measurement input
- Use in IT networks in conjunction with the measurement devices from the series UMG 96...

Dimension diagram

All dimensions in mm



Technical data

Voltage transformer	
3-phase voltage transformer	
Protection class	IP20
Transformer class	1
Core section	M65 / 27.8
Specification	EN 61558 + EN 60044-2
Nominal input voltage	see below (0.028 A)
Output voltage	400 V AC, 0.013 A
Frequency	50 / 60 Hz
Protection	primary M 0.032 A, 5 x 3 mm
Nominal power	5 VA

Voltage transformer

Type	Primary voltage (V AC)	Secondary voltage (V AC)	Primary fuse (A)	Rated power (VA)	Dimensions in mm (H x W x D)	Weight (kg)	Item no.
Voltage transformers BV	525	400	0.032	5	120 x 240.4 x 100.5	5.0	**15.04.035**
Voltage transformers BV	705	400	0.032	5	120 x 240.4 x 100.5	5.0	**15.04.036**
Voltage transformers BV	765	400	0.032	5	120 x 240.4 x 100.5	6.0	**15.04.037**

Voltage tap

ZK4S, ZK4B and ZK4R – Compact and secure

- Terminals to tap off the voltage on current-conducting bus bars
- Suitable for tapping off voltage for energy measurement devices
- Fusing directly on the rail
- Primary connection with M8 Allen screw
- Short-circuit resistance 70 kA to 400 V / 50 Hz
- High operational reliability

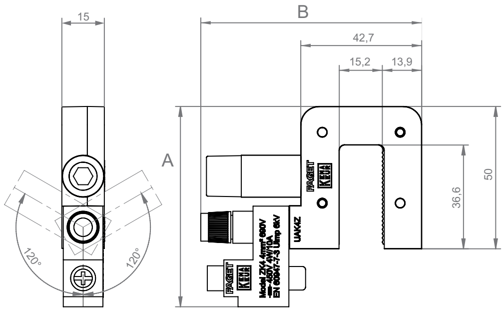
Fig.: ZK4S and ZK4B

Fig.: Insulated tool ZK4R

Dimension diagrams

All dimensions in mm

ZK4S-ZK4B



Technical data

Voltage tap	
Max. operating voltage	690 V
Test voltage / pulse	3 kV / 50 Hz 6 kV
In max.	10 A
Insulation class	E (max. 120°)
Fuse type	5 x 25 mm (with notification), 10 A SIBA DIN 41576-2
Ambient temperature	-5 ... +40 °C*[1]
Temperature increase, bus bar	Max. 75 K*[1]
Primary connection	M8 Allen screw
Allen size	Number 6
Max. bus bar thickness	4 – 15 mm
Housing	Polyamide (PA6.6)
Terminal material	Nickel plated brass

*[1] Max. temperature of the primary rail 120 °C (total of ambient temperature and temperature increase of the rail)

Device overview – Voltage tap								
Type	Color	Description	Fuse (A)	Cross-section connection line (mm^2)	Dimensions in mm (H x W x D)		Weight (kg)	Item no.
					A	B		
ZK4S	Black	With fuse	6.3	1.5 – 4	71	78	0.2	**10.11.525**
ZK4B	Blue	Without fuse	-	0 – 16	58.2	76	0.1	**10.11.526**
Accessories								
1 x voltage tap set	3 x ZK4S (item no. 10.11.525); 1 x ZK4B (item no. 10.11.526)						0.7	**10.11.527**
ZK4R	Insulated tool for fixing the tap; 1,000 V, EN / IEC 60900						0.9	**10.11.528**

Voltage tap

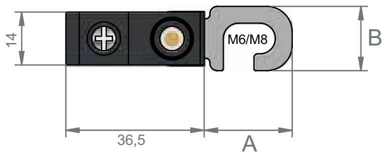
ZK4/M6 and ZK4/M8 – fused measurement voltage connection

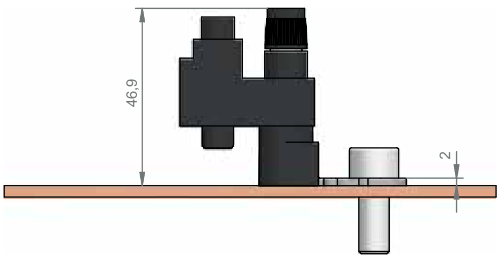
- Fused voltage tap for measurement purposes
- Simple installation underneath existing fastening points, directly on the current bus bar
- Compact housing
- Delivered with a 5 x 25 mm, 2 A, 450 V, F, 70 kA fuse

Dimension diagrams

All dimensions in mm

ZK4M6-M8





Technical data

Environmental conditions	
Installation location	Indoor usage (suitable for copper rails)
Ambient temperature range	-10 ... +55 °C
Relative humidity	5 to 85 % (no thawing)
Protection class	IP20 (basic insulation)
Application conditions	
Standard	IEC 60947-7-3
Maximum operating voltage	400 V ~
Test voltage	3 kV / 50 Hz
Surge voltage	6 kV 1.2 / 50 µs
Imax	2 A
Voltage drop	< 500 m V ~
Fuse	2 A, 450 V, F, 70 kA, 5 x 25 mm, ceramic (SIBA Part.no. 7008913.2)
Torque	Max. 2.0 Nm

Device overview – Voltage tap								
Type	Color	Primary connection (mm)	Fuse (A)	Cross-section connection line (mm²)	Dimensions in mm (H x W x D)		Weight (kg)	Item no.
					A	B		
ZK4/M6	Black	6	2	1.5 – 4	18.8	13.5	0.03	**10.11.534**
ZK4/M8	Black	8	2	1.5 – 4	23.2	17	0.03	**10.11.535**

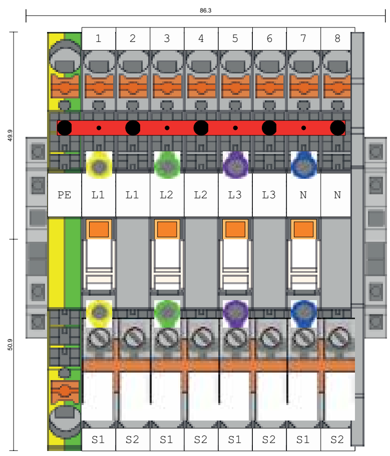
Current transformer terminal block

Modular and reliable

- Application: Short circuiting of current transformers, parallel measurement for cross checking ("quasi calibrating") measurement devices
- For installation on DIN rails
- Completely equipped for 4 conductors
- Insulated bridges for grounding and short circuiting of the CT terminal

Dimension diagrams

All dimensions in mm



Technical data

General data	
DIN mounting rail installation	35 mm DIN rail
Connection max.	4 CTs
4 pairs, 2-conductor, disconnecting and measurement terminals with contact protected test sockets	
Test connector (ø)	4 mm (with switching bridge)
Rated voltage EN	500 V
Measurement surge voltage	6 kV
Rated current	30 A
Degree of pollution	3
Connection design	CAGE CLAMP® S
Type of conductor	Single or fine-stranded
Fine stranded diameter	0.5 – 6 mm²
"f"+ "e" diameter	0.5 ... 10 mm²
"f" diameter with AEH	0.5 ... 6 mm²
Stripping length	13 – 15 mm

Each terminal is labelled. The terminal position S2 on each transformer is connected to ground potential via a fixed, pre-installed bridge. Each pair of disconnecting and measurement terminals is equipped with a yellow switch lock for the disconnect lever. 2 disconnect levers are coupled together via an interlocking cap.

Current transformer terminal block

Type	Rated current (A)	Rated voltage EN (V)	Rated voltage surge (kV)	Type of conductor	Cross-section (mm²)	Dimensions in mm (H x W x D)	Weight (kg)	Item no.
Current transformer terminal block	30	500	6	Single or fine-stranded	0.5 – 6	190 x 85 x 65	0.3	**15.07.001**

Humidity and temperature sensor JFTF-I

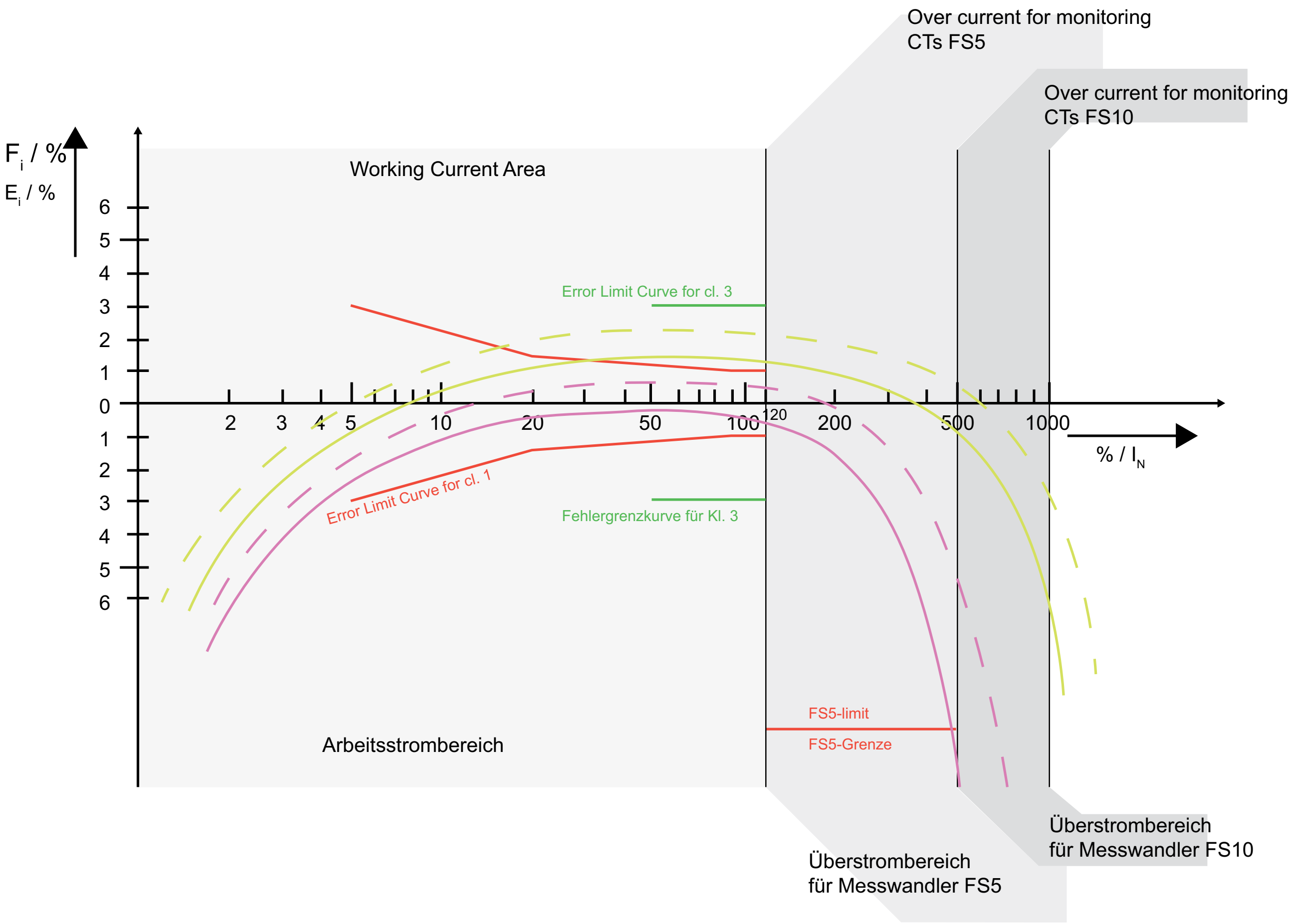
High-precision and reliable measurement

- For the measurement of relative humidity and temperature of the ambient air
- Intended for the measurement of unpolluted, non-condensing air without any positive or negative pressure
- High measurement accuracy
- A sintered filter protects the sensor from external contaminants
- The sensors themselves are fitted in a metal tube so that the warming up of the analogue unit has no detrimental influence on the measurement.
- FBM modul DI8-AI8 required (Item no. 15.06.079)

Overview of devices

Humidity and temperature sensor		
Designation	**Type**	**Item no.**
• With current output (2-wire system) 4 ... 20 mA • Operating voltage 15 ... 36 V DC, depending on total apparent load • Relative humidity output 4 ... 20 mA corresponding to 0... 100 %, Load resistance 200 ... 500 Ω • Temperature output 4 ... 20 mA corresponding to -20... +80 °C Load resistance 200 ... 500 Ω • Current consumption max. 40 mA	JFTF-I	**15.06.074**

Current transformer error curve



Example for a measuring c.t. of cl. 1 FS5 and 1/1 burden
Beispiel eines Strom-Messwandlers der Kl. 1 FS5 bei 1/1 Bürde

Example for a protection c.t. 10P10 and 1/1 burden
Beispiel eines Schutzwandlers 10P10 bei 1/1 Bürde

Example for a measuring c.t. of cl. 1 FS5 and 1/4 burden
Beispiel eines Strom-Messwandlers der Kl. 1 FS5 bei 1/4 Bürde

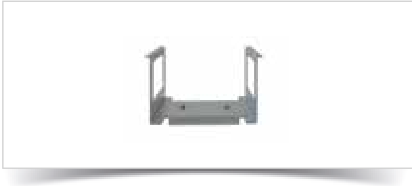
Example for a protection c.t. 10P10 and 1/4 burden
Beispiel eines Schutzwandlers 10P10 bei 1/4 Bürde

07 Accessories

Accessories – Integration and installation aids

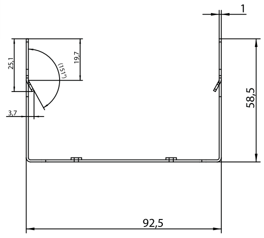
Adapters for DIN rail installation

Description	Type	Item no.
Adapter for DIN rail mounting Dimensions in mm (H x W x D): 60 x 85 x 90	AH96	
UMG 96L / UMG 96 / UMG 96S		**52.09.201**
UMG 96RM basic device / UMG 96RM-M		**52.22.666**

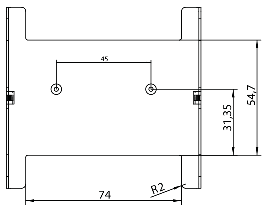


Dimension diagrams

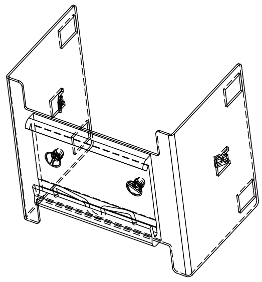
All dimensions in mm



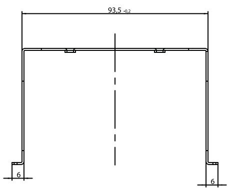
Front view
AH96 for the UMG 96L / UMG 96



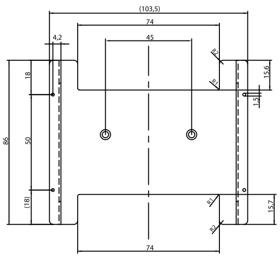
View from below



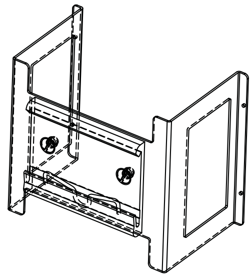
3D view



Front view
AH96 for the UMG 96RM

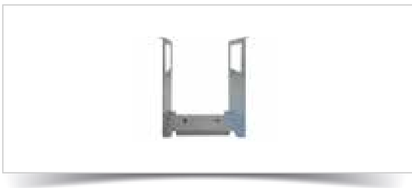


View from below



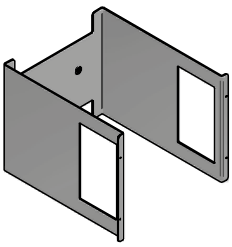
3D view

Description	Type	Item no.
96 mm adapter for DIN rail mounting UMG with Profibus Dimensions in mm (H x W x D): 113 x 85 x 90	AH96P	
UMG 96RM-E / UMG 96RM-EL / UMG 96RM-CBM / UMG 96RM-P / UMG 96RM-PN		**52.22.667**

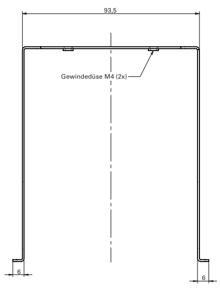


Dimension diagrams

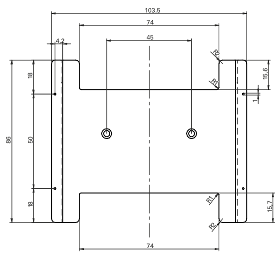
All dimensions in mm



3D view



Front view

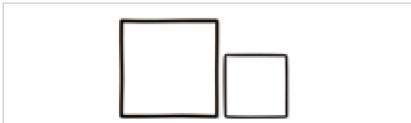


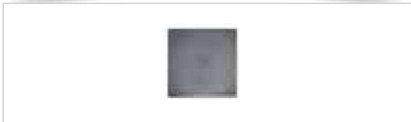
View from below

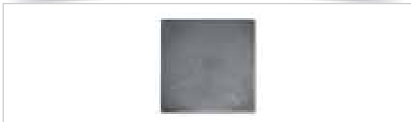
Description	Type	Item no.
144 mm adapter for DIN rail mounting Dimensions in mm (H x W x D): 95 x 160 x 74	AH144	
Prophi®		**52.07.666**
UMG 508 / UMG 511		**52.19.666**

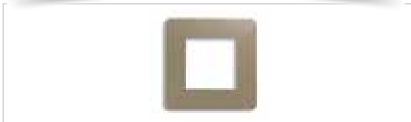
Further accessories

Overview		
Description	**Type**	**Item no.**
Sealing (to IP54) for UMG 96RM, UMG 96RM-P, UMG 96RM-CBM, UMG 96RM-M, UMG 96RM-E, UMG 96RM-EL, UMG 96RM-PN	D96	**29.01.065**
Sealing (to IP42) for UMG 96, UMG 96S and UMG 96L	D96	**29.01.907**
Sealing (to IP42) for UMG 508, UMG 509-PRO, UMG 511, UMG 512-PRO and Prophi®	D144	**29.01.903**
Blank cover in black plastic, 96 x 96 mm	BA96	**29.12.001**
Blank cover in black plastic, 144 x 144 mm	BA144	**29.12.002**
Adapter plate 144 mm to 96 mm, color RAL 7032	AB144/1	**29.12.912**
Adapter plate 144 mm to 96 mm, color RAL 7035	AB144/2	**29.12.913**
Ethernet front panel feed-through with extension frame and RJ45 socket type VS-08-BU-RJ45/BU	EFD	**13.08.016**
Protective cover, flat design for covering the contact insert RJ45	EFDD	**13.08.017**









08 Power factor correction (PFC) and harmonics filter

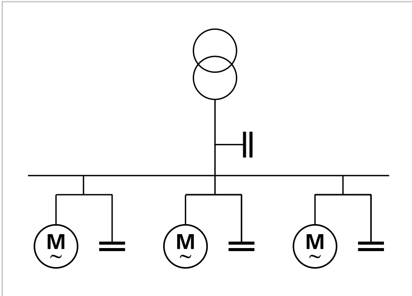
EN 50160 / ISO 50001
Made in Germany

Power factor correction (PFC) and harmonics filter

Types of power factor correction (PFC)

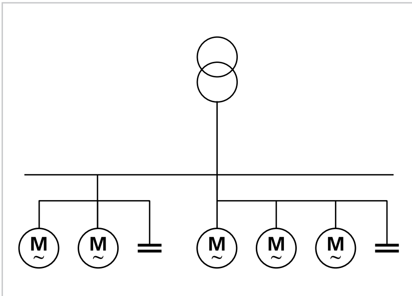
Individual PFC

- A suitably sized capacitor will be connected in parallel to each inductive load
- Relieving of the load on the supply line as well as the switching equipment
- No separate switching equipment required for the capacitor and no controller required
- Economic with longer duty cycles and greater power draw



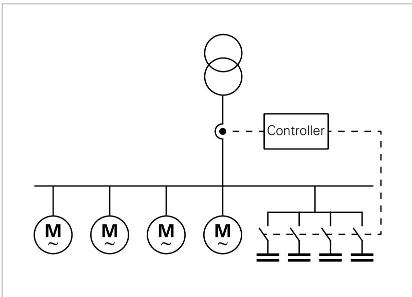
Group PFC

- Will be implemented with load groups with the same operational behaviour
- For multiple inductive loads, that are always operated together
- The supply lines and group switches will be relieved of reactive current and the simultaneity factor results in a smaller capacitor size



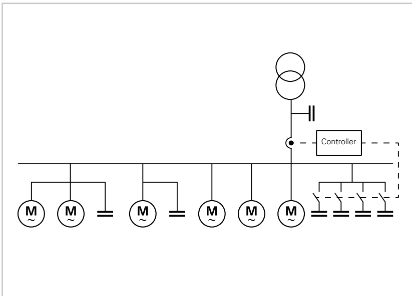
Automatic central PFC (APFC)

- The central PFC will be integrated into the main LV distribution
- Near constant, good power factor that adapts automatically through a power factor controller via contactors or thyristor switches
- The output of the capacitors installed will be better utilised
- Better adaptation of the capacitor power to the reactive power demand
- Networks with harmonics can be more easily detuned through APFC



Mixed PFC

- Combination of individual, group and central PFC



Hybrid switching 

Harmonics display 

 **Dynamic PFC**

 **Smart control**

Prophi® power factor controller

Interfaces / communication (optional)
- RS485
- Profibus

Communication / protocols (optional)
- Modbus RTU (up to 115.2 kBit/s)
- Profibus DP V0 (1.5 MBit/s)

Triple Safety
- Temperature monitoring
- Monitoring the capacitor switching cycles
- Monitoring of over-current

Power quality
- Harmonics up to the 19th
- THD-U in %
- THD-I in %

Smart control
- Minimised number of switching cycles
- Balanced number of contactor switching cycles
- Optimised service life

Network visualisation software
- Free GridVis®-Basic

Alarm messages
- Under-voltage detection
- Over-voltage detection
- Under-compensation
- Measurement current exceedance
- Harmonics threshold values
- Delivery of active power
- Overtemperature
- Dropping below the minimum measurement current

Switching outputs (depending on variants)
- 6 conventional relay outputs
- 12 conventional relay outputs
- 6 transistor outputs for dynamic PFC
- 12 transistor outputs for dynamic PFC
- 6 transistor and 6 relay outputs for hybrid PFC

Areas of application

- Automatically controlled power factor correction
- Detuned power factor correction
- Harmonics filter
- Voltage stabilisation by means of dynamic PFC
- Mixed operation (hybrid switching) contactors and thyristor switching

Main features

- Automatic or manual configuration
- Display of U, I, f, Q, P, S, cosphi, all odd current and voltage harmonics, 1 – 19th harmonics
- Display of the indirectly measured capacitor currents
- Display of the switching cycles per capacitor stage
- Display of the total switch-on duration per capacitor stage
- Zero voltage triggering within 15 ms
- Degree of reactors in % for each stage, programmable from 0 to 20 %
- Setting of the discharge time for all stages from 0 to 1200 sec.
- Capacitor outputs individually programmable
- Temperature sensor for fan control
- Overtemperature shut-down programmable
- Control of external semi-conductor switching (max. 50 switching operations per second)
- Current transformer input for 1 A; 5 A
- Password protection
- External, changable target cosphi 1 and 2 (except 6R / 6T)

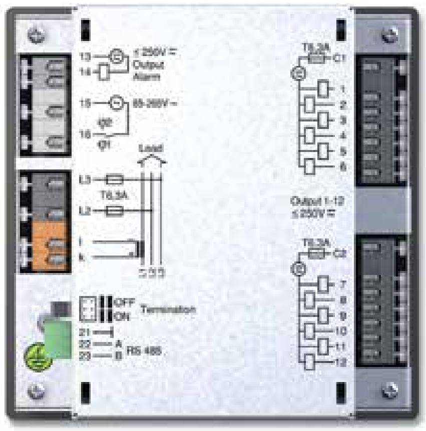


Fig.: Device rear side Prophi® 12RS

Alarm output programmable for ...

- Under-voltage detection
- Over-voltage detection
- Under-compensation
- Measurement current exceedance
- Dropping below the minimum measurement current
- Harmonics threshold values
- Delivery of active power
- Overtemperature

Functional principle

- Single-phase, electronic measurement system
- Acquisition of the active and reactive current portion of the network via the current and voltage circuit
- Reactive power will be calculated with the current from a phase conductor and the voltage between two phase conductors

- Switching ON or OFF of capacitor stages in the event of deviations in the set power factor
- Switching of capacitors via contactors or semiconductors
- Control via capacitor contactors is implemented in an optimised manner
- Transistor outputs for the near-realtime control of semiconductor switches

Fan control

- Fan control via integrated temperature sensors
- Either via relay outputs or the alarm relay
- Programming of a lower or upper limit temperature necessary

Automatic configuration

- With the "LEARN" function it is possible to learn and save the connection configuration of the power factor controller

LCD display

- High quality LCD display with excellent contrast
- Display of comprehensive measurement parameters (app. 100 measured values)

Overtemperature shut-down

- The overtemperature shut-down switches off connected capacitor stages
- This results in the reduction of the interior temperature of the PFC cabinet and protects the capacitors
- Programming of a lower or upper limit temperature as well as the pause time

Interface

- Depending on version, equipped with an RS485 interface
- The Modbus RTU or Profibus DP V0 protocols are available via RS485
- Integration of PLC systems, building management systems or energy management systems
- Modbus transfer rates: 9.6; 19.2; 38.4; 57.6; 115.2 kBit/s
- Profibus transfer rates: Up to max. 1.5 Mbit/s

Fig.: Display examples: Voltage

Fig.: Reactive power

Fig.: Harmonics

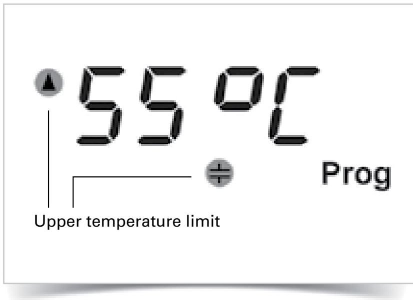


Fig.: Overtemperature shut-down

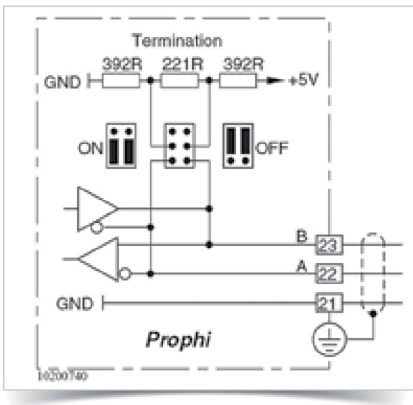
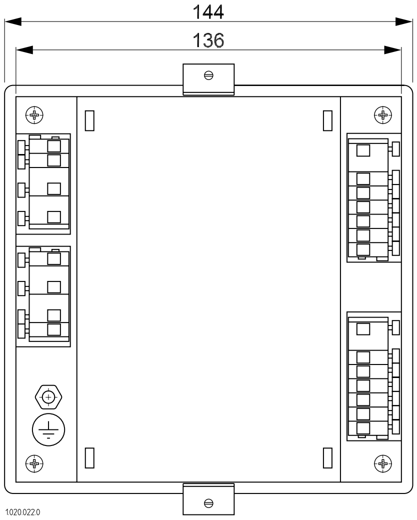


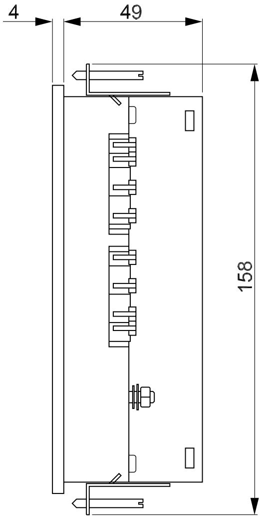
Fig.: Connection assignment - RS485 interface

Dimension diagrams

All dimensions in mm



Rear side view



Side view

Cut out: 138+0,8 x 138+0,8 mm

Typical connection

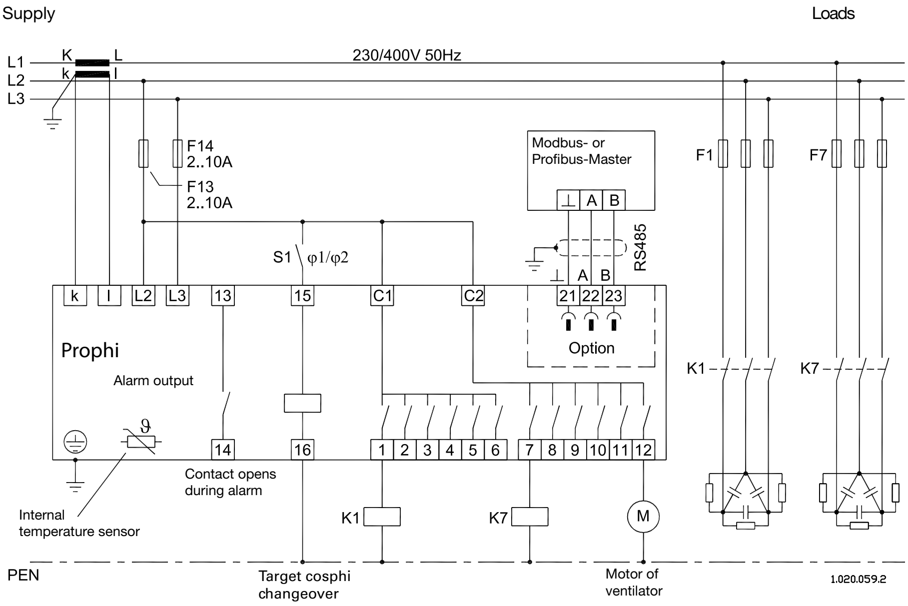


Fig.: Connection example power factor controller Prophi® 12RS (item no. 52.08.008) with voltage measurement L2–L3, 12 relay outputs, target cos(phi) changeover, alarm output and RS485 interface

Device overview and technical data

	Prophi® 6R	Prophi® 12R	Prophi® 6T	Prophi® 12 T
Item number	52.08.002	52.08.003	52.08.005	52.08.006
Measurement and auxiliary voltage 400 V AC (+10 %, -15 %)[*1]	•	•	•	•
Changeover target cosphi 1/2	-	•	-	•
Outputs				
Relay outputs (conventional)	6	12	-	-
Transistor outputs (dynamic)	-	-	6	12
Interface Modbus or Profibus				
RS485 [*2, *4]	-	-	-	-
	Prophi® 6T6R	**Prophi® 12RS**	**Prophi® 6T6RS**	**Prophi® 12TS**
Item number	52.08.007	52.08.008	52.08.009	52.08.091
Measurement and auxiliary voltage 400 V AC (+10 %, -15 %) [*1]	•	•	•	•
Changeover target cosphi 1/2	•	•	•	•
Outputs				
Relay outputs (conventional)	6	12	6	-
Transistor outputs (dynamic)	6	-	6	12
Interface Modbus or Profibus				
RS485 [*2, *4]	-	•	•	•
Software				
Free GridVis®-Basic	-	• [*3]	• [*3]	• [*3]

[*1] Optional measurement and auxiliary voltage 100 V, 110 V, 200 V, 230 V, 440 V AC (+10 %,-15 %).
[*2] Not possible with 50 switching operations per second.
[*3] Optional additional functions with the packages GridVis®-Professional, GridVis®-Enterprise and GridVis®-Service.
[*4] Modbus or Profibus possible, please stipulate when ordering.

General	Prophi®
Use in low and medium voltage networks L-N or L-L	•
Accuracy voltage measurement (1-phase, L-N or L-L)	0.5 %
Accuracy current measurement (1-phase)	0.5 %
Accuracy cosphi measurement (sum L1-L3)	1 % [*5,*6]
Accuracy power measurement (sum L1-L3)	1 %
Accuracy frequency measurement	0,5 % [*6]
Accuracy harmonics measurement	2 %
RMS – momentary value	
Current, voltage, frequency	•
Effective, reactive and apparent power	•
Power factor	•
Recording of the mean values	
Power factor	•
Power quality measurement	
Harmonics per order / current and voltage, 1-phase	1st – 19th, odd
Distortion factor THD-U in %, 1-phase	•
Distortion factor THD-I in %, 1-phase	•
Measured data recording	
Mean, minimum, maximum values	•
Displays and inputs / outputs	
Digital display, 3 buttons	•
Relay outputs (as switch output)	6 or 12 See overview of devices
Transistor outputs (as switch output)	6 or 12 See overview of devices
Alarm output (as switch output)	1
Digital input (for tariff changeover)	1 See overview of devices
Temperature sensor (internal)	1

[*5] Applies to input currents > 0.2 A and in the cosphi range 0.85 to 1.00.
[*6] In the range from -10 to +18 °C and 28 to 55 °C an additional error of ±0,2 ‰ of the measurement value per K must be taken into account.

Communication	
Interface	
RS485: 9.6; 19.2; 38.4; 57.6; 115.2 kbps	See overview of devices
Profibus DP V0: 9.6 kbps to 1.5 Mbps	See overview of devices
Protocols	
Modbus RTU	•
Profibus DP V0	•
Software GridVis®-Basic*3	
Online graphs	•
Historical graphs	•
Databases (Janitza DB, Derby DB); MySQL, MS SQL with higher GridVis® versions)	•
Manual reports	•
Topology views	•
Manual reading	•
Graph sets	•
Error messages	
Under-voltage	•
Over-voltage	•
Dropping below the minimum measurement current	•
Measurement current exceedance	•
Insufficient compensation power	•
Delivery of active power	•
Harmonics threshold values	•
Overtemperature	•

Technical data	
Supply voltage L-L, L-N AC	See overview of devices
Measurement in which quadrants	4
Networks	TN, TT, (IT)
Measurement in multi-phase networks	3 ph
Measured voltage input	
Overvoltage category	CAT III
Measured range, voltage L-N, AC (without potential transformer)	See overview of devices
Measured range, voltage L-L, AC (without potential transformer)	See overview of devices
Voltage tolerance range	- 15 ... +10 %
Back-up fuse	2 A ... 10 AT
Measurement surge voltage	4 kV
Test voltage relative to ground	2,200 V AC
Frequency measuring range	45 ... 65 Hz
Power consumption	max. 7 VA
Sampling rate	2 kHz (at 50 Hz)
Measured current input	
Signal frequency	45 Hz ... 1,200 Hz
Nominal current at .../5 A (.../1 A)	5 A (1 A)
Minimum measurement current	10 mA
Upper measurement current	5.3 A (sinusoidal)
Overloading	180 A for 2 sec.
Measurement rate	30 (50) measurements / sec.
Power consumption	approx. 0.2 VA
Updating the display	1 time per second
Zero voltage triggering	< 15 ms
Inputs and outputs	
Number of digital inputs (for tariff changeover)	1, see overview of devices
Relay outputs (as switch output)	6 or 12, see overview of devices
Back-up fuse	6.3 AT
Switching voltage	max. 250 V AC
Switching power	max. 1,000 W

*3 Optional additional functions with the packages GridVis®-Professional, GridVis®-Enterprise and GridVis®-Service.

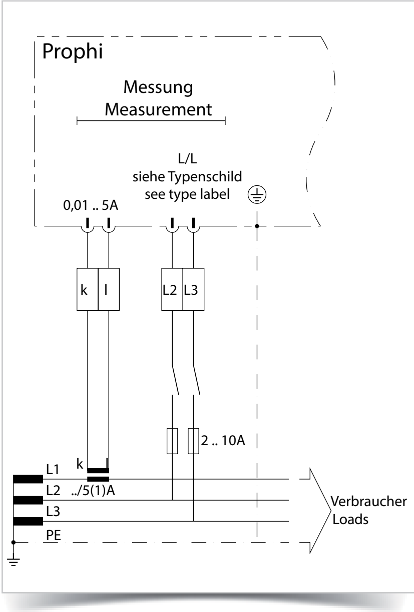


Fig.: Connection of measurement and auxiliary voltage between L2-L3 and the current measurement via current transformer

Max. switching frequency	50 Hz
Mechanical service life	> 30 x 10^6 switching cycles
Electrical service life	> 2.8 x 10^5 switching cycles
Transistor outputs (as switch output)	**6 or 12, see overview of devices**
Switching voltage	5 ... 30 V DC
Switching current	max. 50 mA
Max. switching frequency	50 Hz
Alarm output (as switch output)	1
Temperature sensor (internal)	1
Target cosphi changeover (current consumption)	approx. 2.5 ... 10 mA
Mechanical properties	
Weight	1000 g
Device dimensions in mm (H x W x D)	144 x 144 x 49
Protection class per IEC 60529	Front: IP65, Rear: IP20
Installation	Front panel installation
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	0.08 to 2.5 mm^2 1.5 mm^2
Features	
Display of capacitor currents	•
Display of switch-on times for the individual stages	•
Display of switching cycles per stage	•
Zero voltage triggering	•
Automatic configuration	•
Password protection	•
Environmental conditions	
Temperature range	Operation: -10 ... +55 °C *7 Storage: -20 ... +60 °C
Relative humidity	15 to 95 %
Operating altitude	0 ... 2,000 m above sea level
Degree of pollution	2
Mounting position	any
Electromagnetic compatibility	
Electromagnetic compatibility of equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2 – 008: Particular requirements for testing and measuring circuits	IEC/EN 61010-1-08
Protection class	I = Device with protective conductor
Noise immunity	
Industrial environment	DIN EN 61326-1, Table 2; (IEC 61326-1)
Emissions	
Class B: Residential environment	DIN EN 61326-1; (IEC 61326-1)
Class A: Industrial environment	DIN EN 61326-1; (IEC 61326-1)
Safety	
Europe	CE labelling

Comment: For detailed technical information please refer to the operation manual and the Modbus address list.

*7 Devices with the "RS485 interface" option are only suitable for an operating temperature range of -10 to +50 °C.

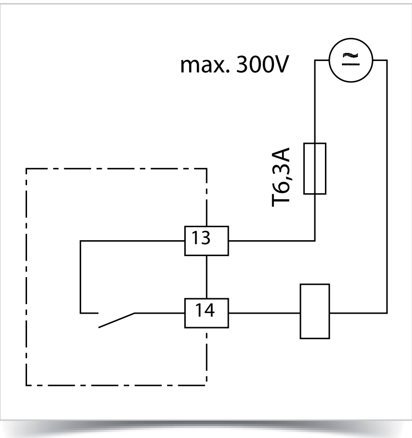


Fig.: Connection assignment, alarm output

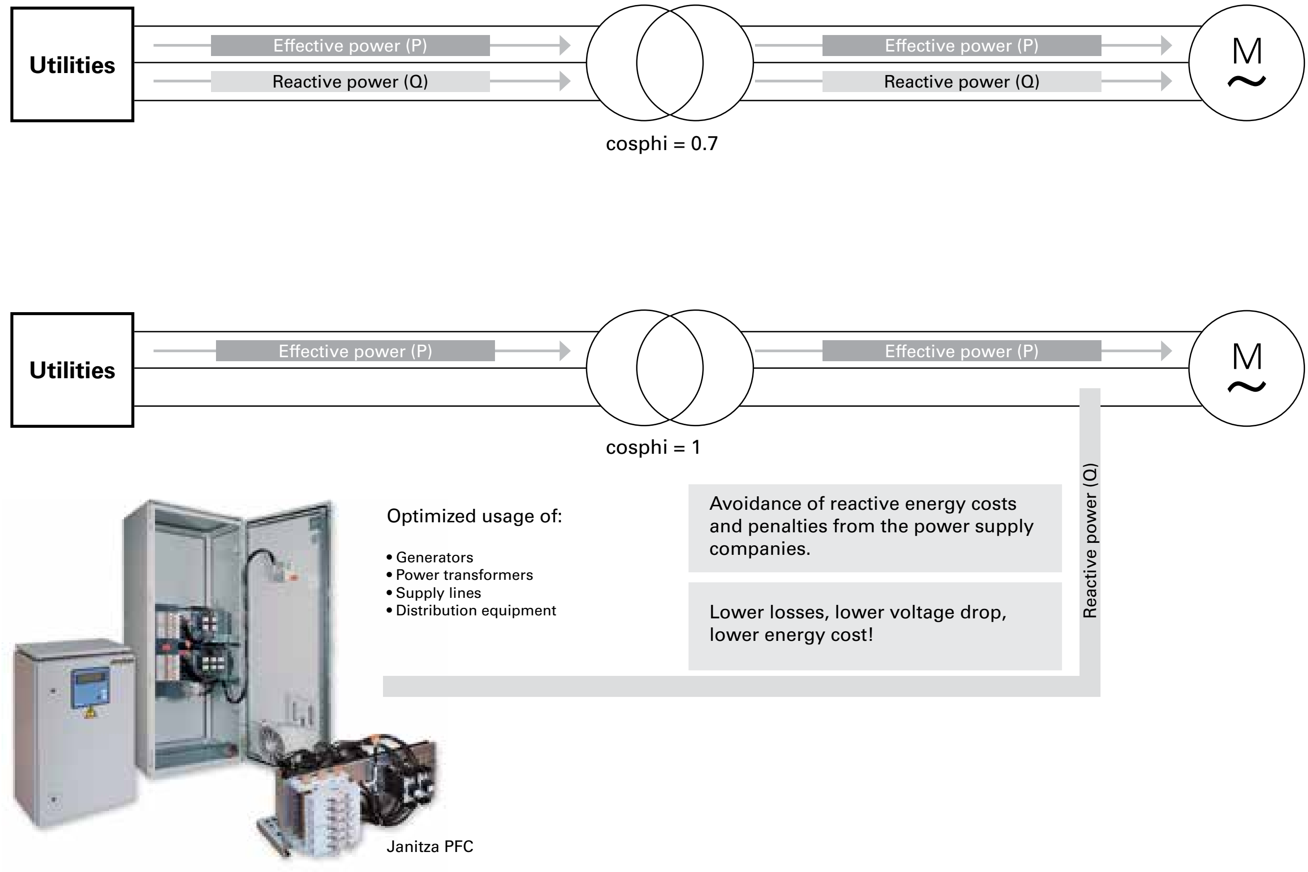


Fig.: Active and reactive power in the mains with PFC

Hybrid switching

Harmonics display

Dynamic PFC

Smart control

EN 50160 / ISO 50001
Made in Germany

Prophi® 7 power factor controller

Interfaces / communication
- RS485

Communication / protocols
- Modbus RTU
- Modbus KTR
- ASCII Out
- Extern
- Slave Hybrid
- Slave Mode
- Master Mode

Triple Safety
- Temperature monitoring
- Monitoring the capacitor protective switching cycles
- Monitoring of over-current
- Single-phase reactive current compensation monitoring

Measuring voltage
- 3-phase
  50–760 V (L-L), 30–440 V (L-N)

Power quality
- Harmonics up to the 33rd
- THD-U in %
- THD-I in %

Intelligent control
- Minimised number of switching cycles
- Compensated number of contactor switch cycles
- Optimised service life
- Mixed control (single and three-phase)
- Separate control of single-phase capacitors
- Sequential switching
- Cyclic switching

Switching outputs
- 15 relay outputs, freely programmable
- 12 transistor and 12 relay outputs for hybrid PFC

Alarm messages
- Undervoltage detection
- Overvoltage detection
- Under-compensation
- Measurement current exceedance
- Harmonics threshold values
- Delivery of active power
- Overtemperature
- Dropping below the measurement current
- C-defect
- Modbus error
- Switching cycle warning

Display mode
- Display three measured values simultaneously
- Graphical representation of harmonics in bar graph form
- Three-digit display of power factor (cos phi), switchable (tan phi)
- Display of controlled steps, fault messages and time
- Display of apparent current, active current and reactive current in display mode

Areas of application

- Automatically regulated power factor correction
- Choked power factor correction
- Harmonics filter
- Voltage stabilisation by means of dynamic PFC
- Mixed operation (hybrid switching) contactors and thyristor switching

Fig.: Auto-Mode

Main features

- 12 or 13 switching outputs
- Extended measured voltage range (up to 760 V ~ L-L)
- Control of inductive compensation systems possible
- 20 pre-programmed control series
- Control series editor
- Graphical display 128 x 64 pixels
- Plain language menu navigation
- Four-quadrant operation
- Automatic initialisation
- Display of various grid parameters
- Display of harmonics
- Display of distortion factor THD-V / THD-I
- Monitoring of the capacitor current
- Saving of the maximum values
- Saving of the switching cycles and times
- Manual / Automatic mode
- Zero voltage shutdown
- Various error messages / alarm relay
- Error memory
- Test run of the system with error analysis
- Control of inductive compensation systems possible
- Voltage, current, frequency, active power, reactive power, apparent power
- Harmonics of the voltage (up to the 33rd / up to the 16th (even))
- Harmonics of the current (up to the 33rd / up to the 16th (even))

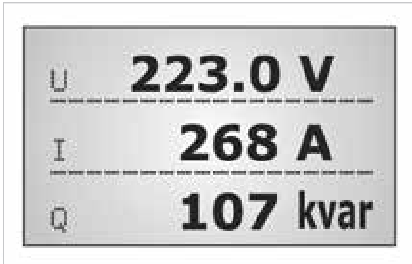


Fig.: Display-Mode

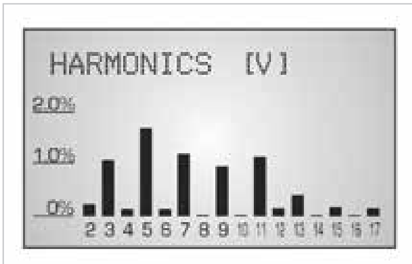


Fig.: Bargraph-Mode

Alarm output programmable for ...

- Undervoltage detection / Overvoltage detection
- Under-compensation / Over-compensation
- Under-current / Over-current
- Harmonics threshold values
- Delivery of active power
- Overtemperature
- Message for delivery of active power
- Measured voltage error
- Switching cycle warning
- Modbus error
- C-defect

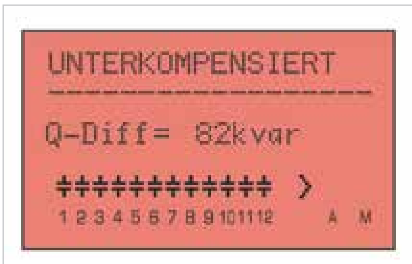


Fig.: Error message (customisable backlight)

Functional principle

- Single-phase/three-phase electronic measurement system
- Detection of the reactive and active current portion of the grid via the current and voltage circuit
- Switching in or out of the capacitor stages via the outputs in the event of deviations in the set power factor
- Switching of capacitors via contactors or semiconductors
- Regulation via capacitor air contactors is implemented in an optimised manner
- Transistor outputs for the near-realtime control of semiconductor switches

Fan control

- Development of fan control via integrated temperature sensors and a fan
- Uses the signal relay
- Programming of a lower or upper limit temperature necessary

LCD display
- Graphical display 128 x 64 pixels
- Display a comprehensive selection of measurement parameters

Overtemperature shut-down

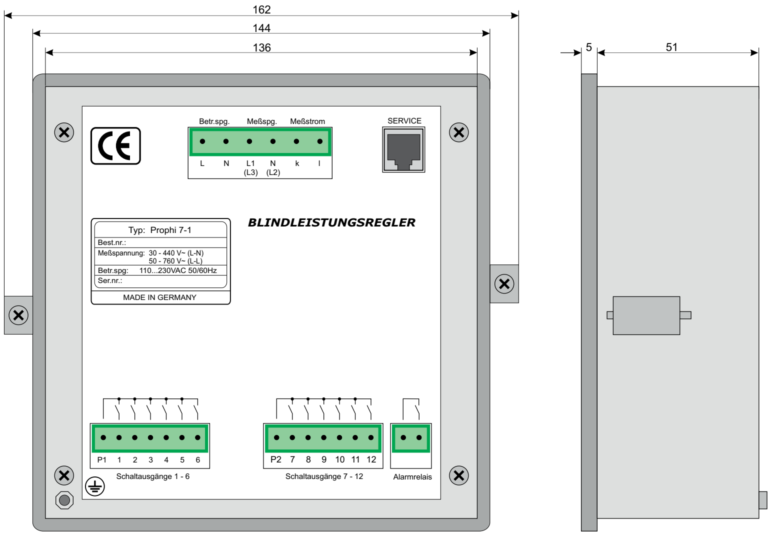
- The overtemperature shut-down switches off the capacitor stages connected
- This results in the reduction of the interior temperature of the switching cabinet and protects the capacitors
- Programming of a lower or upper limit temperature as well as the pause time

Interface

- Two independent potential-free RS485 interfaces
- The Modbus RTU, Modbus KTR, ASCII out, Slave Hybrid, Slave Mode, and Master Mode protocols are available via the RS485s
- Integration of PLC systems, building management systems or energy management systems
- Modbus transfer rates: 9.6 – 256 kBit/s

Dimension diagrams

All dimensions in mm



Rear side view

Side view

Cut out: 138$^{+0,8}$ x 138$^{+0,8}$ mm

Typical connection

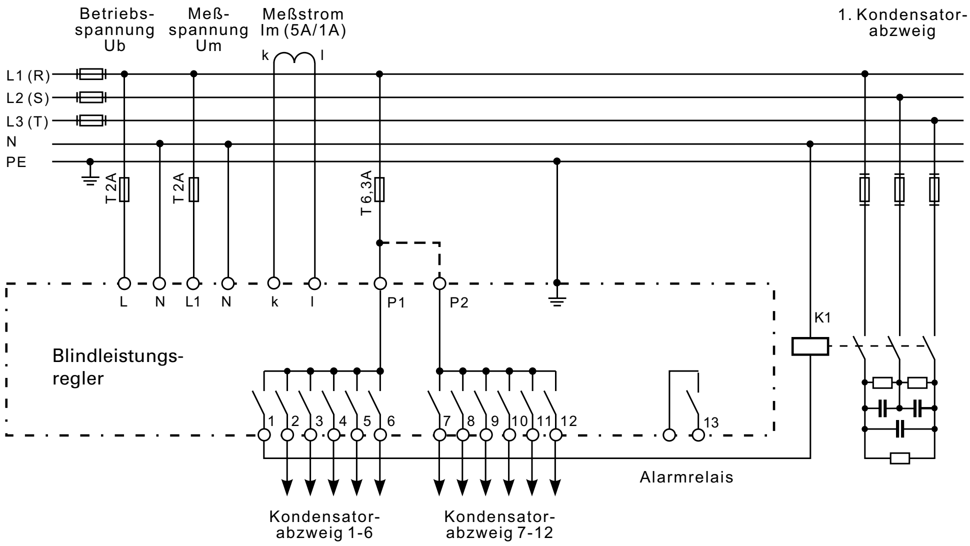


Fig.: Connection example for the Prophi® 7 power factor controller

Device overview and technical data

	Prophi® 7-I	Prophi® 7-III
Item number	**14.16.028**	**14.16.037**
Operating voltage 110 to 440 V ~ +/-15% 50/60 Hz	•	•
Measuring voltage 30 to 440 V ~ (L-N) 50/60 Hz 50 to 760 V ~ (L-L) 50/60 Hz	•	-
Measuring voltage 3 x 30 to 440 V ~ (L-N) 50/60 Hz 50 to 760 V ~ (L-L) 50/60 Hz	-	•
Changeover target cos phi 1/2	-	•
Outputs		
Relay outputs (conventional)	12	12
Transistor outputs (dynamic)*1	-	-
Interfaces (with Modbus)		
RS485 *1	-	•

*1 Prophi® 7 with RS485 and dynamic variant upon request

General	**Prophi® 7**
Use in low and medium voltage networks L-N or L-L	•
Accuracy voltage measurement (1-phase, L-N or L-L)	1 %
Accuracy current measurement (1-phase)	1 %
Accuracy cosphi measurement (sum L1-L3)	1 % *2,*3
Accuracy power measurement (sum L1-L3)	2 %
Accuracy frequency measurement	0,5 % *3
Accuracy harmonics measurement	2 %
RMS – momentary value	
Current, voltage, frequency	•
Effective, reactive and apparent power	•
Power factor	•
Recording of the mean values	
Power factor	•
Power quality measurement	
Harmonics per order / current and voltage, 1-phase	1. – 33., odd
Distortion factor THD-U in %, 1-phase	•
Distortion factor THD-I in %, 1-phase	•
Measured data recording	
Mean, minimum, maximum values	•
Displays and inputs / outputs	
Digital display, 6 buttons	•
Relay outputs (as switch output)	12 See overview of devices
Transistor outputs (as switch output)	12 See overview of devices
Alarm output (as switch output)	1
Digital input (for tariff changeover)	1 See overview of devices
Temperature sensor (internal)	1

*2 Applies to input currents > 0.2 A and in the cosphi range 0.85 to 1.00.
*3 In the range from -10 to +18 °C and 28 to 55 °C an additional error of ±0,2 ‰ of the measurement value per K must be taken into account.

Communication	
Interface	
RS485: 9,6; 19,2; 38,4; 57,6; 115,2; 250; 256 kbps	See overview of devices
Protocols	
Modbus RTU	•
Error messages	
Under-voltage	•
Over-voltage	•
Dropping below the minimum measurement current	•
Measurement current exceedance	•
Insufficient compensation power	•
Delivery of active power	•
Harmonics threshold values	•
Overtemperature	•

Technical data	
Supply voltage L-L, L-N AC	See overview of devices
Measurement in which quadrants	4
Networks	TN, TT, (IT)
Measurement in multi-phase networks	3 ph
Measured voltage input	
Overvoltage category	CAT III
Measured range, voltage L-N, AC (without potential transformer)	See overview of devices
Measured range, voltage L-L, AC (without potential transformer)	See overview of devices
Voltage tolerance range	+10 % , -15 %
Back-up fuse	2 A ... 10 AT
Measurement surge voltage	4 kV
Test voltage relative to ground	2.200 V AC
Frequency measuring range	42 ... 80 Hz
Power consumption	max. 5 VA
Sampling rate	10 kHz (at 50 Hz)
Measured current input	
Signal frequency	45 Hz ... 1.200 Hz
Nominal current at .../5 A (.../1 A)	5 A (1 A)
Minimum measurement current	10 mA
Upper measurement current	5.3 A (sinusoidal)
Overloading	180 A for 2 sec.
Measurement rate	30 (50) measurements / sec.
Power consumption	approx. 0.2 VA
Updating the display	1 time per second
Zero voltage triggering	< 15 ms
Inputs and outputs	
Number of digital inputs (for tariff changeover)	1, see overview of devices
Relay outputs (as switch output)	13, see overview of devices
Back-up fuse	6,3 AT
Switching voltage	max. 250 V AC
Switching power	max. 1.000 W

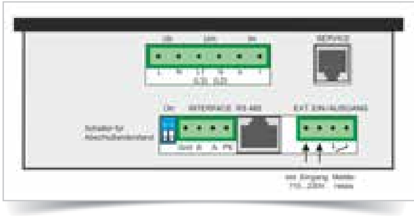


Fig.: Prophi® 7 interface

Max. switching frequency	50 Hz
Mechanical service life	> 30 x 10^6 switching cycles
Electrical service life	> 2.8 x 10^5 switching cycles
Transistor outputs (as switch output)	**12, see overview of devices**
Switching voltage	5 ... 30 V DC
Switching current	max. 50 mA
Max. switching frequency	50 Hz
Alarm output (as switch output)	1
Temperature sensor (internal)	1
Target cosphi changeover (current consumption)	Input 230 V AC
Mechanical properties	
Weight	1000 g
Device dimensions in mm (H x W x D)	144 x 144 x 53
Protection class per IEC 60529	Front: IP54, Rear: IP20
Installation	Front panel installation
Connecting phase (U / I), Single core, multi-core, fine-stranded Terminal pins, core end sheath	 0.08 to 2.5 mm² 1.5 mm²
Features	
Display of capacitor currents	•
Display of switch-on times for the individual stages	•
Display of switching cycles per stage	•
Zero voltage triggering	•
Automatic configuration	•
Password protection	•
Environmental conditions	
Temperature range	Operation: -10 ... +55 °C *4 Storage: -20 ... +60 °C
Relative humidity	15 to 95 %
Operating altitude	0 ... 2,000 m above sea level
Degree of pollution	2
Mounting position	any
Electromagnetic compatibility	
Electromagnetic compatibility of equipment	Directive 2004/108/EC
Electrical appliances for application within particular voltage limits	Directive 2006/95/EC
Equipment safety	
Safety requirements for electrical equipment for measurement, regulation, control and laboratory use – Part 1: General requirements	IEC/EN 61010-1
Part 2 – 008: Particular requirements for testing and measuring circuits	IEC/EN 61010-1-08
Protection class	I = Device with protective conductor
Noise immunity	
Industrial environment	DIN EN 61326-1, Table 2; (IEC 61326-1)
Emissions	
Class B: Residential environment	DIN EN 61326-1; (IEC 61326-1)
Class A: Industrial environment	DIN EN 61326-1; (IEC 61326-1)
Safety	
Euroope	CE labelling

Comment: For detailed technical information please refer to the operation manual and the Modbus address list.

*4 Devices with the “RS485 interface” option are only suitable for an operating temperature range of -10 to +50 °C.

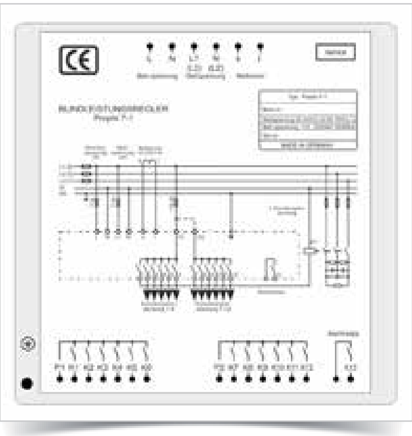


Fig.: Prophi® 7, rear view

The universal capacitor monitoring system

Continuous capacitor monitoring
- Over-current limit value
- Under-current limit value
- Unbalance limit value
- Temperature limit value
- Harmonics limit value
- Voltage limit value
- Number of switching cycles

Safety
- Timely detection of capacitor aging
- Timely replacement of contactors
- Prevention of fire damage
- Prevention of downtimes

Interfaces
- Ethernet
- RS232
- RS485

Communication
- Profibus (DP/ V0)
- Modbus (RTU, TCP, Gateway)
- TCP/IP
- BACnet (optional)
- HTTP (Homepage)
- FTP (file transfer)
- SNMP
- TFTP
- NTP (time synchronisation)
- SMTP (email function)
- DHCP

Power quality
- Harmonics up to 40th harmonic
- Short term interruptions
- Transient recorder (> 50 µs)
- Inrush currents (> 20 ms)
- Imbalance
- Full cycle RMS
  recordings (up to 4.5 min.)

Measured data memory
- 128 MByte Flash
- 16 MB RAM

2 digital outputs
- Pulse output kWh / kvarh
- Switch output
- Threshold value output
- Logic output

Thermistor input
- PT100, PT1000, KTY83, KTY84

PFC protection – Capacitor monitoring **Item no.: 52.16.300**

• Increases the safety of PFC systems
• Monitoring of all overload scenarios by means of the UMG 604E-PRO
•Timely detection of capacitor overloading as well as short circuits

Main features

• Measurement 3-phase, 3 CTs in the supply line for the PFC system
• PFC-APP (Jasic® monitoring software on UMG 604E-PRO)
• Monitoring of: Short-circuit to ground, over-current and under-current, overvoltage, unbalance, switching frequency, temperature, etc.
• Additional, comprehensive network analysis functions
• Extensive analysis options via GridVis®-Basic software
• Integration into networks with Ethernet or RS485-Modbus RTU
• Flexible alarm system with monitoring of up to 32 measured values
• Menu-driven user guidance in plain text on the UMG 604E-PRO homepage

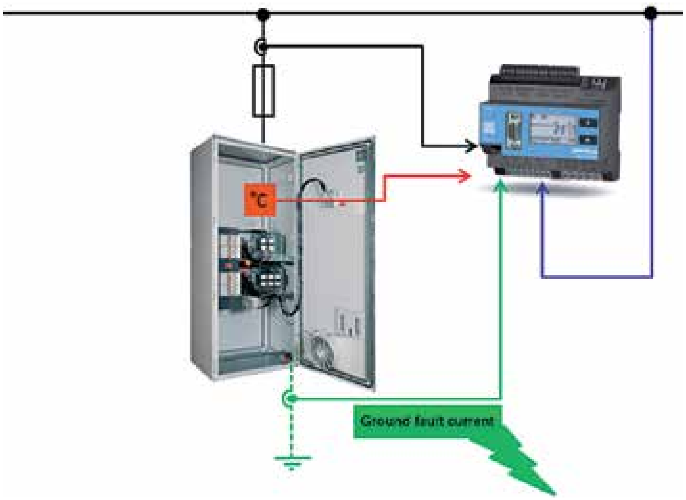


Fig.: Monitoring of short-circuits to ground, temperature, over-current etc. with the power analyser UMG 604E-PRO

Fig.: Capacitor monitoring in a PFC system

Fig.: Monitoring of limit values via UMG 604-PRO homepage

Segmented film

Self-healing

Low loss

Long service life

PFC power capacitors

High tolerance of inrush currents
- Optimised metal spraying process
- Wave-cut film

Long service life
- Highend impregnation technology
- Good thermal dissipation
- High quality base materials

Reliable connection technology
- Connection adapter for reliable long term connections

Fivefold safety
- Self-healing technology
- Dry technology
- Over-pressure disconnector
- Segmented capacitor film
- Integrated discharge device

Areas of application

- Motor fixed PFC
- Group PFC
- Automatic power factor correction
- Detuned power factor correction systems
- Harmonics filter
- Dynamic power factor correction systems

Main features

Fivefold safety

- Self-healing technology
- Dry technology
- Over-pressure disconnector
- Segmented capacitor film
- Integrated discharge device

Long service life (up to 170,000 hours) and high operational reliability

- Highend impregnation technology
- Excellent thermal dissipation
- High quality base materials

Reliable connection technology

- Connection adapter for reliable long term connections

High inrush currents withstand capability

- Optimised metal spraying process
- Wave-cut film design

High of overload withstand capability

- Max. over-current: 2.2 In
- Max. inrush current: 300 x In

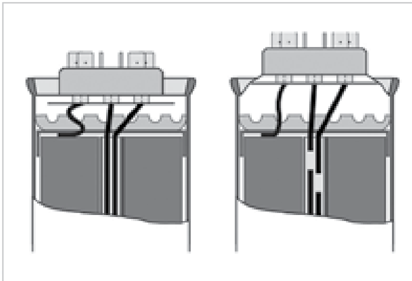


Fig.: Principle of over-pressure disconnector

Fig.: Self-healing, segmented capacitor film

Fig.: The connection adapter offers a low transfer resistance and a permanent, fixed electrical and mechanical contact

Low loss

- 0.2 Watt/kvar dielectric loss
- 0.5 Watt/kvar total power dissipation

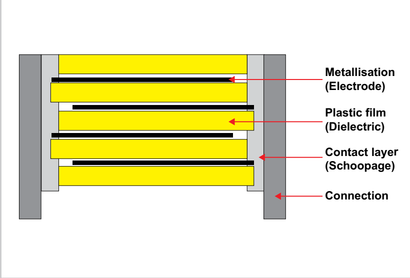


Fig.: Contacting (metal spraying) of the metallised Polypropylene film (Dielectric)

Technical data

Technical data and limit values for power capacitors		
Standards		IEC 60831-1+2, EN 60831-1+2
Output range	QR (kvar)	0.3 – 40
Nominal voltage range	UR (V)	400 V*1
Over-voltage	U_{max}	Un + 10 % (up to 8 h daily) / Un + 15 % (up to 30 mins daily) Un + 20 % (up to 5 mins daily) / Un + 30 % (up to 1 min daily)
Overcurrent	I_{max}	2.2 x In (at nominal voltage, 50 Hz)
Inrush current withstand capability	IS	Up to 300* In
Dielectic losses	Pdiel.	< 0.2 Watt per kvar
Total capacitor losses	Pv	< 0.5 Watt per kvar
Nominal frequency	f	50 / 60 Hz
Capacitor tolerance		-5 ... + 10 %
Test voltage (terminal / terminal)	VTT	2.15 x Un, AC, 2 s / 1.85 x Un, AC, 18 s
Test voltage (terminal / housing)	VTC	3,900 V, 2 s
Service life expectancy	t LD(Co)	Up to 170,000 h
Ambient temperature		Class: -25/D Max. temperature +65 °C Max. 24 h average = +45 °C Max. 1 year average = +35 °C Lowest temperature = -40 °C
Max. housing temperature	Tg	+75 °C
Air humidity	H_{rel}	max. 95 %
Operating altitude		max. 4,000 m above sea level
Fastening and grounding		M12 threaded bolts and house base
Safety		Dry technology, over-pressure disconnector, self-healing, max. permissible fault current 10,000 A per UL-810 standard
Discharging		Discharge resistors
Housing		Aluminium can and sheet steel housing
Protection class		IP20, indoor installation (optionally with IP54 terminal covering)
Dielectric		Polypropylene film
Impregnation		Dry
Number of switching cycles per year		Max. 60,000 switching cycles in accordance with IEC 60831 (with capacitor contactors)

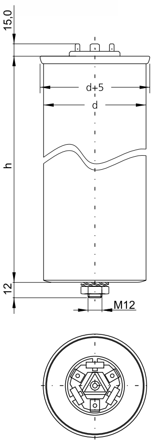
*1 Nominal voltage 400 V illustrated in the catalogue. 230 – 800 V on request.

3-phase power capacitors in aluminium cans

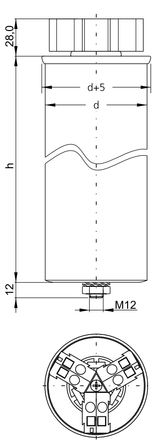
Main features

- PFC power capacitors in aluminium cans
- Delta connection
- With discharge resistors
- Long service life, low loss

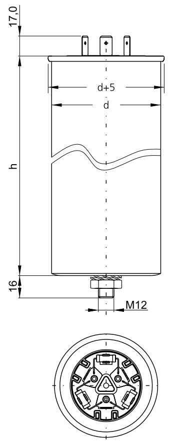
Dimension diagrams



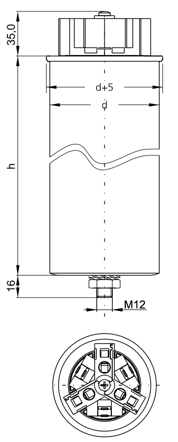
Capacitor with
d = 60 / 70 mm
for connection with
flat connector
6.3 x 0.8 mm



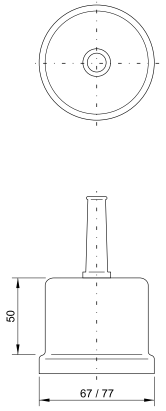
Capacitor with
connection
adapter ASS 1
d = 60 / 70 mm



Capacitor with
d = 85 mm
for connection with
flat connector 9.5 x 1.2 mm



Capacitor with
connection
adapter ASS 2
d = 85 mm



Protective cap SK60 / SK70 for
Capacitor with d = 60 / 70 mm
(not available for capacitors
with d = 85 mm)

Technical data

Delta connection with discharge resistor - Protection type: IP00 – Frequency: 50 Hz									
Nominal output in kvar at a nominal voltage of:					Type	Capacitance in µF -5 ... + 10 %	Dimensions in mm (D x H)	Weight in kg	Item no.
400 V	415 V	440 V	480 V	525 V					
2.4	2.6	2.9	3.5	4.17	JCP525/4.1-D	3 x 16.0	60 x 225	0.7	**19.02.275**
2.5	2.7	3.0	3.6	4.3	JCP480/3.6-D	3 x 16.6	60 x 150	0.5	**19.02.205**
4.8	5.2	5.8	7	8.33	JCP525/8.3-D	3 x 32.0	70 x 225	0.9	**19.02.249**
5	5.4	6	7.2	8.6	JCP480/7.2-D	3 x 33.2	60 x 225	0.8	**19.02.210**
5.8	6.3	7	8.33	10	JCS525/10.0-D	3 x 38.5	70 x 225	0.8	**19.02.150**
6.25	6.7	7.6	9.0	-	JCP440/7.6-D	3 x 41.7	60 x 225	0.7	**19.02.211**
7.2	7.8	8.7	10.5	12.5	JCS525/12.5-D	3 x 48.1	70 x 225	1.1	**19.02.180**
8.7	9.4	10.5	12.5	15	JCS525/15.0-D	3 x 57.7	70 x 265	1.2	**19.02.103**
7.5	8.1	9.1	10.8	-	JCP440/9.1-D	3 x 49.9	60 x 225	0.7	**19.02.215**
10	10.8	12.1	14.4	-	JCP440/12.1-D	3 x 66.3	70 x 225	1.1	**19.02.217**
10.8	11.6	13.1	15.5	-	JCS480/15.5-D	3 x 71.4	70 x 225	1.1	**19.02.116**
9.3	10	11.2	-	-	JCP400/9.3-D	3 x 61.4	70 x 225	1.1	**19.02.219**
10	10.8	12.1	-	-	JCP400/10.0-D	3 x 66.3	70 x 225	1.1	**19.02.220**
11.7	12.5	14.1	-	-	JCP400/11.7-D	3 x 77.3	70 x 225	1.1	**19.02.221**
12.5	13.4	15.1	-	-	JCS440/15.0-D	3 x 82.9	70 x 225	1.1	**19.02.125**
20	-	24.2	-	-	JCP400/20.0-D	3 x 132.6	85 x 285	2.4	**19.02.228**
23.3	25.1	28.2	-	-	JCS440/28.2-D	3 x 154.6	85 x 355	2.5	**19.02.126**
25	29.9	30.2	-	-	JCS440/30.0-D	3 x 164.4	85 x 355	2.6	**19.02.127**

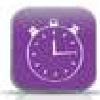
Protective caps / connection adapter	Type		Item no.
Protective cap with cable entry Height +77 mm	SK60	For power capacitors with a diameter of 60 mm	**19.02.620**
Protective cap with cable entry Height +75 mm	SK70	For power capacitors with a diameter of 70 mm	**19.02.621**
Connection adapter for D 60 / 70 mm with spring type terminals 2 x 6 mm²	ASS 1	Height = 28 mm	**19.02.610**
Connection adapter for D85 mm with spring type terminals 16 mm²	ASS 2	Height = 30.5 mm	**19.02.612**

Optimised, thermal design

Self-healing

Low loss

Long service life



Automatic power factor correction systems without reactors

High tolerance of start-up currents inrush current withstand capability
- Optimised metal spraying process
- Wave-cut film design
- Capacitor contactors with pre-closing contacts for inrush current damping

Long service life
- Generous space- / power-ratio
- Generously dimensioned cooling system
- High quality capacitors

High operational reliability
- Capacitors with fivefold safety system
- PFC controller with 8-way alarm message
- Heavy duty sheet steel cabinets
- Optimised thermal design
- Exclusive use of quality components

Areas of application

- Automatica Power Factor Correction (APFC)
- For use in mains supply with low harmonics distortion
- Converter power (non-linear loads) < 15 % of total connection power
- Total harmonic distortion of THD-U < 3 %
- No combined use in networks with de-tuned capacitors
- No use with critical ripple control systems in the range 270 to 425 Hz

Device overview and technical data

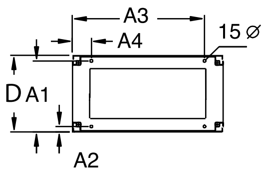
Power factor correction without reactors		
Standards	DIN, VDE 0660 part 500, EN 60439-1 and EN 60831-1/2	
Design	DIN EN 60439 part 1, partial type-approved combination	
Construction type	Sheet steel cabinet for versions KB and ES, module for version MO	
PFC controller	Prophi® per datasheet or selection table	
Power capacitors	High quality, self-healing, polypropylene 3-phase capacitors using dry technology	
Contactors	Specific capacitor contactors with pre-charging resistors	
Capacitor protection	HRC fuses, 3-phase, per capacitor stage	
Nominal voltage	400 V, 50 Hz (other voltages on request)	
Control voltage	230 V, 50 Hz (other voltages on request)	
Output range	10 – 600 kvar (alternative staging, powers on request)	
Capacitor nominal voltage	440 V without reactors	
Voltage withstand capability of capacitors	8 h daily	484 V
	30 min daily	506 V
	5 min	528 V
	1 min	572 V
Power dissipation	Capacitors < 0.5 W/kvar, systems 4 – 7 W/kvar	
Switching cycles capacitor contactors	max. 100,000 switching cycles	
Current transformer connection	... /1 A, .../5 A	
Control ratio	See overview of variants	
Discharging	With discharge resistors per EN 60831-1/2	
Maximum altitude	Up to 2,000 m above sea level	
Ambient temperature	35 °C per DIN EN 60439 part 1 (temperature class of the capacitors should be assured with adequate ventilation/cooling at the place of installation!)	
Protection class	Cabinet version = IP32 / Slide-in module = IP00	
Type of cooling	Forced ventilation (except slide-in modules)	
Colour	Grey, RAL 7035 (other colours on request)	
Noise emission (FK)	< 60 dB with closed systems at 1 m distance	
Connection cross-section and fuse	See technical annex	

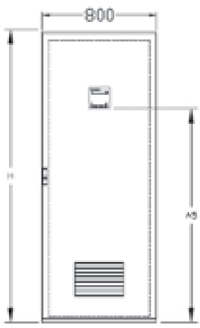
Automatic power factor correction in modular design (up to 500 kvar ...)

Main features

- APFC in the steel cabinet
- For free-standing installation
- Nominal voltage: 400 V, 3-phase, 50 Hz
- Protection class: IP32
- With natural convection (air exchange)
- With discharge resistors
- With power factor controller Prophi® 6R/12R

Dimension diagrams





ES8184 (dimensions in mm):
H = 1820, W = 800, D = 400
A1 = 374, A2 = 25, A3 = 700, A4 = 100
A5 = 1,480

Technical data

APFC in modular design ES8184						
Nominal output kvar	**Stage power kvar**	**Control ratio**	**Type**	**Width in mm**	**Weight in kg**	**Item no.**
150	25/25/50/50	1:1:2:2	JF440/150ER6ES8184**	800	208	**50.81.400**
150	12.5/12.5/25/50/50	1:1:2:4:4	JF440/150ER12ES8184**	800	208	**50.81.415**
150	25/25/25...	1:1:1:1:1:1	JF440/150ER6ES8184**	800	208	**50.81.425**
160	20/20/40...	1:1:2:2:2	JF440/160ER8ES8184**	800	209	**50.81.450**
175	25/50/50/50	1:2:2:2	JF440/175ER7ES8184**	800	210	**50.81.475**
175	12.5/12.5/25/25/50...	1:1:2:2:4:4	JF440/175ER14ES8184***	800	210	**50.81.490**
180	20/40/40...	1:2:2:2:2	JF440/180ER9ES8184**	800	211	**50.81.515**
200	50/50...	1:1:1:1	JF440/200ER4ES8184**	800	212	**50.81.540**
200	25/25/50...	1:1:2:2:2	JF440/200ER8ES8184**	800	212	**50.81.550**
200	12.5/12.5/25/50...	1:1:2:4:4...	JF440/200/ER16ES8184**	800	212	**50.81.560**
200	20/20/40...	1:1:2:2:2:2	JF440/200ER10ES8184**	800	212	**50.81.570**
240	20/20/40...	1:1:2:2...	JF440/240ER12ES8184***	800	232	**50.81.600**
250	50...	1:1:1:1:1	JF440/250ER5ES8184**	800	233	**50.81.625**
250	25/25/50...	1:1:2:2...	JF440/250ER10ES8184**	800	233	**50.81.635**
250	12.5/12.5/25/50...	1:1:2:4:4...	JF440/250ER20ES8184***	800	233	**50.81.645**
300	50/50...	1:1:1:1:1:1	JF440/300ER6ES8184**	800	236	**50.81.670**
300	25/25/50...	1:1:2:2...	JF440/300ER12ES8184***	800	236	**50.81.680**
300	12.5/12.5/25/50...	1:1:2:4:4...	JF440/300ER24ES8184***	800	236	**50.81.690**
400	50/50/50...	1:1...	JF440/400ER8ES8184***	2 x 800	475	**50.81.693**
500	50/50/50...	1:1...	JF440/500ER10ES8184***	2 x 800	500	**50.81.696**
Accessories						
Socket 100 mm high	SO 100/800/400				5	**29.03.317**
Socket 200 mm high	SO 200/800/400				10	**29.03.322**

** With power factor controller Prophi® 6R
*** With power factor controller Prophi® 12R

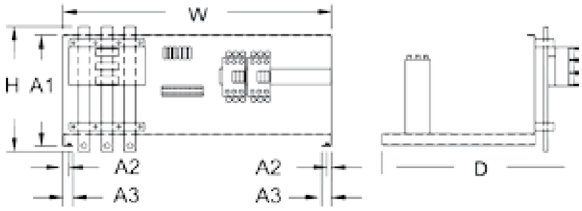
Other rated voltages, frequencies, kvar-outputs, mechanical configurations or variants with circuit breakers on request. Expansion units, systems in ISO housing as well as audio frequency blocking devices on request.

Automatic power factor correction on extractable module, up to 100 kvar

Main features

- Ready-to-install PFC slide-in modules without reactors
- For cabinet installation
- Nominal voltage: 400 V, 3-phase, 50 Hz
- Protection class: IP00
- With natural convection (air exchange)
- With discharge resistors

Dimension diagrams



MO84 (dimensions in mm):
H = 330, W = 703, D = 333
A1 = 290, A2 = 14, A3 = 26.5

Technical data

PFC module M084					
Nominal output kvar	**Stage power kvar**	**Control ratio**	**Type**	**Weight in kg**	**Item no.**
50	50		JF440/50EK1MO84	22	**50.80.700**
50	25/25	1:1	JF440/50/2EK2MO84	22	**50.80.740**
50	10/20/20	1:2:2	JF440/50/3EK5MO84	22	**50.80.770**
50	12.5/12.5/25	1:1:2	JF440/50/3/EK4MO84	22	**50.80.774**
60	20/40	1:2	JF440/60/2EK3MO84	23	**50.80.775**
60	10/10/20/20	1:1:2:2	JF440/60/4EK6MO84	23	**50.80.776**
75	25/50	1:2	JF440/75/2EK3MO84	24	**50.80.800**
75	25/25/25	1:1:1	JF440/75/3EK3MO84	24	**50.80.810**
75	12.5/12.5/25/25	1:1:2:2	JF440/75/4EK6MO84	24	**50.80.811**
80	40/40	1:1	JF440/80/2EK2MO84	24	**50.80.835**
80	20/20/40	1:1:2	JF440/80/3EK4MO84	24	**50.80.837**
100	50/50	1:1	JF440/100/2EK2MO84	25	**50.80.875**
100	25/25/50	1:1:2	JF440/100/3EK4MO84	25	**50.80.880**
100	25/25/25/25	1:1:1:1	JF440/100/4EK4MO84	25	**50.80.900**
100	20/40/40	1:2:2	JF440/100/3EK5MO84	25	**50.80.902**
100	12.5/12.5/25/50	1:1:2:4	JF440/100/4EK8MO84	25	**50.80.903**
Control module with Prophi® 6R controller MCCB, CT terminals and 2 m connection cable (mounted on the capacitor module)					**50.80.003**
Control module with Prophi® 12R controller MCCB, CT terminals and 2 m connection cable (mounted on the capacitor module)					**50.80.004**
Accessories Set module fixing rail for Rittal cabinets, left/right, with accessories (for Rittal cabinet MO84)					**50.00.100**

Other rated voltages, frequencies, ouputs, mechanical configurations or variants with circuit breakers on request.

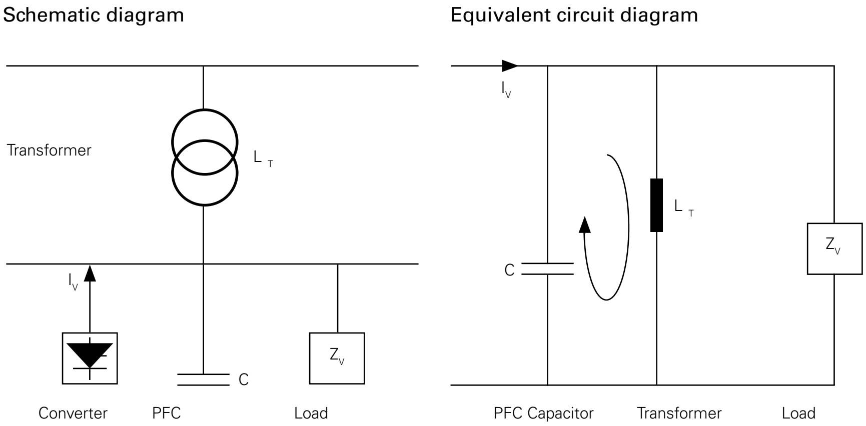


Fig.: Parallel resonant circuit between transformer and capacitors without reactors

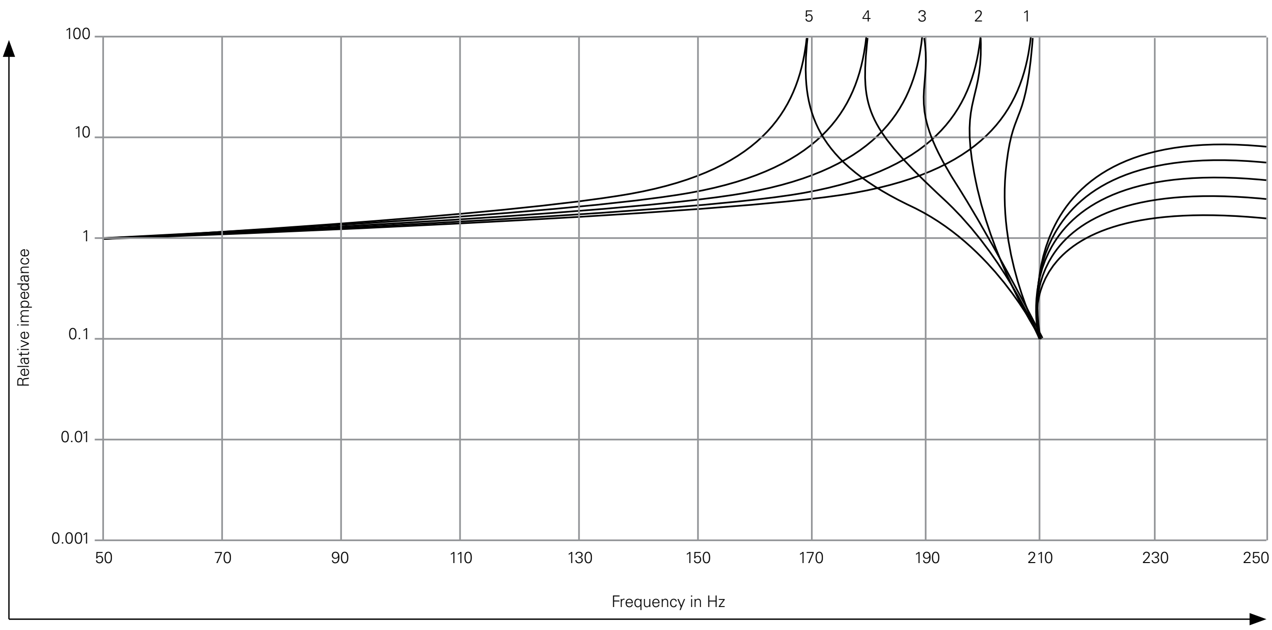


Fig.: Relative impedance progression for parallel resonant circuit with detuned capacitor and transformer

U_k = 4 %
p = 5.67 %
1...Q_C / S_N = 5 %
2...Q_C / S_N = 15 %
3...Q_C / S_N = 30 %
4...Q_C / S_N = 50 %
5...Q_C / S_N = 80 %
Q_C=PFC output
S_n=Apparent power of transformer

Optimised, thermal design

De-tuned version

Low loss

Long service life

Automatic de-tuned power factor correction systems

Optimised filter design
- Precise filter circuit frequency matching
- High quality reactors
- Temperature protection in the event of overload
- Filter circuit reactors with high linearity and low loss

Long service life
- Generous space- / power-ratio
- Generously dimensioned cooling system
- High quality capacitors and filter circuit reactors with 100 % duty cycle

High operational reliability
- Capacitors with fivefold safety
- PFC controller with 8-way alarm message
- Optimised thermal design
- Exclusive use of quality components

Areas of application

- Automatic power factor correction with reactors
- For use in mains supply with harmonics distortion
- Converter power (non-linear loads) > 15 % of the connection power
- Total harmonic distortion of THD-U > 3 %
- To preveant cases of resonance
- Harmonics filtering and improvement of power quality
- Reduction in reactive energy costs and PFC penalties

Device overview and technical data

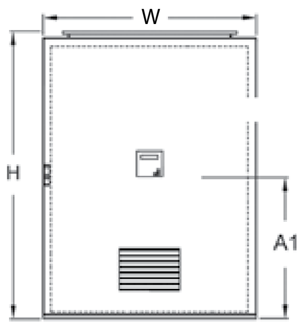
De-tuned power factor correction				
Technical data				
Standards	DIN, VDE 0660 part 500, EN 60439-1 and EN 60831-1/2			
Design in accordance with	DIN EN 60439 part 1, partial type-approved combination			
Construction type	Sheet steel cabinet for versions KB and ES, module for version MO			
Dynamic PFC controller	Prophi® per datasheet or selection table			
Power capacitors	High quality, self-healing, polypropylene 3-phase capacitors using dry technology			
Filter circuit reactors	Low-loss 3-phase reactors with high linearity, 7%, 14% (other ratings on request), with 100% duty cycle			
Contactors	Specific capacitor contactors			
Capacitor protection	HRC fuses, 3-phase, per capacitor stage			
Nominal voltage	400 V, 50 Hz (other voltages on request)			
Control voltage	230 V, 50 Hz (other voltages on request)			
Output range	10 – 600 kvar (alternative staging, outputs on request)			
Capacitor nominal voltage	440 V with 5.67 – 7 % (detuned), 525 V with 14 % (detuned)			
Voltage withstand capability of capacitors	At p = 5.67 – 7 %	440 V	At p = 14 %	525 V
	8 h daily	484 V		577 V
	30 min daily	506 V		604 V
	5 min	528 V		630 V
	1 min	572 V		682 V
Power dissipation	Capacitors < 0.5 W/kvar, systems 4 – 7 W/kvar			
System design	**Permissible harmonics currents**		**Harmonics voltage**	
	I 250 Hz	I 350 Hz	U 250 Hz	U 350 Hz
FK 5.67	0.565 IN	0.186 IN	5 %	5 %
FK 7	0.31 IN	0.134 IN	5 %	5 %
FK 14	0.086 IN	0.051 IN	5 %	5 %
Switching cycles capacitor contactors	max. 100,000 switching cycles			
Current transformer connection	... /1 A, .../5 A			
Control ratio	See overview of variants			
Discharging	With discharge resistors per EN 60831-1/2			
Maximum altitude	Up to 2,000 m above sea level			
Ambient temperature	35 °C per DIN EN 60439 part 1 (temperature class of the capacitors should be assured with adequate ventilation/cooling at the place of installation!)			
Protection class	Cabinet version = IP32 / Slide-in module = IP00			
Type of cooling	Forced ventilation (except slide-in modules)			
Colour	Grey, RAL 7035 (other colours on request)			
Noise emission (FK)	< 60 dB with closed systems at 1 m distance			
Connection cross-section and fuse	See technical annex			
The following reactors can be used in mains supply with ripple control systems:				
Ripple control frequency	**De-tuning factor**		**Filter series resonant frequency**	
< 168 Hz	p = 14 %		fr = 134 Hz	
168 – 183 Hz	p = 14 / 5.67 %		fr = 134 / 210 Hz	
> = 216.67	p = 8 %		fr = 177 Hz	
> 228 Hz	p = 7 %		fr = 189 Hz	
> 350 Hz	p = 5.67 %		fr = 210 Hz	

Automatic de-tuned power factor correction (Harmonics filter), compact design

Main features

- APFC in the steel cabinet
- For wall mounting
- Nominal voltage: 400 V, 3-phase, 50 Hz
- Reactors: 7 % and 14 %
- Protection class: IP32
- Ventilation: From 31 kvar with fan in the cabinet door for forced cooling
- With discharge resistors
- With power factor controller Prophi® 6R

Dimension diagrams



KB6825 (dimensions in mm):

W = 600, H = 800, D = 250, A1 = 410

KB6123 (dimensions in mm):

W = 600, H = 1,200, D = 300, A1 = 655

Technical data

7 % de-tuned in accordance with series resonant frequency 189 Hz

Nominal output kvar	Stage power kvar	Control ratio	Type	Design	Weight in kg	Item no.
15	5/10	1:2	JF440/15ER3KB6825FK7	KB6825	112	**50.52.020**
20	5/5/10	1:1:2	JF440/20ER4KB6825FK7	KB6825	113	**50.52.040**
25	5/10/10	1:2:2	JF440/25ER5KB6825FK7	KB6825	116	**50.52.080**
31	6.25/12.5/12.5	1:2:2	JF440/31/ER5KB6825FK7	KB6825	118	**50.52.110**
35	5/10/20	1:2:4	JF440/35ER7KB6825FK7	KB6825	122	**50.52.150**
43.75	6.25/12.5/25	1:2:4	JF440/43.75ER7KB6825FK7	KB6825	138	**50.52.180**
50	10/20/20	1:2:2	JF440/50ER5KB6825FK7	KB6825	142	**50.52.210**
60	10/20/30	1:2:3	JF440/60ER6KB6123FK7	KB6123	158	**50.52.225**
75	12.5/25/37.5	1:2:3	JF440/75ER6KB6123FK7	KB6123	167	**50.52.240**

Other rated voltages, frequencies, outputs, reactors, mechanical configurations or variants with circuit breakers on request.

14 % de-tuned in accordance with series resonant frequency 134 Hz

Nominal output kvar	Stage power kvar	Control ratio	Type	Design	Weight in kg	Item no.
15	5/10	1:2	JF525/15ER3KB6825FK14	KB6825	123	**50.52.520**
20	5/5/10	1:1:2	JF525/20ER4KB6825FK14	KB6825	124	**50.52.540**
25	5/10/10	1:2:2	JF525/25ER5KB6825FK14	KB6825	128	**50.52.580**
31	6.25/12.5/12.5	1:2:2	JF525/31/ER5KB6825FK14	KB6825	130	**50.52.610**
35	5/10/20	1:2:4	JF525/35ER7KB6825FK14	KB6825	134	**50.52.650**
43.75	6.25/12.5/25	1:2:4	JF525/43.75ER7KB6825FK14	KB6825	152	**50.52.680**
50	10/20/20	1:2:2	JF525/50ER5KB6825FK14	KB6825	173	**50.52.710**
60	10/20/30	1:2:3	JF525/60ER6KB6123FK14	KB6123	184	**50.52.725**
75	12.5/25/37.5	1:2:3	JF525/75ER6KB6123FK14	KB6123	195	**50.52.729**

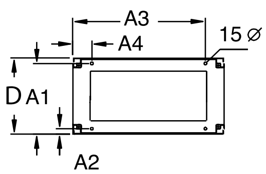
Other rated voltages, frequencies, outputs, reactors, mechanical configurations or variants with circuit breakers on request.

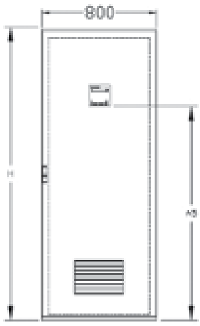
7 % de-tuned power factor correction (harmonics filter), extractable design ES8206 FK7

Main features

- APFC in steel cabinet (free-standing mounting)
- Nominal voltage: 400 V, 3-phase, 50 Hz
- Reactor: 7 % (189 Hz series resonant frequency)
- Protection class: IP32
- Ventilation: From 120 kvar with fan in the cabinet door for forced cooling
- With power factor controller Prophi® 6R/12R

Dimension diagrams





ES8206 (dimensions in mm):

H = 2.020, W = 800 or 1.600, D = 600

A1 = 537, A2 = 63, A3 = 737, A4 = 62, A5 = 1,480

Technical data

Nominal output kvar	Stage power kvar	Control ratio	Type	Width in mm	Weight in kg	Item no.
60	10/20/30	1:2:3...	JF440/60ER6ES8206FK7**	800	278	**50.89.040**
75	12.5/12.5/25...	1:1:2...	JF440/75ER6ES8206FK7**	800	278	**50.89.080**
100	25/25/50	1:1:2	JF440/100ER4ES8206FK7**	800	288	**50.89.120**
100	12.5/12.5/25/50	1:1:2:4	JF440/100ER8ES8206FK7**	800	288	**50.89.200**
120	20/20/40/40	1:1:2:2	JF440/120ER6ES8206FK7**	800	340	**50.89.320**
150	25/25/50/50	1:1:2:2	JF440/150ER6ES8206FK7**	800	344	**50.89.400**
175	25/50/50/50	1:2:2:2	JF440/175ER7ES8206FK7**	800	367	**50.89.440**
200	50...	1:1:1...	JF440/200ER4ES8206FK7**	800	314	**50.89.480**
200	25/25/50...	1:1:2...	JF440/200ER8ES8206FK7**	800	314	**50.89.520**
200	12.5/12.5/25/50...	1:1:2:4..	JF440/200ER16ES8206FK7**	800	314	**50.89.560**
250	50...	1:1:1...	JF440/250/ER5ES8206FK7**	800	437	**50.89.600**
250	25/25/50...	1:1:2...	JF440/250ER10ES8206FK7**	800	437	**50.89.640**
300	50...	1:1:1...	JF440/300ER6ES8206FK7**	800	487	**50.89.685**
300	25/25/50...	1:1:2...	JF440/300ER12ES8206FK7***	800	498	**50.89.687**
350	50...	1:1:1...	JF440/350ER7ES8206FK7-1S***	800	520	**50.89.720**
350	50...	1:1:1...	JF440/350ER7ES8206FK7***	1,600	352/347	**50.89.722**
400	50...	1:1:1...	JF440/400ER8ES8206FK7-1S***	800	570	**50.89.744**
400	50...	1:1.1...	JF440/400ER8ES8206FK7***	1,600	2x370	**50.89.740**
450	50...	1:1:1...	JF440/450ER9ES8206FK7***	1,600	437/347	**50.89.770**
500	50...	1:1:1...	JF440/500ER10ES8206FK7***	1,600	479/359	**50.89.800**
550	50...	1:1:1...	JF440/550ER11ES8206FK7***	1,600	2x431	**50.89.805**
600	50...	1:1:1...	JF440/600ER12ES8206FK7***	1,600	2x481	**50.89.820**
Accessories						
100 mm high socket for easy supply cable connection		SO 100 / 800 / 600			5	**50.00.150**
200 mm high socket for easy supply cable connection		SO 200 / 800 / 600			10	**50.00.151**

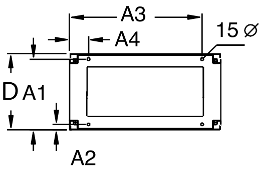
Other rated voltages, frequencies, outputs, reactors, mechanical configurations or variants with circuit breakers on request.
** With Prophi® 6R, *** With Prophi® 12R

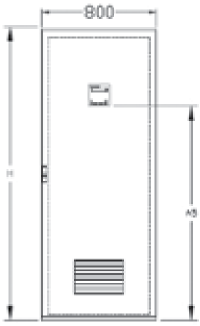
14 % de-tuned power factor correction (harmonics filter), extractable design ES8206 FK14

Main features

- APFC in steel cabinet (free-standing mounting)
- Nominal voltage: 400 V, 3-phase, 50 Hz
- Reactors: 14 % (134 Hz series resonant frequency)
- Protection class: IP32
- Ventilation: From 120 kvar with fan in the cabinet door for forced cooling
- With power factor controller Prophi® 6R/12R

Dimension diagrams





ES8206 (dimensions in mm):
H = 2.020, W = 800 or 1.600, D = 600
A1 = 537, A2 = 63, A3 = 737, A4 = 62, A5 = 1,480

Technical data

Nominal output kvar	Stage power kvar	Control ratio	Type	Width in mm	Weight in kg	Item no.
60	10/20/30	1:2:3	JF525/60ER6ES8206FK14**	800	317	**50.93.040**
75	12.5/12.5/25/25	1:1:2:2	JF525/75ER6ES8206FK14**	800	318	**50.93.080**
100	25/25/50	1:1:2	JF525/100ER4ES8206FK14**	800	368	**50.93.120**
100	12.5/12.5/25/50	1:1:2:4	JF525/100ER8ES8206FK14**	800	380	**50.93.200**
120	20/20/40/40	1:1:2:2	JF525/120ER6ES8206FK14**	800	379	**50.93.320**
150	25/25/50/50	1:1:2:2	JF525/150ER6ES8206FK14**	800	375	**50.93.400**
175	25/50/50/50	1:2:2:2	JF525/175ER7ES8206FK14**	800	407	**50.93.440**
200	50	1:1:1:1	JF525/200ER4ES8206FK14**	800	420	**50.93.480**
200	25/25/50...	1:1:2...	JF525/200ER8ES8206FK14**	800	421	**50.93.520**
200	12.5/12.5/25/50...	1:1:2:4...	JF525/200ER16ES8206FK14**	800	371	**50.93.560**
250	50	1:1:1...	JF525/250/ER5ES8206FK14**	800	478	**50.93.600**
250	25/25/50...	1:1:2...	JF525/250ER10ES8206FK14**	800	490	**50.93.640**
300	50	1:1:1...	JF525/300ER6ES8206FK14**	800	500	**50.93.685**
300	25/25/50...	1:1:2...	JF525/300ER12ES8206FK14***	800	500	**50.93.690**
350	50...	1:1:1...	JF525/350ER7ES8206FK14-1S***	800	550	**50.93.720**
350	50...	1:1:1...	JF525/350ER7ES8206FK14***	1,600	424/365	**50.93.722**
400	50...	1:1:1...	JF525/400ER8ES8206FK14-S***	800	600	**50.93.740**
400	50...	1:1:1...	JF525/400ER8ES8206FK14***	1,600	2x424	**50.93.742**
450	50...	1:1:1...	JF525/450ER9ES8206FK14***	1,600	2x478	**50.93.770**
500	50...	1:1:1...	JF525/500ER10ES8206FK14***	1,600	500/420	**50.93.800**
550	50...	1:1:1...	JF525/550ER11ES8206FK14***	1,600	500/478	**50.93.805**
600	50...	1:1:1...	JF525/600ER12ES8206FK14***	1,600	500/500	**50.93.920**
Accessories						
100 mm high socket for easy supply cable connection	SO 100 / 800 / 600				5	**50.00.150**
200 mm high socket for easy supply cable connection	SO 200 / 800 / 600				10	**50.00.151**

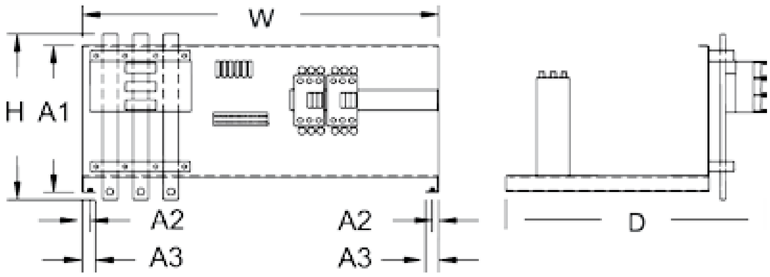
Other rated voltages, frequencies, outputs, reactors, mechanical configurations or variants with circuit breakers on request.
** With Prophi® 6R, *** With Prophi® 12R

De-tuned capacitor modules, extractable design

Main features

- Ready-to-install, de-tuned PFC slide-in modules
- Completely mounted and wired with capacitors, reactors, contactors and HRC-fuses
- For slide-in installation in existing PFC or switchgear cabinets
- Nominal voltage: 400 V, 3-phase, 50 Hz
- Reactors: 7 % (189 Hz) and 14 % (134 Hz)
- Protection class: IP32
- Ventilation: Natural (care must be taken to ensure sufficient ventilation)
- With discharge resistors

Dimension diagrams



Dimensions in mm:
H = 330, W = 703, D = 533
A1 = 290, A2 = 14, A3 = 26.5

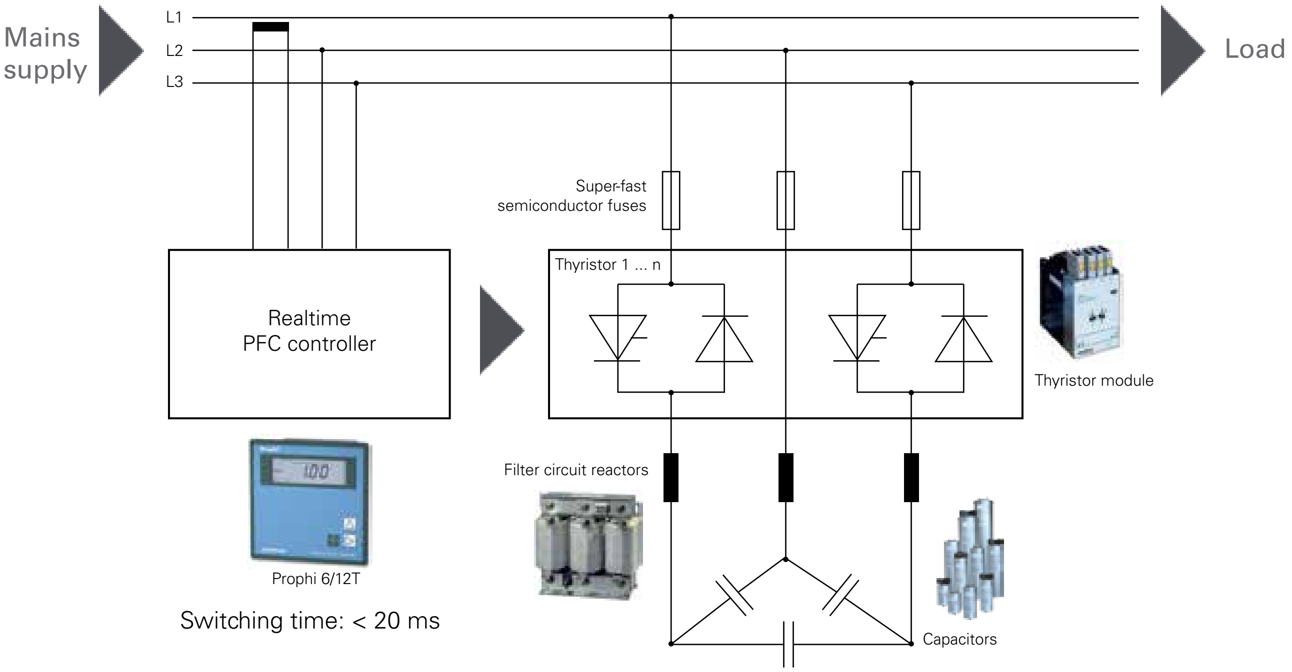
Technical data

7 % de-tuned capacitor modules (189 Hz) MO86FK7 (width 800 mm, depth 600 mm)					
Nominal output kvar	Stage power kvar	Control ratio	Type	Weight in kg	Item no.
10	10		JF440/10EK1MO86FK7	24	**50.88.650**
12.5	12.5		JF440/12.5EK1MO86FK7	26	**50.88.680**
20	20		JF440/20EK1MO86FK7	33	**50.88.710**
25	25		JF440/25/EK1MO86FK7	33	**50.88.740**
40	40		JF440/40EK1MO86FK7	43	**50.88.770**
50	50		JF440/50EK1MO86FK7	45	**50.88.800**
20/2	10	1:1	JF440/20/2EK2MO86FK7	36	**50.88.801**
25/2	12.5	1:1	JF440/25/2EK2MO86FK7	38	**50.88.830**
30/2	10/20	1:2	JF440/30/2EK2MO86FK7	42	**50.88.860**
40/2	20	1:1	JF440/40/2EK2MO86FK7	55	**50.88.890**
40/3	10/10/20	1:1:2	JF440/40/3EK2MO86FK7	55	**50.88.891**
50/2	25	1:1	JF440/50/2EK2MO86FK7	56	**50.88.930**
75/2	25/50	1:2	JF440/75/2EK2MO86FK7	72	**50.88.932**
80/2	40	1:1	JF440/80/2EK2MO86FK7	72	**50.88.933**
100/2	50	1:1	JF440/100/2EK2MO86FK7	86	**50.88.931**

Other rated voltages, frequencies, outputs, reactors, mechanical configurations
(e.g. 500 mm switch cabinet depth) or variants with circuit breakers on request. Accessories, see page 273.

14 % de-tuned capacitor modules (134 Hz) MO86FK14 (width 800 mm, depth 600 mm)					
Nominal output kvar	Stage power kvar	Control ratio	Type	Weight in kg	Item no.
10	10		JF525/10EK1MO86FK14	34	**50.92.650**
12.5	12.5		JF525/12.5EK1MO86FK14	35	**50.92.680**
20	20		JF525/20EK1MO86FK14	40	**50.92.710**
25	25		JF525/25EK1MO86FK14	40	**50.92.740**
40	40		JF525/40EK1MO86FK14	52	**50.92.770**
50	50		JF525/50EK1MO86FK14	54	**50.92.800**
20/2	10	1:1	JF525/20/2E2MO86FK14	53	**50.92.803**
25/2	12.5	1:1	JF525/25/2EK2MO86FK14	60	**50.92.804**
30/2	10/20	1:2	JF525/30/2EK2MO86FK14	45	**50.92.849**
40/2	20	1:1	JF525/40/2EK2MO86FK14	67	**50.92.850**
40/3	10/10/20	1:1:2	JF525/40/3EK3MO86FK14	72	**50.92.851**
50/2	25	1:1	JF525/50/2EK2MO86FK14	69	**50.92.890**
75/2	25/50	1:2	JF525/75/2EK2MO86FK14	78	**50.92.893**
80/2	40	1:1	JF525/80/2EK2MO86FK14	78	**50.92.896**
100/2	50	1:1	JF525/100/2EK2MO86FK14	92	**50.92.892**

Other rated voltages, frequencies, outputs, reactors, mechanical configurations or variants (e.g. 500 mm switch cabinet depth) with circuit breakers on request. Accessories, see page 273.


Mains supply
L1
L2
L3
Load
Super-fast semiconductor fuses
Realtime PFC controller
Thyristor 1 ... n
Thyristor module
Filter circuit reactors
Prophi 6/12T
Switching time: < 20 ms
Capacitors

Optimised, thermal design

De-tuned version

Long service life

Minimised grid distortion

Dynamic power factor correction systems (real time PFC)

Hardly any mains supply distortion
- Switching at zero point transition
- No inrush currents
- Stabilisation of the mains supply voltage
- Reduction of harmonics distortion
- Switching times < 20 ms

Long service life
- Generous space- / power-ratio
- Generously dimensioned cooling system
- High quality capacitors and filter circuit reactors

High operational reliability
- Capacitors with fivefold safety
- PFC controller with 8-way alarm message
- Filter circuit reactors with high linearity and 100% duty cycle
- Optimised thermal design
- Exclusive use of quality components
- Thyristor switch for capacitor connection without mains supply distortion

Areas of application

- Use in applications with fast and high load changes
- APFC in LVDB
- For use in mains supply with harmonics burden
- Converter power (non-linear loads) > 15 % of the connection power
- Total harmonic distortion of THD-U > 3 %
- Harmonics filtering and improvement of power quality
- Reduction in reactive current costs
- Stabilisation of the mains supply voltage

Typical applications

- Automotive industry (welding systems, presses, etc.)
- Lift systems and cranes
- Start-up compensation for large motors
- Drilling rigs in oil production
- Wind turbines
- Welding technology
- Steel production
- Plastic injection moulding systems
- Fishing vessels

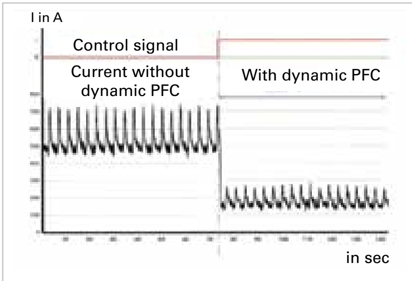


Fig.: Current reduction by means of dynamic PFC

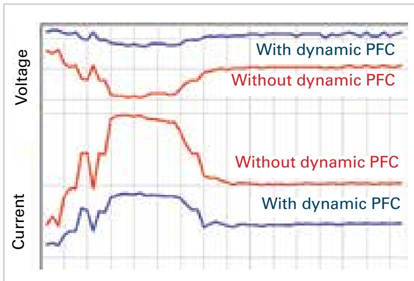


Fig.: Comparison of current and voltage with and without dynamic PFC when starting up a large motor

Particular advantages

- Improved power quality, i.e. avoidance of high start-up currents for the power capacitors
- Significant extending the service life for the PFC system
- Safety of the complete system is significantly increased (i.e. avoidance of damages through defective contactors and subsequent exploding capacitors)
- Ultra-fast compensation of power factor, resulting in a reduction in the reactive current costs and kWh losses
- Voltage stabilisation (e.g. contactors support during the start-up phase of large motors)
- Improved utilisation of the energy distribution (transformers, cabling, switchgear, etc.) through the elimination of power peaks
- Shortening of process times (e.g. welding) due to stabilized voltage

Device overview and technical data

Dynamic power factor correction				
Technical data				
Standards	DIN, VDE 0660 part 500, EN 60439-1 and EN 60831-1/2			
Design in accordance with	DIN EN 60439 part 1, partial type-approved combination			
Construction type	Sheet steel cabinet for versions KB and ES, module for version MO			
Dynamic power factor controller	Prophi®T version per datasheet or selection table			
Power capacitors	High quality, self-healing, polypropylene 3-phase capacitors using dry technology			
Filter circuit reactors	Low-loss 3-phase reactors with high linearity, 7%, 14% (other reactor ratings on request)			
Electronic switch (t < 20 ms)	Thyristor actuator for switching in the zero point transition (to avoid network disturbances)			
Capacitor protection	Ultra-fast electronic fuses			
Nominal voltage	400 V, 50 Hz (other voltages on request)			
Control voltage	230 V, 50 Hz (other voltages on request)			
Output range	10 – 600 kvar (alternative staging, outputs on request)			
Capacitor nominal voltage	440 V with out reactors and 5.67 – 7 % (choked), 525 V with 14 % (reactors)			
Voltage withstand capability of capacitors	At p = 5.67 – 7 %	440 V	At p = 14 %	525 V
	8 h daily	484 V		577 V
	30 min daily	506 V		604 V
	5 min	528 V		630 V
	1 min	572 V		682 V
Power dissipation	Capacitors < 0.5 W/kvar, systems 4 – 7 W/kvar			
System design	**Permissible harmonics currents**		**Harmonics voltage**	
	I 250 Hz	I 350 Hz	U 250 Hz	U 350 Hz
FK 5.67	0.565 IN	0.186 IN	5 %	5 %
FK 7	0.31 IN	0.134 IN	5 %	5 %
FK 14	0.086 IN	0.051 IN	5 %	5 %
Current transformer connection	... /1 A, .../5 A			
Control ratio	See overview of variants			
Discharging	With discharge resistors per EN 60831-1/2			
Maximum altitude	Up to 2,000 m above sea level			
Ambient temperature	35 °C per DIN EN 60439 part 1 (temperature class of the capacitors should be assured with adequate ventilation/cooling at the place of installation!)			
Protection class	Cabinet version = IP32 / Slide-in module = IP00			
Type of cooling	Forced ventilation (except slide-in modules)			
Colour	Grey, RAL 7035			
Noise emission (FK)	< 60 dB with closed systems at 1 m distance			
Connection cross-section and fuse	See technical annex			

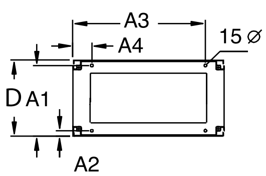
The following reactors can be used in mains supply with ripple control systems:		
Mains supply ripple control frequency	**De-tuning factor**	**Filter series resonant frequency**
< 168 Hz	p = 14 %	fr = 134 Hz
168 – 183 Hz	p = 14 / 5.67 %	fr = 134 / 210 Hz
> = 216.67	p = 8 %	fr = 177 Hz
> 228 Hz	p = 7 %	fr = 189 Hz
> 350 Hz	p = 5.67 %	fr = 210 Hz

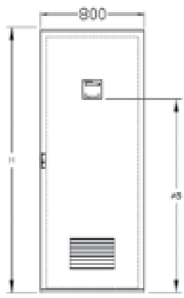
7 % de-tuned dynamic power factor correction, extractable design ES8206 FKTh

Main features

- Dynamic (t < 20 ms), de-tuned APFC in extractable design in steel cabinet
- Modular cabinet for free-standing mounting (expandable in output)
- Nominal voltage: 400 V, 3-phase, 50 Hz
- Reactors: 7 % (189 Hz series resonant frequency)
- Protection class: IP32
- Ventilation: From 120 kvar with fan in PFC cabinet door for forced cooling
- With power factor controller Prophi® 6T / 12T

Dimension diagrams





ES8206 (dimensions in mm):
H = 2,020, W = 800, D = 600, A1 = 537
A2 = 63, A3 = 737, A4 = 62, A5 = 1,480

Technical data

Nominal output kvar	Stage power kvar	Control ratio	Type	Width in mm	Weight in kg	Item no.
60	10/20/30	1:2:3	JF440/60ER6ES8206FK7Th**	800	290	**50.19.040**
75	12.5/12.5/25/25	1:1:2:2	JF440/75ER6ES8206FK7Th**	800	290	**50.19.080**
100	25/25/50	1:1:2	JF440/100ER4ES8206FK7Th**	800	306	**50.19.120**
120	20/20/40/40	1:1:2:2	JF440/120/ER6ES8206FK7Th**	800	306	**50.19.320**
100	12.5/12.5/25/50	1:1:2:4	JF440/100ER8ES8206FK7Th**	800	380	**50.19.200**
125	12.5/25/37.5/50	1:2:3:4	JF440/125ER10ES8206FK7Th**	800	390	**50.19.325**
150	12.5/12.5/25/50...	1:1:2:4...	JF440/150ER12ES8206FK7Th**	800	410	**50.19.330**
150	25/25/50/50	1:1:2:2	JF440/150ER6ES8206FK7Th**	800	410	**50.19.400**
175	12.5/25/37.5/50...	1:2:3:4...	JF440/175ERES8206FK7Th**	800	420	**50.19.440**
200	50/50/50/50	1:1:1:1	JF440/200ER4ES8206FK7Th**	800	430	**50.19.480**
200	25/25/50...	1:1:2...	JF440/200ER8ES8206FK7Th**	800	430	**50.19.520**
200	12.5/12.5/25/50...	1:1:2:4...	JF440/200ER16ES8206FK7Th**	800	435	**50.19.560**
250	50/50...	1:1...	JF440/250ER5ES8206FK7Th**	800	478	**50.19.600**
250	25/25/50...	1:1:2...	JF440/250ER10ES8206FK7Th**	800	490	**50.19.640**
250	12.5/12.5/25/50...	1:1:2:4...	JF440/250ER20ES8206FK7Th***	800	495	**50.19.645**
300	50/50...	1:1...	JF440/300ER6ES8206FK7Th**	800	500	**50.19.685**
300	25/25/50...	1:1:2...	JF440/300ER12ES8206FK7Th***	800	500	**50.19.690**
400	50/50...	1:1...	JF440/400ER8ES8206FK7Th***	1,600	2 x 421	**50.19.742**
500	50/50...	1:1...	JF440/500ER10ES8206FK7Th***	1,600	500 / 421	**50.19.800**
600	50/50...	1:1...	JF440/600ER12ES8206FK7Th***	1,600	2 x 500	**50.19.820**
Accessories						
100 mm high socket for easy supply cable connection		SO 100 / 800 / 600			5	**50.00.150**
200 mm high socket for easy supply cable connection		SO 200 / 800 / 600			10	**50.00.151**

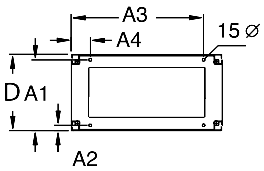
Other rated voltages, frequencies, outputs, reactors, mechanical configurations or variants with circuit breakers on request.
** With Prophi® 6T, *** With Prophi® 12T

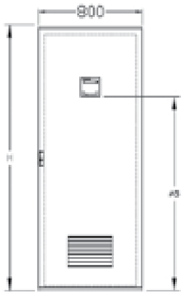
14 % de-tuned dynamic power factor correction, extractable design ES8206 Th

Main features

- Dynamic (t < 20 ms), de-tuned APFC in extractable design in steel cabinet
- Modular cabinet for free-standing mounting (expandable in output)
- Nominal voltage: 400 V, 3-phase, 50 Hz
- Reactors: 14 % (134 Hz series resonant frequency)
- Protection class: IP32
- Ventilation: From 120 kvar with fan in PFC cabinet door for forced cooling
- With power factor controller Prophi® 6T / 12T

Dimension diagrams





ES8206 (dimensions in mm):
H = 2,020, W = 800, D = 600, A1 = 537
A2 = 63, A3 = 737, A4 = 62, A5 = 1,480

Technical data

Nominal output kvar	Stage power kvar	Control ratio	Type	Width in mm	Weight in kg	Item no.
60	10/20/30	1:2:3	JF525/60ER6ES8206FK14Th*	800	290	**50.98.040**
75	12.5/12.5/25/25	1:1:2:2	JF525/75ER6ES8206FK14Th**	800	290	**50.98.080**
100	25/25/50	1:1:2	JF525/100ER4ES8206FK14Th**	800	306	**50.98.120**
120	20/20/40/40	1:1:2:2	JF525/120/ER6ES8206FK14Th**	800	306	**50.98.320**
100	12.5/12.5/25/50	1:1:2:4	JF525/100ER8ES8206FK14Th**	800	380	**50.98.200**
125	12.5/25/37.5/50	1:2:3:4	JF525/125ER10ES8206FK14Th**	800	390	**50.98.325**
150	12.5/12.5/25/50...	1:1:2:4...	JF525/150ER12ES8206FK14Th**	800	410	**50.98.330**
150	25/25/50/50	1:1:2:2	JF525/150ER6ES8206FK14Th**	800	410	**50.98.400**
175	12.5/25/37.5/50...	1:2:3:4...	JF525/175ERES8206FK14Th**	800	420	**50.98.440**
200	50/50/50/50	1:1:1:1	JF525/200ER4ES8206FK14Th**	800	430	**50.98.480**
200	25/25/50...	1:1:2...	JF525/200ER8ES8206FK14Th**	800	430	**50.98.520**
200	12.5/12.5/25/50...	1:1:2:4...	JF525/200ER16ES8206FK14Th**	800	435	**50.98.560**
250	50/50...	1:1...	JF525/250ER5ES8206FK14Th**	800	478	**50.98.600**
250	25/25/50...	1:1:2...	JF525/250ER10ES8206FK14Th**	800	490	**50.98.640**
250	12.5/12.5/25/50...	1:1:2:4...	JF525/250ER20ES8206FK14Th***	800	495	**50.98.645**
300	50/50...	1:1...	JF525/300ER6ES8206FK14Th**	800	500	**50.98.685**
300	25/25/50...	1:1:2...	JF525/300ER12ES8206FK14Th***	800	500	**50.98.690**
400	50/50...	1:1...	JF525/400ER8ES8206FK14Th***	1,600	2 x 421	**50.98.742**
500	50/50...	1:1...	JF525/500ER10ES8206FK14Th***	1,600	500 / 421	**50.98.800**
600	50/50...	1:1...	JF525/600ER12ES8206FK14Th***	1,600	2 x 500	**50.98.920**
Accessories						
100 mm high socket for easy supply cable connection	SO 100 / 800 / 600				5	**50.00.150**
200 mm high socket for easy supply cable connection	SO 200 / 800 / 600				10	**50.00.151**

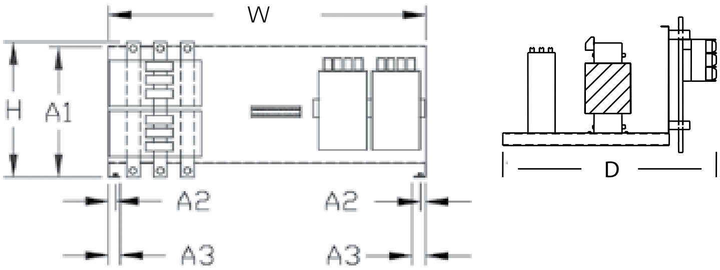
Other rated voltages, frequencies, powers, reactors, mechanical configurations or variants with circuit breakers on request.
** With Prophi® 6R, *** With Prophi® 12R

De-tuned, dynamic PFC modules extractable design

Main features

- Dynamic (t < 20 ms), de-tuned APFC in extractable desgin in steel cabinet
- For installation in existing switch gear or PFC cabinets
- Nominal voltage: 400 V, 3-phase, 50 Hz
- Reactors: 7 % (189 Hz series resonant frequency),
  14 % (134 Hz series resonant frequency)
- Protection class: IP32
- Ventilation: Natural cooling
  (care must be taken to ensure sufficient ventilation)
- With discharge resistors

Dimension diagrams



dimensions in mm:

H = 330, W = 703, D = 550

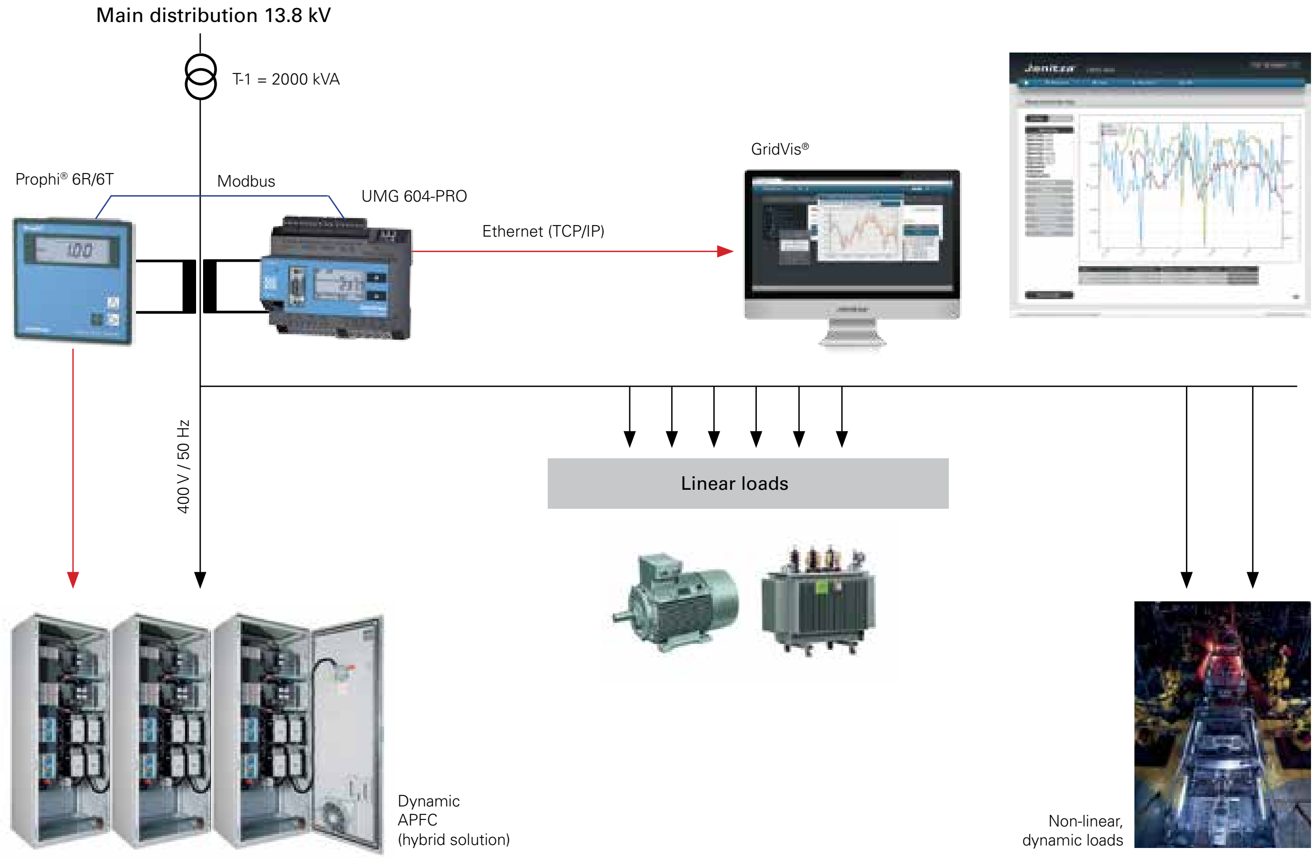
A1 = 290, A2 = 14, A3 = 26.5

Technical data

7 % de-tuned capacitor modules MO86FK7Th (width 800 mm, depth 600 mm)					
Nominal output kvar	Stage power kvar	Control ratio	Type	Weight in kg	Item no.
10	10		JF440/10EK1MO86FK7Th	26	**50.18.650**
12.5	12.5		JF440/12.5EK1MO86FK7Th	28	**50.18.680**
20	20		JF440/20EK1MO86FK7Th	35	**50.18.710**
25	25		JF440/25/EK1MO86FK7Th	35	**50.18.740**
40	40		JF440/40EK1MO86FK7Th	45	**50.18.770**
50	50		JF440/50EK1MO86FK7Th	47	**50.18.800**
20/2	10	1:1	JF440/20/2EK2MO86FK7Th	40	**50.18.801**
25/2	12.5	1:1	JF440/25/2EK2MO86FK7Th	42	**50.18.830**
30/2	10/20	1:2	JF440/30/2EK2MO86FK7Th	46	**50.18.860**
40/2	20	1:1	JF440/40/2EK2MO86FK7Th	57	**50.18.890**
50/2	25	1:1	JF440/50/2EK2MO86FK7Th	58	**50.18.930**
75/2	25/50	1:2	JF440/75/2EK2MO86FK7Th	76	**50.18.932**
80/2	40/40	1:1	JF440/80/2EK2MO86FK7Th	77	**50.18.933**
100/2	50/50	1:1	JF440/100/2EK2MO86FK7Th	90	**50.18.931**

14 % de-tuned capacitor modules MO86FK14Th (width 800 mm, depth 600 mm)					
Nominal output kvar	Stage power kvar	Control ratio	Type	Weight in kg	Item no.
10	10		JF525/10EK1MO86FK14Th	36	**50.12.650**
12.5	12.5		JF525/12.5EK1MO86FK14Th	37	**50.12.680**
20	20		JF525/20EK1MO86FK14Th	42	**50.12.710**
25	25		JF525/25EK1MO86FK14Th	43	**50.12.740**
40	40		JF525/40EK1MO86FK14Th	54	**50.12.770**
50	50		JF525/50EK1MO86FK14Th	56	**50.12.800**
20/2	10	1:1	JF525/20/2E2MO86FK14Th	57	**50.12.803**
25/2	12.5	1:1	JF525/25/2EK2MO86FK14Th	64	**50.12.804**
30/2	10/20	1:2	JF525/30/2EK2MO86FK14Th	69	**50.12.849**
40/2	20	1:1	JF525/40/2EK2MO86FK14Th	71	**50.12.850**
50/2	25	1:1	JF525/50/2EK2MO86FK14Th	73	**50.12.890**
75/2	25/50	1:2	JF525/75/2EK2MO86FK14Th	82	**50.12.893**
80/2	40/40	1:1	JF525/80/2EK2MO86FK14Th	84	**50.12.896**
100/2	50/50	1:1	JF525/100/2EK2MO86FK14Th	96	**50.12.892**

Other rated voltages, frequencies, outputs, reactors, mechanical configurations
or variants with circuit breakers on request.


Main distribution 13.8 kV
T-1 = 2000 kVA
Prophi® 6R/6T
Modbus
UMG 604-PRO
Ethernet (TCP/IP)
GridVis®
400 V / 50 Hz
Linear loads
Dynamic
APFC
(hybrid solution)
Non-linear,
dynamic loads

Reactors

Capacitors

Capacitor contactors

HRC fuses

EN 50160 / ISO 50001
Made in Germany

Power factor correction spare parts and accessories

Component selection table for a nominal voltage 400 V – 50 Hz

De-tuned power factor correction							
De-tuning factor %	Reactive output in kvar	Capacitor Item no.	Filter circuit reactors Item no.	Capacitor contactor Item no.	Cable diameter (mm²)	HRC fuse socket Item no.	HRC fuses Item no.
7	2.50	1 x JCP525 / 4.17-D 19.02.275	FKD 2.50 kvar / 7 % 04.01.500	KS 12.5 kvar / K3-18ND10230 01.02.025	4	NH / RSUmB / Gr00 / 3p 05.03.002	NHS10Gr00 05.05.000
7	5.00	1 x JCP525 / 8.33-D 19.02.249	FKD 5.00 kvar / 7 % 04.01.509	KS 12.5 kvar / K3-18ND10230 01.02.025	4	NH / RSUmB / Gr00 / 3p 05.03.002	NHS10Gr00 05.05.000
7	6.25	1 x JCS525 / 10.0-D 19.02.150	FKD 6.25 kvar / 7 % 04.01.510	KS 12.5 kvar / K3-18ND10230 01.02.025	4	NH / RSUmB / Gr00 / 3p 05.03.002	NHS16Gr00 05.05.001
7	10.00	1 x JCP400 / 9.30-D 19.02.219	FKD 10.0 kvar / 7 % 04.01.501	KS 12.5 kvar / K3-18ND10230 01.02.025	10	NH / RSUmB / Gr00 / 3p 05.03.002	NHS25Gr00 05.05.002
7	12.50	1 x JCP400 / 11.7-D 19.02.221	FKD 12.5 kvar / 7 % 04.01.502	KS 12.5 kvar / K3-18ND10230 01.02.025	10	NH / RSUmB / Gr00 / 3p 05.03.002	NHS25Gr00 05.05.002
7	15.00	1 x JCP400 / 9.30-D 19.02.221 1 x JCP525 / 8.30-D 19.02.249	FKD 15 kvar / 7 % 04.01.512	KS 20.0 kvar / K3-24A00230 01.02.026	10	NH / RSUmB / Gr00 / 3p 05.03.002	NHS35Gr00 05.05.003
7	20.00	2 x JCP400 / 9.30-D 19.02.219	FKD 20.0 kvar / 7 % 04.01.503	KS 20.0 kvar / K3-24A00230 01.02.026	10	NH / RSUmB / Gr00 / 3p 05.03.002	NHS50Gr00 05.05.004
7	25.00	2 x JCP400 / 11.7-D 19.02.221	FKD 25.0 kvar / 7 % 04.01.504	KS 25.0 kvar / K3-32A00230 01.02.027	16	NH / RSUmB / Gr00 / 3p 05.03.002	NHS63Gr00 05.05.005
7	30.00	3 x JCP400 / 9.30-D 19.02.219	FKD 30.0 kvar / 7 % 04.01.505	KS 50.0 kvar / K3-62A00230 01.02.029	35	NH / RSUmB / Gr00 / 3p 05.03.002	NHS63Gr00 05.05.005
7	40.00	3 x JCS440 / 15.0-D 19.02.125	FKD 40.0 kvar / 7 % 04.01.506	KS 50.0 kvar / K3-62A00230 01.02.029	35	NH / RSUmB / Gr00 / 3p 05.03.002	NHS100Gr00 05.05.007
7	50.00	4 x JCP400 / 11.7-D 19.0.2221	FKD 50.0 kvar / 7 % 04.01.507	KS 50.0 kvar / K3-62A00230 01.02.029	50	NH / RSUmB / Gr00 / 3p 05.03.002	NHS125Gr00 05.05.008
14	2.50	1 x JCP525 / 4.17-D 19.02.275	FKD 2.50 kvar / 14 % 04.01.525	KS 12.5 kvar / K3-18ND10230 01.02.025	4	NH / RSUmB / Gr00 / 3p 05.03.002	NHS10Gr00 05.05.000
14	5.00	1 x JCP525 / 7.70-D 19.02.202	FKD 5.00 kvar / 14 % 04.01.526	KS 12.5 kvar / K3-18ND10230 01.02.025	4	NH / RSUmB / Gr00 / 3p 05.03.002	NHS10Gr00 05.05.000
14	6.25	1 x JCP480 / 7.20-D 19.02.210	FKD 6.25 kvar / 14 % 04.01.529	KS 12.5 kvar / K3-18ND10230 01.02.025	4	NH / RSUmB / Gr00 / 3p 05.03.002	NHS16Gr00 05.05.001
14	10.00	1 x JCS525 / 15.0-D 19.02.103	FKD 10.0 kvar / 14 % 04.01.528	KS 12.5 kvar / K3-18ND10230 01.02.025	10	NH / RSUmB / Gr00 / 3p 05.03.002	NHS25Gr00 05.05.002
14	12.50	1 x JCS525 / 12.5-D 19.02.180 1 x JCP525 / 5.90-D 19.02.270	FKD 12.5 kvar / 14 % 04.01.530	KS 12.5 kvar / K3-18ND10230 01.02.025	10	NH / RSUmB / Gr00 / 3p 05.03.002	NHS25Gr00 05.05.002
14	15.00	1 x JCS525 / 12.5-D 19.02.180 1 x JCP525 / 10.0-D 19.02.150	FKD 15 kvar / 14 % 04.01.563	KS 20.0 kvar / K3-24A00230 01.02.026	10	NH / RSUmB / Gr00 / 3p 05.03.002	NHS35Gr00 05.05.003
14	20.00	1 x JCS525 / 12.5-D 19.02.180 1 x JCS525 / 15.0-D 19.02.103"	FKD 20.0 kvar / 14 % 04.01.531	KS 25.0 kvar / K3-32A00230 01.02.027	10	NH / RSUmB / Gr00 / 3p 05.03.002	NHS50Gr00 05.05.004
14	25.00	3 x JCS525 / 12.5-D 19.02.180	FKD 25.0 kvar / 14 % 0401532	KS 50.0 kvar / K3-62A00230 01.02.029	16	NH / RSUmB / Gr00 / 3p 05.03.002	NHS63Gr00 05.05.005
14	30.00	3 x JCS525 / 15.0-D 19.02.103	FKD 30.0 kvar / 14 % 04.01.561	KS 50.0 kvar / K3-62A00230 01.02.029	35	NH / RSUmB / Gr00 / 3p 05.03.002	NHS63Gr00 05.05.005
14	40.00	1 x JCS525 / 12.5-D 19.02.180 3 x JCS525 / 15.0-D 19.02.103	FKD 40.0 kvar / 14 % 04.01.533	KS 50.0 kvar / K3-62A00230 01.02.029	35	NH / RSUmB / Gr00 / 3p 05.03.002	NHS100Gr00 05.05.007
14	50.00	1 x JCS525 / 12.5-D 19.02.180 4 x JCS525 / 15.0-D 19.02.103	FKD 50.0 kvar / 14 % 04.01.534	KS 50.0 kvar / K3-62A00230 01.02.029	50	NH / RSUmB / Gr00 / 3p 05.03.002	NHS125Gr00 05.05.008

Component selection table for dynamic PFC

Dynamic power factor correction							
De-tuning factor %	**Reactive output in kvar**	**Capacitor Item no.**	**Filter circuit reactors Item no.**	**Thyristor actuator Item no.**	**Cable diameter (mm²)**	**HRC fuse socket Item no.**	**HRC fuses Item no.**
7	2.50	1 x JCP525 / 4.17-D 19.02.275	FKD 2.50 kvar / 7 % 04.01.500	TSM-LC10 THY 01.02.504	4	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/20A/Ultra Quick 05.05.068
7	5.00	1 x JCP525 / 8.33-D 19.02.249	FKD 5.00 kvar / 7 % 04.01.509	TSM-LC10 THY 01.02.504	4	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/20A/Ultra Quick 05.05.068
7	6.25	1 x JCS525 / 10.0-D 19.02.150	FKD 6.25 kvar / 7 % 04.01.510	TSM-LC10 THY 01.02.504	4	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/20A/Ultra Quick 05.05.068
7	10.00	1 x JCP400 / 9.30-D 19.02.219	FKD 10.0 kvar / 7 % 04.01.501	TSM-LC10 THY 01.02.504	10	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/25A/Ultra Quick 05.05.066
7	12.50	1 x JCP400 / 11.7-D 19.02.221	FKD 12.5 kvar / 7 % 04.01.502	TSM-LC10 THY 01.02.504	10	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/25A/Ultra Quick 05.05.066
7	15.00	1 x JCP400 / 9.30-D 19.02.221 1 x JCP525 / 8.30-D 19.02.249	FKD 15 kvar / 7 % 04.01.512	TSM-LC25 THY 01.02.505	10	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/50A/Ultra Quick 05.05.065
7	20.00	2 x JCP400 / 9.30-D 19.02.219	FKD 20.0 kvar / 7 % 04.01.503	TSM-LC25 THY 01.02.505	10	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/50A/Ultra Quick 05.05.065
7	25.00	2 x JCP400 / 11.7-D 19.02.221	FKD 25.0 kvar / 7 % 04.01.504	TSM-LC25 THY 01.02.505	16	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/63A/Ultra Quick 05.05.061
7	30.00	3 x JCP400 / 9.30-D 19.02.219	FKD 30.0 kvar / 7 % 04.01.505	TSM-LC50 THY 01.02.503	35	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/63A/Ultra Quick 05.05.061
7	40.00	3 x JCS440 / 15.0-D 19.02.125	FKD 40.0 kvar / 7 % 04.01.506	TSM-LC50 THY 01.02.503	35	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/100A/Ultra Quick 05.05.064
7	50.00	4 x JCP400 / 11.7-D 19.0.2221	FKD 50.0 kvar / 7 % 04.01.507	TSM-LC50 THY 01.02.503	50	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/125A/Ultra Quick 05.05.062
14	2.50	1 x JCP525 / 4.17-D 19.02.275	FKD 2.50 kvar / 14 % 04.01.525	TSM-LC10 THY 01.02.504	4	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/20A/Ultra Quick 05.05.068
14	5.00	1 x JCP525 / 7.70-D 19.02.202	FKD 5.00 kvar / 14 % 04.01.526	TSM-LC10 THY 01.02.504	4	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/20A/Ultra Quick 05.05.068
14	6.25	1 x JCP480 / 7.20-D 19.02.210	FKD 6.25 kvar / 14 % 04.01.529	TSM-LC10 THY 01.02.504	4	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/20A/Ultra Quick 05.05.068
14	10.00	1 x JCS525 / 15.0-D 19.02.103	FKD 10.0 kvar / 14 % 04.01.528	TSM-LC10 THY 01.02.504	10	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/25A/Ultra Quick 05.05.066
14	12.50	1 x JCS525 / 12.5-D 19.02.180 1 x JCP525 / 5.90-D 19.02.270	FKD 12.5 kvar / 14 % 04.01.530	TSM-LC10 THY 01.02.504	10	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/25A/Ultra Quick 05.05.066
14	15.00	1 x JCS525 / 12.5-D 19.02.180 1 x JCP525 / 10.0-D 19.02.150	FKD 15 kvar / 14 % 04.01.563	TSM-LC25 THY 01.02.505	10	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/50A/Ultra Quick 05.05.065
14	20.00	1 x JCS525 / 12.5-D 19.02.180 1 x JCS525 / 15.0-D 19.02.103	FKD 20.0 kvar / 14 % 04.01.531	TSM-LC25 THY 01.02.505	10	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/50A/Ultra Quick 05.05.065
14	25.00	3 x JCS525 / 12.5-D 19.02.180	FKD 25.0 kvar / 14 % 0401532	TSM-LC25 THY 01.02.505	16	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/63A/Ultra Quick 05.05.061
14	30.00	3 x JCS525 / 15.0-D 19.02.103	FKD 30.0 kvar / 14 % 04.01.561	TSM-LC50 THY 01.02.503	35	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/63A/Ultra Quick 05.05.061
14	40.00	1 x JCS525 / 12.5-D 19.02.180 3 x JCS525 / 15.0-D 19.02.103	FKD 40.0 kvar / 14 % 04.01.533	TSM-LC50 THY 01.02.503	35	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/100A/Ultra Quick 05.05.064
14	50.00	1 x JCS525 / 12.5-D 19.02.180 4 x JCS525 / 15.0-D 19.02.103	FKD 50.0 kvar / 14 % 04.01.534	TSM-LC50 THY 01.02.503	50	NH / RSUmB / Gr00 / 3p 05.03.002	NH00/125A/Ultra Quick 05.05.062

PFC-Accessories

Dynamic power factor correction

Thyristor control modules		
Item	**Weight in kg**	**Item no.**
Control module with Prophi® 6T controller (for 6 capacitor stages) MCCB, CT terminals and 2 m connection cable (mounted on the capacitor module)	3	**50.10.003**
Control module with Prophi® 12T controller (for 12 capacitor stages) MCCB, CT terminals and 2 m connection cable (mounted on the capacitor module)	3	**50.10.004**

Fixing rails		
Item	**Weight in kg**	**Item no.**
Set fixing rail, left / right (for Rittal cabinets MO84)	1	**50.00.100**
Set fixing rail, left / right (for Rittal cabinets MO86)	1.5	**50.00.101**

Accessory – Passive harmonics filter

Control modules	
Item	**Item no.**
Control module with Prophi® 6R controller, 6 stages (relay outputs) MCCB, CT terminals and 2 m connection cable (mounted on the capacitor module)	**50.80.003**
Control module with Prophi® 12R controller, 12 stages (relay outputs) MCCB, CT terminalsand 2 m connection cable (mounted on the capacitor module)	**50.80.004**

Fixing rail for slide-in modules in Rittal switch gear cabinets	
Item	**Item no.**
Set fixing rail, left / right (for Rittal cabinets MO84)	**50.00.100**
Set fixing rail, left / right (for Rittal cabinets MO86)	**50.00.101**

Power analyser with Ethernet connection and PQ analysis software		
Item		**Item no.**
UMG 508	With display, front panel mounting	**52.21.001**
UMG 604E-PRO	DIN rail mounting	**52.16.002**

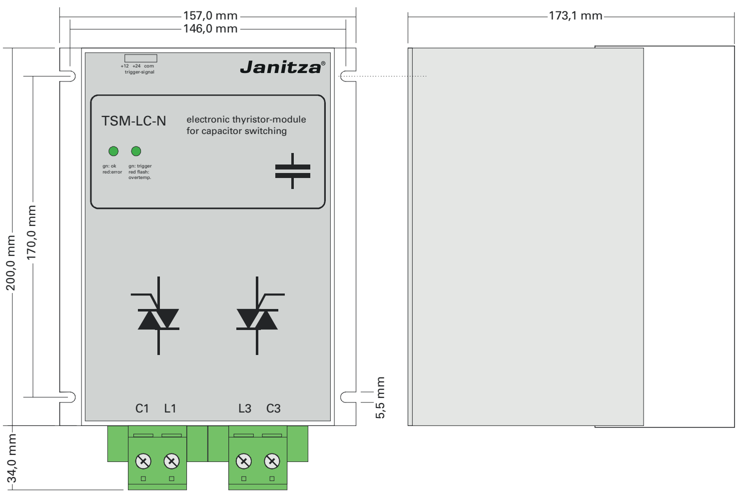
See main catalogue chapter 02 "Energy and power quality measurement products" for other variants

Electronic circuit breaker (thyristor controller)

Main features

- Areas of application: dynamic compensation of rapid processes (presses, welding machines, lifts, power plants, wind turbines, etc.)
- Component for developing dynamic compensation systems
- Optimisation of switching behaviour by microprocessor-controlled adaptation to unchoked or choked capacitor branches
- No wearing parts
- Monitoring of voltage, phase, temperature
- Instant switching
- No mains feedback from switching operations (transients)
- No auxiliary voltage required
- Maintenance-free
- Long service life
- No switching noise
- Improved connection technology (connectors)
- Improved temperature management

Dimension diagrams



Technical data

Nominal output kvar	Nominal voltage V (50/60 Hz)	Control V DC	Type	Dimensions in mm (W x H x D)	Superfast fuse in A	Weight in kg	Item no.
12,5	400	10 – 24	TSM-LC 10THY (400 V / 12,5 kvar)	162 x 150 x 75	35	1,75	**01.02.504**
25	400	10 – 24	TSM-LC-N 25THY (400 V / bis 25 kvar)	157 x 200 x 173	63	4,80	**01.02.516**
50	400	10 – 24	TSM-LC-N 50THY (400 V / bis 50 kvar)	157 x 200 x 173	125	4,80	**01.02.515**
50 – 85	400 – 690	10 – 24	TSM-LC-N690THY (690 V / bis 50 kvar)	157 x 200 x 190	125	4,80	**01.02.514**

09 Services


Janitza
harmonics voltage L1
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EN 50160 / ISO 50001
Made in Germany

Services

From planning to commissioning

After we have developed your technical solution, executed it and commissioned it, we continue to support you further:

- Training of your personnel
- Commissioning, maintenance and support of the systems
- Regular training for safe handling of energy management, power quality and our products and system solutions
- On-site power analysis of existing systems

Training: GridVis® software

GridVis® is an elementary module for your energy management and power quality monitoring systems. GridVis® serves to facilitate the programming and configuration of power analysers, universal measurement devices, data loggers and power factor controllers, as well as the configuration, storage, display, processing, analysis and evaluation of the measured data. Although GridVis® constitutes a highly intuitive software solution in use, the large scope of functionality should be noted. In order to ensure your personnel a rapid and efficient start, we recommend one day of GridVis® basic training as a minimum.

The aims of this training programme are:

- Starting out with the GridVis® software
- Installation of **GridVis®-Service (planner version, limited to 5 devices) as a full version for training purposes** on your laptops. The laptop must have administrator rights in order to facilitate the software installation!
- Acquisition of the most important basic functions of the software GridVis®

This training includes:

- Setting up the program
- Establishing user administration
- Creating projects
- Setting up UMG measurement devices
- Creating company-specific measurement structures
- Configuration of UMG measuring devices
- Configuration of the TCP/IP and Modbus connections
- Calling up online measured values
- Calling up and saving historical measured values
- Graphic display of the measured values
- Creating graph sets and topologies
- Setting threshold values (possible alarm routes)
- Reports / costs and quality reporting
- Access and configuration of the UMGs via web browser
- The following subjects are only briefly mentioned and no detailed training is provided:
  - Programming of the UMGs with Jasic®
  - APPs

Training	
Description	**Item no.**
GridVis® basic training for beginners: 1 day Minimum participants per course: 6 persons	**51.01.001**
GridVis® additional training for advanced users: 1 day Minimum participants per course: 6 persons Prerequisite: Basic knowledge of GridVis® available	**51.01.000**
GridVis® intensive training for power users (includes the GridVis® basic and additional training): 2 days Minimum participants per course: 6 persons Prerequisite: Basic knowledge of GridVis® available	**51.01.002**
Graphic programming with Jasic®: 1 day Minimum participants per course: 6 persons Prerequisite: Basic knowledge of GridVis®	**51.01.003**
Inhouse training at customer location	**51.01.004**

Commissioning

Janitza possesses decades of know-how in the field of energy measurement technology and complete monitoring systems. We shall be happy to support you from concept generation right through to the commissioning of your monitoring solutions. This encompasses the complete bandwidth of tasks:

- Installation of the GridVis® system software
- Creation of customer projects in GridVis® with measurement point structure
- Parametrisation of the measurement devices, data loggers and other components in the system according to customer specifications (VBI form for preparation)
- Checking the bus function and accessibility of the measurement devices
- Generation of graph sets
- Generation of topology views
- Brief instruction of the operating personnel on working with the hardware and software components of the Janitza energy management system
- Official system handover

Putting into service	
Description	**Item no.**
Creation of a **customer project incl. measurement point structure** (tree structure) with integration of up to 20 devices (e.g. UMG meters) in an existing IT structure with database set-up	**51.01.005**
Creation of a **customer project incl. measurement point structure** (tree structure) with integration of up to 100 devices (e.g. UMG meters) in an existing IT structure with database set-up	**51.01.006**
Creation of a **customer project incl. measurement point structure** (tree structure) with integration of more than 100 devices (e.g. UMG meters) in an existing IT structure with database set-up	**51.01.007**
Commissioning MBUS Gateway MG80	**51.01.069**

Other services

Other services	
Description	**Item no.**
Creation of a cost centre management with virtual devices and specific evaluations / reports	51.01.008
Creation of APPs and / or Jasic® programming	51.01.009
Alignment of a UMG device homepage	51.01.010
Project planning of an energy monitoring or power quality monitoring system Discussion and analysis of the actual status on site, formulation of a customer-specific solution	51.01.011
Maintenance of an energy monitoring or power quality monitoring system with checking of communication parameters, plausibility analysis of the measured values, device firmware and GridVis®upgrades ...	51.01.012
Integration test of generic Modbus devices	51.01.014
PQ QuickCheck to EN 61000-2-4/EN50160	51.01.024
Creation of dashboards / templates Creation of customer-specific dashboards and templates on a T&M basis. The customer will supply their specifications - Daily rate	51.01.061
Creation of widgets Creation of customer-specific widgets on a T&M basis. The customer will supply their specifications - Daily rate.	51.01.062

Checking the power quality and IT-compliant energy distribution

Energy and system check: Checking the power quality quality and TNS system-compliant electrical installation for IT and other systems.

In order to prevent damage and faults in the systems, a link with fault-free electrical supply systems must be created. If this unit is not established, faults can have a negative effect on operating equipment. Such operating equipment includes in particular sensitive operating equipment such as data transfer systems, PLC controls, as well as supply lines for gas and water (alternating current corrosion).

Occurrences such as faults in the IT system due to EMC problems, damage to systems through hazardous energy peaks, as well as strongly accelerated appearances of corrosion in buildings can lead to severe damage and production failures. Likewise, the personal safety of personnel and that of the system can also be endangered.

Fig.: Avoidance of stray currents on data lines


Fig.: Corrosion of pipes

Scope of performance

- Measurement and analysis of the electrical supply system
- Detecting potential error sources and fault factors
- Creation of a detailed report, which provides information on the actual status of the system
- Creation of a measures catalogue for the improvement and optimisation of the energy supply
- Further optional measures such as thermographic investigations, online monitoring including recurrent reporting, system monitoring for monitoring the improved systems, etc. on request

Benefits

- High operational reliability
- Reduction of production downtimes
- Substantiation of the system state
- Rapid overview of error sources
- Unique error code analysis
- Timely detection of system problems
- Cost centre optimisation of procurement material and repairs
- Extended service life of machines and systems
- Rapid data transfer
- Reports on damaging events
- Improvement of personnel and system protection

Customer-side prerequisites for execution

- Current transformers and voltage transformers must be available for measurement in the medium voltage power grid
- Presence of the system supervisor or a representative in their absence

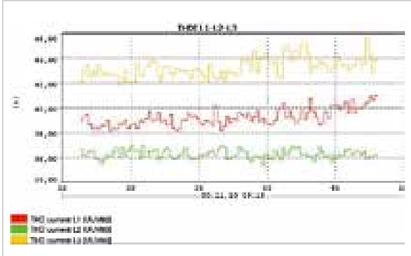


Fig.: Heating up of neutral conductors through high current harmonics

Other services	
Description	**Item no.**
On-site power quality analysis of an existing system Comprehensive network data logging with recording of error sources, evaluation of power quality per EN standard, the basic data (incl. U, I, P, Q, S, cos phi), the critical network parameters (incl. harmonics, flicker, transients), as well as PFC system dimensioning.	**51.01.013**

Power analysers for leasing

Who is not familiar with the problems of grid distortion effects caused by non-linear loads?

Typical problems such as defective LED lamps, exploded capacitors, short service lives of converters or other electrical loads, flicker occurrences, production failures due to voltage dips, etc. arise frequently in practice. With concrete power quality problems, whereby no fixed installation power analysers are available, we offer mobile power analysers from the MRG (UMG) range for temporary measurement and fault analysis. The network visualisation software GridVis®-Basic is made available in the portable measuring device and in the fixed installation UMG measurement devices. As such, no time-consuming training period is required.

Fig.: MRG portable PQ measuring device

Other services	
Description	**Item no.**
Loan device mobile energy measurement device MRG 96RM-E RCM Flex • Loan device for one week • For measuring, monitoring and the control of electrical characteristics in power distributions incl. residual current monitoring. • Evaluation with the software GridVis® • Incl. Rogowski coil, Item no. 15.03.604 (Ø 95 mm) or 15.03.605 (Ø 190 mm). The size of the Rogowski coil must also be specified in the order. • Current transformer for residual current monitoring on request.	**51.01.030**
Loan device power quality analyser MRG 512 PQ Flex for a power analysis according to EN 50160 • Loan device for one week • Extensive network data collection with recording of faults • Evaluation of critical network parameters (harmonics, short-time interruptions, ...) and PFC design as well • Evaluation with the software GridVis® • Incl. Rogowski coil, Item no. 15.03.604 (Ø 95 mm) or 15.03.605 (Ø 190 mm). The size of the Rogowski coil must also be specified in the order. • Current transformer for residual current monitoring on request.	**51.01.031**

Analysis and dimensioning of a power factor correction system

Daily power factor check – economic checking of power factor correction

Upon determining high reactive energy costs it is advisable to check whether the costs arising could be saved through the use of a power factor correction system.

In order to design such a system, the billing information of the energy supplier is first applied. If the power factor correction system exceeds 100 kvar, the network conditions installed on site should be determined in order to check for potential harmonic loads.
The requisite data is determined here with the aid of a three-phase measurement over 24 hours with load operation. In this way it is possible to check the efficiency of the power factor correction system, as well as the dimensioning in regards to of the harmonic load and further aspects.

Fig.: PFC system

Scope of performance

- Installation of the measuring equipment
- Documentation of the data from the billing documents of the energy supplier
- Acquisition of the local installation conditions
- Evaluation of the acquired results in the form of a short report
- Follow-up meeting
- Proposal for of an economical PFC system

Fig.: Open dynamic PFC system

Benefits

Short amortisation times, lengthy service life and economical investments are guaranteed through a PFC system optimally tailored to the conditions and requirements. If, however, incorrect configuration arises – for example due to systems being too large or too small by design – this leads to increased investment costs and inaccurate power dimensioning. Incorrectly dimensioned PFC systems in terms of harmonic loads lead in some circumstances to resonance and to a short service life of the PFC system.

Customer-side prerequisites for execution

- Availability of a 230-V power supply at the measurement point
- Presence of the system supervisor or a representative in their absence

Other services	
Description	**Item no.**
Daily reactive power check	**51.01.023**

PFC maintenance with performance per the maintenance contract

Annual reactive power check – function and safety checking of a PFC system

With the aid of a power factor correction system it is possible on the one hand to avoid superfluous reactive power costs by the energy provider, whilst also guaranteeing the optimisation of the energy costs. Furthermore, an improvement in the power quality is also guaranteed with a detuned PFC system because the harmonic currents can be effectively filtered from the network. Checking of the PFC system, which should take place once annually, ensures a long service life and optimum power capability.

Scope of performance

- Visual inspection of the system, which encompasses the following points: Parts, contactors, fans, connections, capacitors, reactors, lines, checking the housing for damage and deformation
- The regular elimination of dust and pollution prevents creepage distances and short circuits from arising and safeguards the air cooling
- Measurement and recording of the power values for function testing
- Creation of a test report for the actual status of the system
- Further measures: Thermographic testing, etc.

Benefits

Through consistent care and ensuring the functionality of the system, the following desired beneficial effects and advantages are attained:

- Avoidance of reactive energy costs on a monthly basis, e.g. it is possible to save up to € 500 per month in Germany through the economical configuration of a PFC system with 300 kvar
- Only a carefully maintained system guarantees a long service life; insufficiently cared for systems can also pose a safety risk
- Very short amortisation times of just 1 to 2 years can be guaranteed through a functional PFC system

Other services	
Description	**Item no.**
Annual PFC check	**51.01.025**
PFC maintenance with performance per the maintenance contract	**51.01.017**

TeamViewer sessions

Our engineers and service technicians possess many years of experience and are frequently able to support you without difficulty by way of a remote session in the event of problems and new systems. Furthermore, remote commissioning and training are also possible via remote maintenance.

Other services	
Description	**Item no.**
TeamViewer sessions	51.01.050

Remote maintenance contracts on an annual basis

Safeguard your monitoring and energy management system by having it checked once annually, and keep it in line with the latest engineering practice! Janitza remote maintenance contracts encompasses services including the following:

- Database: Availability, size, available storage
- Availability of the measurement devices (communication to the UMGs)
- Measurement device settings
- Verification of the recorded measured data
- Running test reports
- Under certain circumstances upgrade of the GridVis® system software
- Under certain circumstances upgrade of the UMG firmware

Other services	
Description	**Item no.**
Remote maintenance contracts on an annual basis	51.01.060

Calibration with calibration reports

Calibration includes the following services:
- Visual inspection for external damage
- Opening the device and visual inspection for observable damage to electronics and circuit paths
- Comprehensive function check with automatic testing
- Firmware update
- Calibration
- High voltage test (safety check)
- Provision of a factory calibration report

Other services	
Description	**Item no.**
Calibration with calibration reports	88.10.015

10 Technical annex

Technical annex

Valid standards

Janitza develops, produces and tests its measurement devices and products according to internationally valid standards and directives. The most important national and international standards in conjunction with our products, solutions and applications are as follows:

General standards and EMC standards:

- IEC/EN 60868-0: Assessment of the flicker strength.

- IEC/EN 61000-2-2: Electromagnetic compatibility (EMC): Ambient conditions; compatibility level for low frequency, conducted interferences and signal transferral in public low voltage networks.

- IEC/EN 61000-2-4: Electromagnetic compatibility (EMC): Ambient conditions; compatibility level for low frequency, conducted interferences in industrial plants.

- IEC/EN 61000-3-2: Threshold values for harmonic currents for electrical devices with current consumption of < 16 A per phase.

- IEC/EN 61000-3-3: Threshold values – limit of voltage changes, voltage variations and flicker in public low voltage supply networks for devices with a rated current < = 16 A per phase.

- IEC/EN 61000-3-4: Electromagnetic compatibility (EMC): Threshold values limit of transmission of harmonic currents in low voltage supply networks for devices and equipment with rated currents of over 16 A.

- IEC/EN 61000-3-11: Electromagnetic compatibility (EMC): Threshold values – limit of voltage changes, voltage variations and flicker in public low voltage supply networks; devices and equipment with a rated current < = 75 A.

- IEC/EN 61000-3-12: Threshold values for harmonic currents, caused by devices and equipment with a current input of > 16 A and ≤ 75 A per phase, which are intended for connection with public low voltage networks.

- IEC/EN 61557-12: Electrical safety in low voltage networks up to AC 1000 V and DC 1500 V – Devices for testing, measuring or monitoring protective measures.

Power quality standards:

- EN 50160: Characteristics of the voltage (PQ) in public electricity supply networks.

- D-A-CH-CZ: Technical regulations for the evaluation of grid distortion effects in Germany, Austria, Switzerland and the Czech Republic.

- TOR D2: Technical and organisational regulations for operators and users of electrical networks, Part D: Special technical regulations; section D2: Directives for the evaluation of grid distortion effects.

- IEEE 519: (Recommended Practices and Requirements for Harmonics Control in Electrical Power Systems) as a common recommendation from energy suppliers and operators for limiting the effects of non-linear loads through the reduction of harmonics.

- ENGINEERING RECOMMENDATION: G5/4-1 (planning levels for harmonic voltage distortion to be used in the process for the connection of non-linear equipment) as a directive of the Energy Networks Association (UK) for limiting the effects of non-linear loads through the reduction of harmonics at the transition point (PCC). Valid in Great Britain and Hong Kong.

- IEEE1159-3 PQDIF: Recommended Practice for the Transfer of Power Quality Data (data exchange format for power quality data).

- ITIC (CBEMA): The ITI curve of the Information Technology Industry Council (ITI) represents the withstand capability of computers / power supplies in relation to the height and duration of voltage variations.

Standards for PQM devices (power quality analysers)

- IEC/EN 61000-4-2: Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test.

- IEC/EN 61000-4-3: Electromagnetic compatibility (EMC)Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test.

- IEC/EN 61000-4-4: Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test.

- IEC/EN 61000-4-5: Electromagnetic Compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test.

- IEC/EN 61000-4-6: Electromagnetic compatibility (EMC)Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields.

- IEC/EN 61000-4-7: Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques – General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto.

- IEC/EN 61000-4-8: Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test.

- IEC/EN 61000-4-11: Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests.

- IEC/EN 61000-4-15: Electromagnetic compatibility (EMC) – Part 4-15: Testing and measurement techniques – Flickermeter – Functional and design specifications.

- IEC/EN 61000-4-30: Electromagnetic compatibility (EMC) – Part 4-30: Testing and measurement techniques – Power quality measurement methods.

Standards for energy measurement devices

- DIN EN 62053-21: Electricity metering equipment (a.c.) – Particular Requirements – Part 21: Static meters for active energy (classes 1 and 2).

- DIN EN 62053-22: Electricity metering equipment (a.c.) – Particular requirements – Part 22: Static meters for active energy (classes 0,2 S and 0,5 S).

- DIN EN 62053-23: Electricity metering equipment (a.c.) – Particular requirements – Part 23: Static meters for reactive energy (classes 2 and 3).

- DIN EN 62053-31: Electricity metering equipment (a.c.) – Particular requirements – Part 31: Pulse output devices for electromechanical and electronic meters (two wires only.

- DIN EN 60529: Degrees of protection provided by enclosures (IP code).

Standards for energy management

- DIN EN ISO 50001: Energy management systems – Requirements with instructions on application.

- DIN EN 16247-1: Describes the requirements for an energy audit, which enables small and medium-sized companies (SME) to improve their energy efficiency and reduce their energy consumption.

- DIN EN 16247-1: Energy audits – Part 1: General requirements; possibility for small and medium-sized companies (SME), in the sense of recommendation 2003/361/EC of the European Commission, to fulfil the requirements of the electricity and energy tax legislation for surplus settlement.

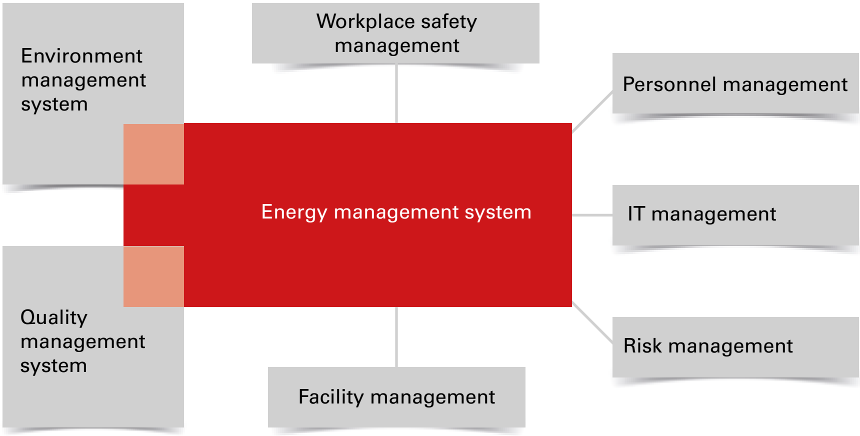
Energy(data)management – or why ISO 50001 is not everything

We are constantly confronted with the question: "You sell energy management systems?!" The response is always the same: "Yes and no". Our product portfolio encompasses components, software and solutions for the acquisition and analysis of energy-related data and is therefore also the basis for various possible tasks and objectives, and accordingly also for an energy management system.

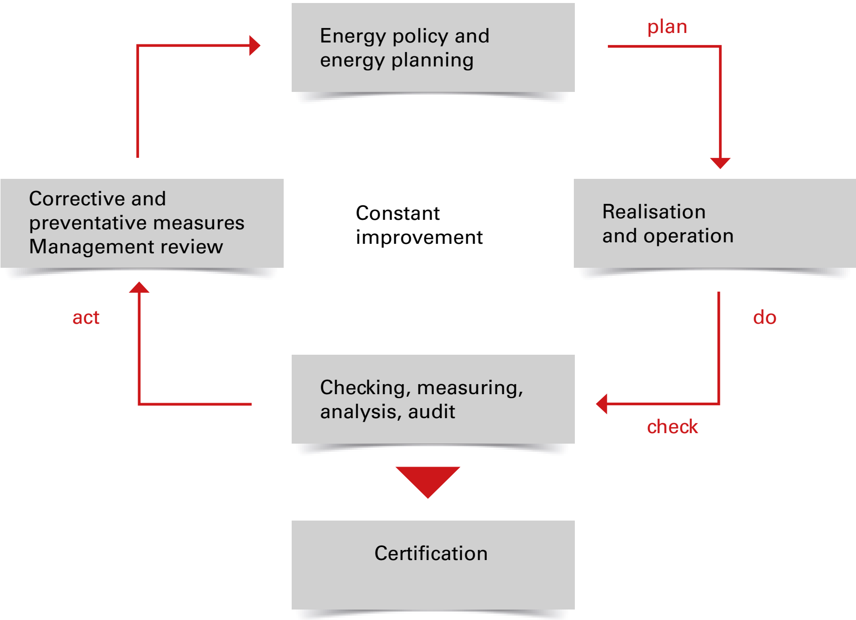
ISO 50001

ISO 50001 is the standardised basis for the introduction of an energy management system. The focus here lies on the term management system. This is a methodology, applied in conjunction with other management systems such as ISO 9001 or ISO 14001, through which to set objectives, implement these systematically and in doing so eliminate the chance factor insofar as possible. The term "objective" should essentially be understood here in the sense of "the route is the objective".

Using the PDCA system or Plan-Do-Check-Act a CIP (constant improvement process) is pursued, which assesses the step-by-step processes and procedures for their optimisation potential, as well as stipulating measures and responsibilities and the resources and time frames required for these. ISO 50001 is similar in configuration to ISO 9001 or ISO 14001 and can therefore be easily integrated into existing management systems. This considerably eases the work involved in introduction.



The word "check" in the PDCA process also pertains to the subject of measured data acquisition and evaluation, or expressed otherwise: Energy data management. Without measurement it is not possible to obtain a target/actual comparison or a benchmark. Although no clear specifications are described in ISO 50001 in relation to the scope and frequency of energy measurements, in practice it is apparent that a minimum volume of measuring technology is required for constant acquisition – at least for all significant loads – otherwise potential can only be determined to a limited degree and saving objectives cannot be adequately attained on a comprehensive basis. Customers who have achieved their certification with a minimum measurement scope recognise – during the ongoing PDCA process – the benefits of comprehensive monitoring across as many loads as possible.



Our measuring systems are scalable in application and grow with the requirements of the customer. Existing structures can be incorporated, and likewise our measuring devices can be integrated in existing systems.

Questions are regularly asked regarding the gauging and subsequent calibration of measuring devices in conjunction with the introduction of ISO 50001. The standard does not specify one or the other. Measuring devices in the form of calibrated meters are not a requirement, nor is the re-calibration of measuring devices at regular intervals. This would mean an infeasible volume of work, because digital measuring devices cannot usually be calibrated whilst installed.

The company requiring certification must merely ensure the comparability of the measurements within the various time frames, and document the checks in the usual way. For our universal measuring devices – if used as intended (ambient temperature!) – this means the accuracy of measurement is always better even after years of use than that of conventional meters immediately after delivery. In practice, we recommend random comparative or parallel measurement of the power and energy values with a high quality measuring device such as our portable measuring devices MRG 605 or MRG 511, via the current transformer measurement terminal strips available from us.

Who even needs ISO 50001?

(most recent German legal situation 2013)

EEG § 40 ff. – EEG levy reduction

Under certain conditions companies are entitled to submit an application for a reduction in the EEG (German renewable energy act) levy.

- The company must belong to the manufacturing industry
- The electricity costs must account for at least 14 % of the gross value added
- The annual consumption must be at least 1 GWh per site
- **From an annual consumption of 10 GWh, certification per ISO 50001 is required in order to request the reduction**

Information on the subject and application can be obtained from the Federal Office of Economics and Export Control: www.bafa.de/bafa/en/index.html

The regulation is intended to secure the international competitiveness of energy-intensive companies. Due to the increase in the proportion of renewable energy generators, the EEG levy is likely to continue rising considerably. This means a significant competitive disadvantage for energy-intensive companies. Despite all the half-truths being touted by the media, in practice it is apparent that the lion's share of all companies who have applied for the EEG reduction and received approval for this are actually amongst the most energy-intensive companies and are in international competition. A significantly greater proportion of companies with a high power consumption of > 1 GWh per year fell at the first hurdle of the approval process, with the 14 % gross value added requirement.

Electricity tax law § 10 – surplus settlement

Under certain conditions, companies in the manufacturing sector are able to benefit from the so-called surplus settlement according to § 10 StromStG. This allows companies to obtain a reimbursement or tax relief against their remaining tax burden, through the application of § 9b StromStG. This "relief in special cases" (surplus settlement) is only granted if the tax burden exceeds € 1,000 in the calendar year (excess/basic amount). The rate of relief is dependent on the difference between the energy tax, which exceeds the basic amount, and the (notional) relief, which is derived on the basis that pension contributions have fallen since the introduction of energy tax (general pension contribution was 20.3 % prior to the introduction of energy tax and now stands at 18.9 %; with an employer contribution of 50 % this means a reduction of 0.7 % for the employer in 2013; the "difference"). A maximum 90 % of this difference is granted as relief, reimbursed or credited. This calculation formula leads to companies with a high power consumption and few employees (subject to statutory pension contributions) profiting in particular from the surplus settlement.

Since 2013 large companies require a certified energy management system per ISO 50001 in order to request the surplus settlement. For small and medium-sized companies (SME) an energy audit per DIN EN 16247-1 is sufficient.

You can receive applications and information from the main customs office responsible: www.zoll.de/EN/Home/home_node.html

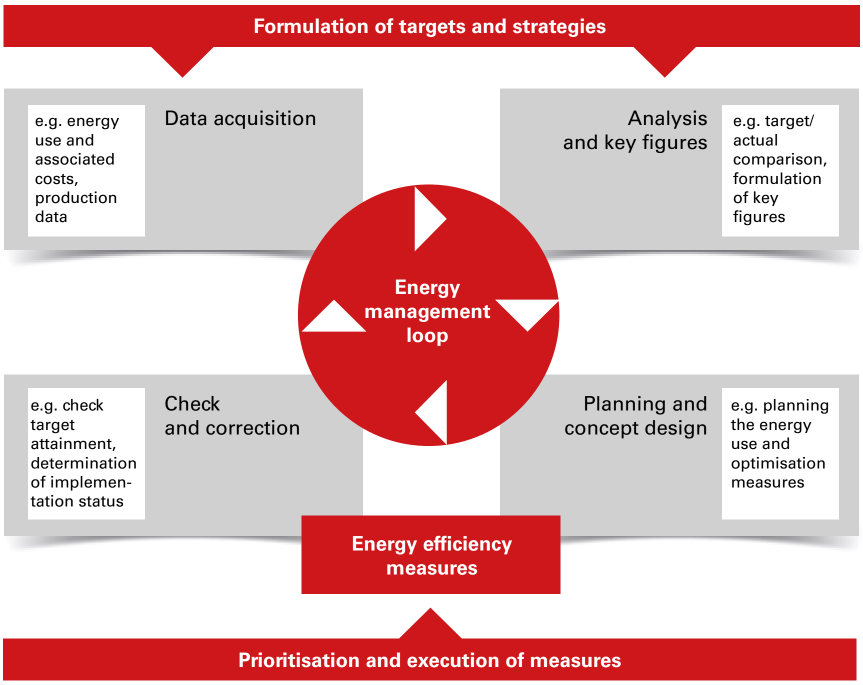
In practice:

Managing director F. to works manager A.: "How much current do we actually use?" Works manager A.: "Not entirely sure, certainly a lot!" Managing director F.: "Be sure to change that!" Works manager A. to site electrician M.: "We need to reduce our energy costs. Take care of it." One year later. Managing director F. to works manager A.: "The energy bills are as high as ever. How is that possible?" Works manager A.: "I need to ask M. that." Works manager A. to site electrician M.: "We are still paying crazy energy bills. How is that possible? I told you that you needed to sort that out!" Site electrician M.: "Yes boss. But the controller cancelled the cash for new drives, then my colleague was ill for four weeks and you know that day-to-day work is hectic, the telephone rings constantly and everyone wants something!"

... with ISO 50001 that would not have happened!

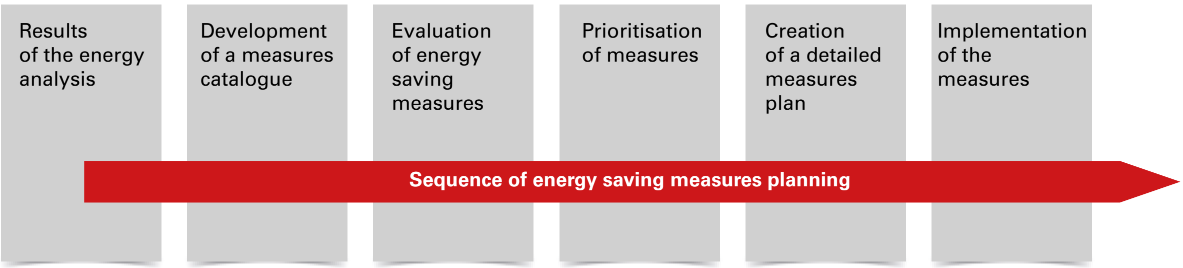
Who else needs an energy management system (EnMS)?

Essentially, every company that consumes a certain amount of power and has a large number of different loads and processes benefits from the introduction of an energy management system per ISO 50001. The system behind this ensures sustainable targeted measures for the reduction of energy costs. Furthermore, an EnMS per ISO 50001 will also become an increasingly significant marketing instrument for the presentation of a green and environmentally aware company philosophy in the future.



Energy management constitutes a closed loop with the objective of constant improvement.

One must concede that professionally functioning companies do not necessarily need to establish a certified management system within their organisation, in order to reduce their energy costs on a sustained basis. Furthermore, there are countless companies, for whom the legal prerequisites for an EEG levy reduction or the surplus settlement are irrelevant, whereby ISO 50001 is not a significant subject. However, energy costs remain high. Anyone who establishes the requisite transparency with an energy data management system from Janitza, lays in place the cornerstone for sustainable energy-conscious housekeeping.



Peak load management and grid fees

A further important aspect for cost reduction, which can be pursued with an energy data management system, is the control and reduction of peak loads. Electricity supply companies calculate grid fees on the basis of the maximum load measured within a quarter of an hour. This value then applies under certain circumstances for the entire year. However, it may be that this value was simply arbitrary or coincidental. It is frequently the case that the actual "troublemakers", responsible for the generation of peak loads, are not immediately discernible.

Only those companies who create transparency regarding the load curves of their significant loads will be able to actively counter these. This can take place through the targeted switching off of loads, through the switching on of their own generators or – where this is not possible for process reasons – with time-delayed switch-on processes or the shutting down of unimportant processes.
According to § 19 section 1 StromNEV (Germany) – special forms of grid use, a further and frequently unknown factor is that supply companies are required to offer their customers a reduced monthly supply tariff if the peak load measured once was significantly higher than normal for the respective company due to unusual circumstances.

Load management and optimisation of production processes

It is not only peak loads that increase energy costs. Investigations into large production operations have shown that even during shift-free periods and idle phases, depending on the process, annual power consumptions of multiple gigawatt hours can arise per site! A fine-meshed network of measurement points within the production structures in conjunction with modern PLC controllers and production control systems enable automated optimisation in real-time at high level. Janitza monitoring devices and systems are suitable for

You can find a helpful overview of all subjects pertaining to ISO 50001, energy efficiency and subsidy options for the German market on the following internet sites:

Federal Office of Economics and Export Control: www.bafa.de/bafa/en/index.html

From the main customs offices:
www.zoll.de/EN/Home/home_node.html

DENA – German energy agency:
www.dena.de/en.html

The DENA list of certified energy consultants:
www.energie-effizienz-experten.de

Credit institute for reconstruction
www.kfw.de/kfw.de-2.html

A comprehensive overview of all subsidy measures:
www.foerderdatenbank.de

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety:
www.bmu.de/energieeffizienz

NRW energy agency:
www.energie-im-unternehmen.de
IHK, TÜV and DEKRA on their state-specific websites

this task due to their open communication interfaces, the high sampling rate and accuracy of measurement.

Load management and purchasing electricity

Anyone who knows their load curves and buys electricity on the spot market is naturally able to do so with pinpoint accuracy, with precise knowledge of their volatile demand due to their load profiles.

Grants and public funds

The state provides comprehensive assistance for the implementation of measures and investment in systems and operating equipment for the enhancement of energy efficiency. From low-interest credit to actual investment grants and covering the costs of (sometimes mandatory) certified energy consultants. The list is long and the offers change all the time and vary from country to country.

MID – Measuring Instruments Directive

The abbreviation MID stands for the term **"Measuring Instruments Directive"** and is the equivalent of the German term **"Messgeräte-Richtlinie"**. This refers to the measuring instruments directive 2004/22/EC of the European parliament and the council dated the 31st March 2004.

What are the aims of the MID?

- EU-wide regulation of the market access of respective measuring devices
  - Creation of a harmonised European market for measuring devices
  - Uniform approval process for all EU states and individual additional states
  - Single, uniform approval testing
  - Uniform, cross-border specification for first calibration
- Uniform product labelling
- Reduction of tests and test costs
  - First calibration takes place through a manufacturer's declaration of conformity
  - Separate calibration testing and calibration fees omitted
  - Reduced delivery times
- Equality in competition due to high requirements for product quality
  - Additional requirements regarding precision in the small load range
  - Higher EMC requirements
  - Improved picture of the latest measuring technology status

What does MID regulate?

The MID applies to 10 types of measuring device (electricity meters, water meters, gas meters, etc.) in the fields of statutory metrology, and defines fundamental and measuring device-specific requirements.

A conformity evaluation process – whereby the cooperation of a notified body chosen by the manufacturer is prescribed – replaces the previous first calibration by the calibration authority or the state-certified test centre.

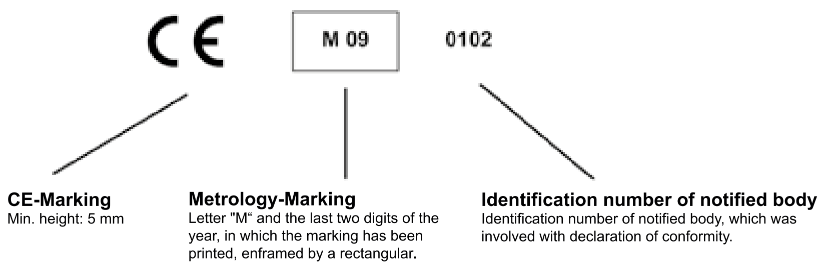
It transfers the responsibility for first circulation and first commissioning within the EU to the manufacturer. After this, national law applies.

The manufacturer must select one of the conformity evaluation processes prescribed in the MID, through which they guarantee the compliance of the measuring device with the MID under the supervision of a notified body. Only then is it permissible to put the measuring device - compliant with the MID - into circulation or into operation. A declaration of conformity must be supplied with the meter. This is frequently printed in the operating manual.

Following circulation or commissioning of the measuring device, the responsibility for attaining accurate measuring results passes to the user.

Labelling the devices

The sequence of MID labelling is prescribed and must comply with the following example:



Re-calibrating?

The MID has no effect on re-calibrating according to calibration regulations. Measuring devices, whose conformity has been specified in a prescribed conformity evaluation process and which are correctly labelled, are deemed in German to have been initially calibrated.

The measuring device user is once again responsible for submitting a timely application for re-calibration.

The duration of calibration validity is stipulated in the national calibration ordinance. In Germany, this is a period of eight years after MID labelling in the case of electronic electricity meters.

Further information applicable to Germany can be found under the following link: www.eichamt.de

Overview of the various power quality parameters

In modern energy supply a wide range of single and three-phase, non-linear loads are used in industrial networks right through to office blocks. These include lighting equipment such as lighting controls for headlamps or low energy bulbs, numerous frequency converters for heating, air conditioning and ventilation systems, frequency converters for automation technology or lifts, as well as the entire IT infrastructure with the typically used regulated switched mode power supplies. Today, one also commonly finds inverters for photovoltaic systems (PV) and uninterruptible power supplies (UPS). All of these non-linear electrical loads cause grid distortion effects to a greater or lesser extent, with a distortion of the original "clean" sinusoidal form. This results in the current or voltage waveform being distorted in the same way.

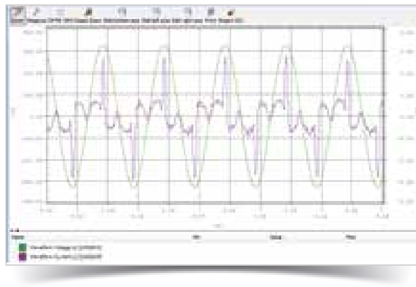


Fig.: Distorted current form through consumer electronics

The reliable operation of modern plants and systems always demands a high degree of supply reliability and good power quality.

The load on the network infrastructure through electrical and electronic loads with grid distortion effects has increased significantly in recent years. Depending on the type of generation system and the operating equipment (mains feed with converter, generator), mains rigidity at the connection point and the relative size of the non-linear loads, varying strengths of grid distortion effects and influences arise.

The following power quality parameters must be taken into particular consideration:

- Harmonics
- Current and voltage unbalance
- Rapid voltage changes - transients
- Voltage dips and short-term overvoltage
- Voltage interruption (SIs - short term interruptions)
- Flicker
- Phase shifting and reactive power

Harmonics

The constantly rising number of non-linear loads in our power networks is causing increasing "noise on the grid". One also speaks of grid distortion effects, similar to those that arise in the environment due to water and air pollution. Generators ideally produce purely sinusoidal form current at the output terminals. This sinusoidal current form is considered the ideal alternating current form and any deviation from this is designated mains interference.

An increasing number of loads are extracting non-sinusoidal current from the grid. The FFT-Fast-Fourier-Transformation of this "noisy" current form results in a broad spectrum of harmonic frequencies - often also referred to as harmonics.

Harmonics are damaging to electrical networks, sometimes even dangerous, and connected loads are harmed by these; in a similar way to the unhealthy effect that polluted water has on the human body. This results in overloads, reduced service lives and in some cases even the early failure of electrical and electronic loads.

Harmonic loads are the main cause of invisible power quality problems and result in massive maintenance and investment costs for the replacement of defective devices. Grid distortion effects of an impermissible high level and the resultant poor power quality can therefore lead to problems in production processes and even to production downtimes.

Harmonics are currents or voltages whose frequency lies above the 50/60-Hz mains frequency, and which are many times this mains frequency. Current harmonics have no portion of the effective power, they only cause a thermal load on the network. Because harmonic currents flow in addition to "active" sinusoidal oscillations, they cause electrical losses within the electrical installation. This can lead to thermal overloads. Additionally, losses in the load lead to heating up or overheating, and therefore to a reduction in the service life.

The assessment of harmonic loads usually takes place at the connection or transition point to the public mains supply network of the respective energy supplier. One speaks in this case of a Point of Common Coupling (PCC). Under certain circumstances it may also be important to determine and analyse the harmonic load through individual operating equipment or equipment

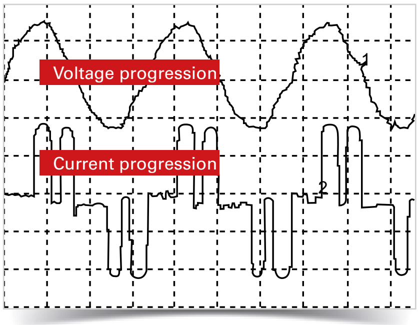


Fig.: Grid distortion effects through frequency converters

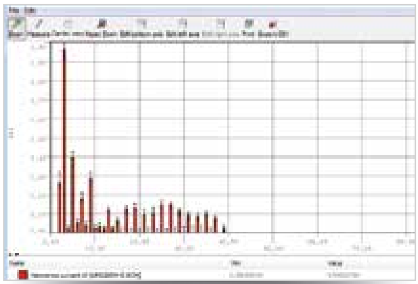


Fig.: Harmonics analysis (FFT)

Threshold values of individual harmonic voltages at the transition point up to the 25th order as a percentage of the fundamental oscillation U1					
Odd harmonics				Even harmonics	
No multiple of 3		Multiple of 3			
Order h	**Relative voltage amplitude U_h**	**Order h**	**Relative voltage amplitude U_h**	**Order h**	**Relative voltage amplitude U_h**
5	6.0 %	3	5.0 %	2	2.0 %
7	5.0 %	9	1.5 %	4	1.0 %
11	3.5 %	15	0.5 %	6 to 24	0.5 %
13	3.0 %	21	0.5 %		
17	2.0 %				
19	1.5 %				
23	1.5 %				
25	1.5 %				

groups, in order to indicate internal power quality problems and possibly determine their causes.

The following parameters are used to assess harmonic loads:

Total Harmonic Distortion (THD)

Total Harmonic Distortion (THD) is a means of quantifying the proportion of distortion arising due to the non-linear distortion of an electrical signal. It therefore gives the ratio of the effective value of all harmonics to the effective value of the mains frequency. The THD value is used in low, medium and high voltage systems. Conventionally, THD_i is used for the distortion of current, and THD_u for the distortion of voltage.

Fig.: Capacitors destroyed due to harmonics

THD for voltage

- M = Ordinal number of harmonics
- M = 40 (UMG 604-PRO, UMG 508, UMG 96RM)
- M = 63 (UMG 605-PRO, UMG 511)
- Mains frequency fund equals n = 1

$$THD_U = \frac{1}{|U_{fund}|}\sqrt{\sum_{n=2}^{M}|U_{n.Harm}|^2}$$

THD for current

- M = Ordinal number of harmonics
- M = 40 (UMG 604-PRO, UMG 508, UMG 96RM)
- M = 63 (UMG 605-PRO, UMG 511)
- Mains frequency fund equals n = 1

$$THD_I = \frac{1}{|I_{fund}|}\sqrt{\sum_{n=2}^{M}|I_{n.Harm}|^2}$$

Total Demand Distortion (TDD)

In North America in particular, the expression TDD is commonly used in conjunction with the issue of harmonics. It is a figure that refers to THD_i, although in this case the total harmonic distortion is related to the fundamental oscillation portion of the nominal current value. The TDD therefore gives the relationship between the current harmonics (analogous to the THD_i) and the effective current value under **full load conditions** that arises within a certain interval. Standard intervals are 15 or 30 minutes.

$$TDD = \frac{1}{I_L}\sqrt{\sum_{n=2}^{M} I_n^2} \times 100\%$$

TDD (I)

- TDD gives the relationship between the current harmonics (THD_i) and the effective current value with a full load.
- I_L = Full load current
- M = 40 (UMG 604-PRO, UMG 508, UMG 96RM)
- M = 63 (UMG 605-PRO, UMG 511)

Current / voltage unbalance

One speaks of balance in a three-phase system if the three phase voltages and currents are of an equal size and are phase-shifted at 120° to each other.

Unbalance arises if one or both conditions are not fulfilled. In the majority of cases the cause of unbalance lies in the loads.

In high and medium voltage power grids the loads are usually three-phase and symmetrical, although large one- or two-phase loads may also be present here (e.g. mains frequency induction furnaces, resistance furnaces, etc.). In the low voltage network electrical loads are frequently also single-phase (e.g. PCs, consumer electronics, lighting systems, etc.), and the associated load current circuits should be distributed as evenly as possible within the electrical wiring on the three phase conductors. Depending on the symmetry of the single-phase loads, the network is operated on a more balanced or unbalanced basis.

The compatibility level for the degree of unbalance of the voltage in stationary operation caused by all mains loads is defined as ≤ 2 %. Related to individual load systems the resultant degree of unbalance is limited to = 0.7 %, whereby an average over 10 minutes must be obtained.

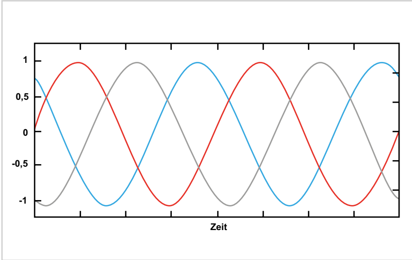


Fig.: Balance

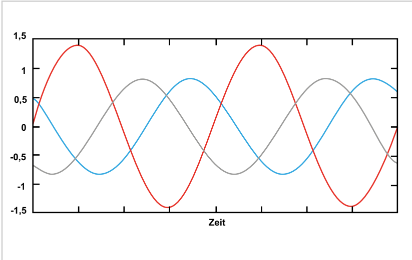


Fig.: Unbalance

The following effects arise due to unbalance in the voltage:

- Increased current loading and losses in the network.
- With equal load power the phase currents can attain 2 to 3 times the value, the losses 2 to 6 times the value. It is then only possible to load lines and transformers with half or one third of their rated power.
- Increased losses and vibration moments in electrical machinery.
- The field built up by the negative sequence component of the currents runs against the phase sequence of the rotor and therefore induces currents in it, which lead to increased thermal loading.
- Rectifiers and inverters react to unbalance in the power supply with uncharacteristic harmonic currents.
- In three-phase systems with star connection, current flows through the neutral conductor.

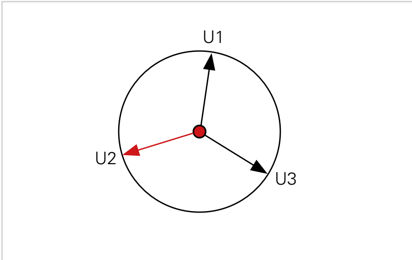


Fig.: Illustration of unbalance in the Vector diagram

You can find the related detailed formulas in the collection of formulas.

Transients

Transients are pulsed electrical phenomena, which exist for just a short period of time. These are usually high frequency, steep signals in the form of transient oscillations.

The reliable detection of transient processes in the electrical supply network is very important in order to avoid damages. Through constant changes in the electrical supply network due to switching operations and faults, new network states arise constantly, which the entire system is required to tune itself to. In normal cases transient compensation currents and compensation voltages arise here. In order to assess whether the transient processes result from a desired or undesired change in the network, and whether these still lie in the tolerance range, one requires reliable decision criteria.

High transient overvoltage, and high dV/dt-ratios, can lead to insulation damage and the destruction of systems and machines, also depending on the energy input (e.g. lightening strike).

In order to detect and record transients it is necessary to use high quality, digital power quality analysers with a high sampling rate.

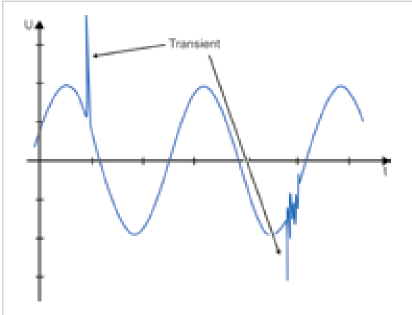


Fig.: Transients

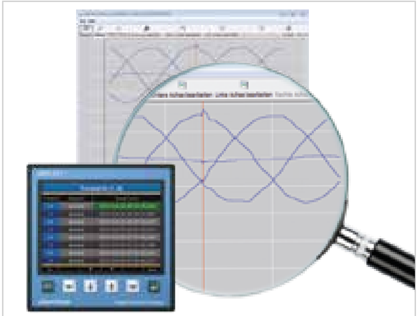


Fig.: With the UMG 511 it is possible to display the transients directly on the measuring device.

Practical example:

High transient currents often arise due to the switching – in of capacitors (without reactors or damping facility) – also with problem-free network configurations. Choking has a strongly damping effect and therefore protects against avoidable problems that are difficult to foresee. Alternatively, special capacitor contactors or switching devices should be used, e.g. with pre-charging resistors at LV side.

Voltage dips and interruptions

Voltage drops can lead to huge complications – for example the failure of production processes – and to quality problems. Such voltage drops arise much more frequently than interruptions. The commercial effects of voltage drops are seriously underestimated time and again.

Fig.: Example: Voltage dips due to bird droppings

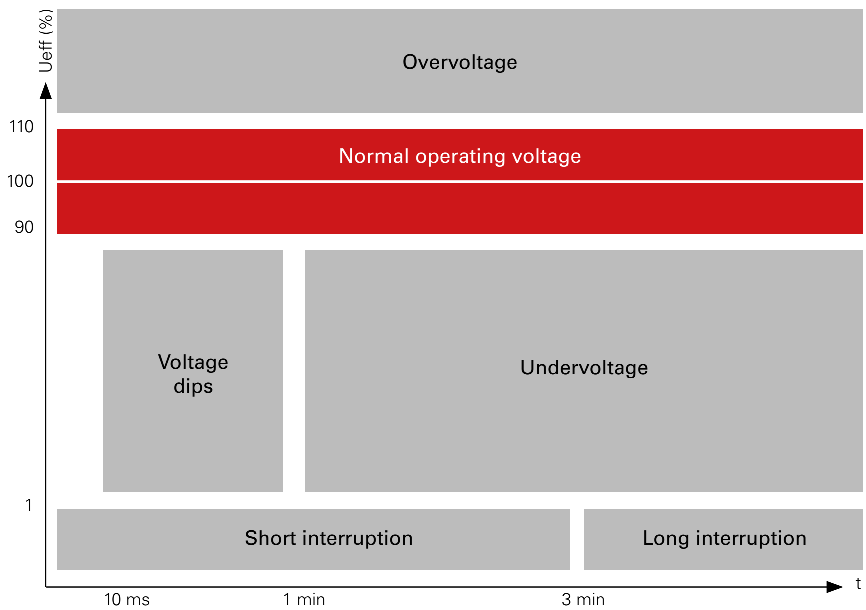
What is a voltage drop?

According to the European standard EN 50160 a voltage drop is a sudden lowering of the effective voltage value to a value of between 90% and 1% of the stipulated nominal value, followed by the immediate reinstatement of this voltage. The duration of a voltage drop lies between a half period (10 ms) and one minute.

If the effective value of the voltage does not drop below 90% of the stipulated value then this is considered to be normal operating conditions. If the voltage drops below 1% of the stipulated value then this is considered an interruption.

A voltage drop should therefore not be confused with an interruption. An interruption arises, for example, after a circuit breaker has tripped (typ. 300 ms). The mains power failure is propagated throughout the remaining distribution network as a voltage drop.

The diagram clarifies the difference between a drop, a short interruption and an undervoltage situation.



Voltage variations are caused by:

- Short circuits
- Switch-on and switch-off processes with large loads
- Starting drives (larger load)
- Load changes with drives
- Pulsed power (oscillation package controls, thermostatic controls)
- Arc furnaces
- Welding machines
- Switching on capacitors
- Construction works
- Bird droppings

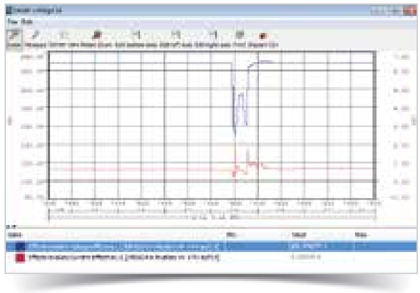


Fig.: Critical voltage dip with production standstill

Voltage drops can lead to the failure of computer systems, PLC systems, relays and frequency converters. With critical processes just a single voltage drop can result in high costs, continuous processes are particularly impacted by this. Examples of this are injection moulding processes, extrusion processes, printing processes or the processing of foodstuffs such as milk, beer or beverages.

The costs of a voltage drop are comprised of:

- Loss of profits due to production stoppage
- Costs for catching up with lost production
- Costs for delayed delivery of products
- Costs for raw materials wastage
- Costs for damage to machinery, equipment and moulds
- Maintenance and personnel costs

Sometimes processes run in unmanned areas in which voltage drops are not immediately noticed. In this case an injection moulding machine, for example, could come to a complete standstill unnoticed. If this is discovered later there will already be a large amount of damage. The customer receives the products too late and the plastic in the machine has hardened off.

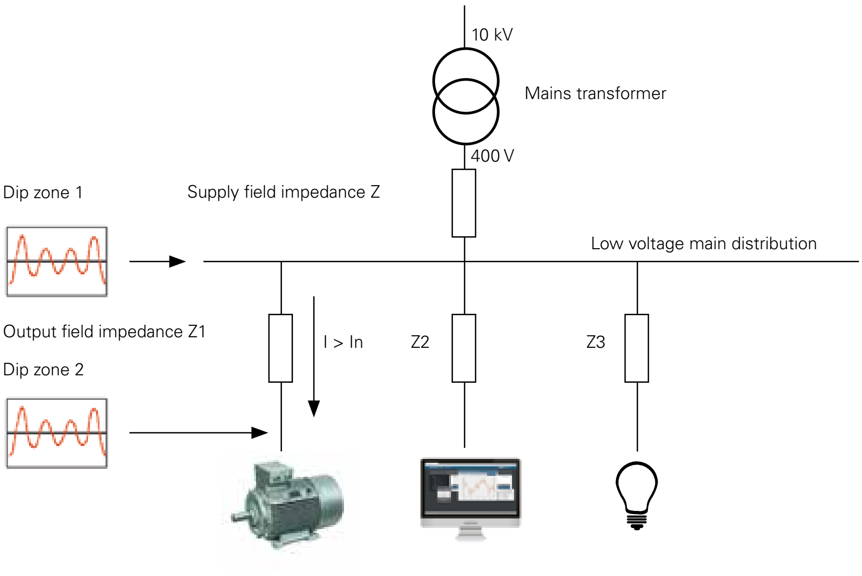


Fig.: Motor start-up currents can lead to a voltage dip

Flicker

Flicker refers to the subjective impression of light density changes or an impression of unsteadiness of visual perceptions, caused by luminous stimuli with temporal fluctuations of the light density or the spectral distribution. From a technical perspective, voltage variations cause light density changes in lamps, which can result in visual perceptions referred to as flicker. From a certain threshold value the appearance of flicker can be disturbing. The disturbing effect of voltage variations depends here on the extent of the repetition rate and the curve form of the change in voltage. The short-term flicker strength and long-term flicker strength are defined measures of the disturbing effect.

Voltage variations, caused by individual devices (on the low voltage network), are permissible if the resultant flicker disturbance factor is not greater than 1. The long-term flicker disturbance factor averaged from twelve values must not exceed a value of 0.65. The most simple method for evaluating the value is the = 1 p.u. curve. P.u. stands here for the "unit of perception" and is the maximum tolerance level for the interference sensitivity of the human eye with regards to its perception of light fluctuations. It is also not permissible to exceed the value = 1 p.u. in combination with all interferers.

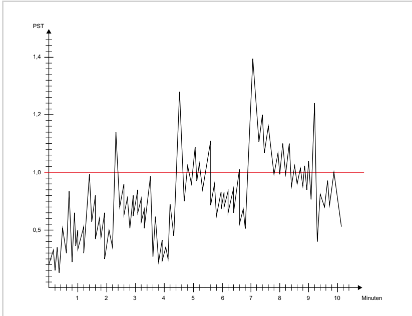


Fig.: Development over time of short-term flicker (PST)

Fig.: Practical example for flicker: Gravel quarry

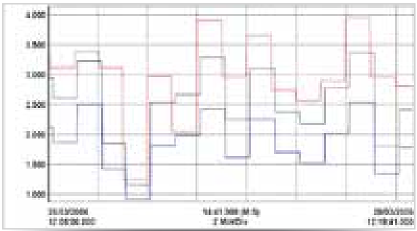


Fig.: Development of flicker

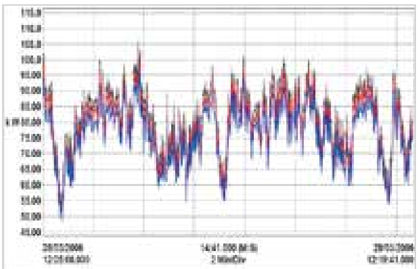


Fig.: Effective power development dependent on the volume and consistency of material

Phase shifting and reactive power

Reactive power is required in order to generate electromagnetic fields in machines such as three phase motors, transformers, welding systems, etc. Because these fields build up and break down continuously, the reactive power swings between generator and load. In contrast to the effective power it cannot be used, i.e. converted into another form of energy, and burdens the supply network and the generator systems (generators and transformers). Furthermore, all energy distribution systems for the provision of the reactive current must exhibit larger dimensions.

It is therefore expedient to reduce the inductive reactive power arising close to the load through a counteractive capacitive reactive power, of the same size where possible. This process is referred to as power factor correction. With power factor correction, the proportion of inductive reactive power in the network reduces by the reactive power of the power capacitor of the power factor correction system (PFC). The generator systems and energy distribution equipment are thereby relieved of the reactive current. The phase shifting between current and voltage is reduced or, in an ideal situation with a power factor of 1, entirely eliminated.

The power factor is a parameter that can be influenced by mains interference such as distortion or unbalance. It deteriorates with progressive phase shifting between current and voltage and with increasing distortion of the current curve. It is defined as a quotient of the sum of the effective power and apparent power, and is therefore a measure of the efficiency with which a load utilises the electrical energy. A higher power factor therefore constitutes better use of the electrical energy and ultimately also a higher degree of efficiency.

Power Factor (arithmetic)
•The power factor is unsigned

cos phi – Fundamental Power Factor
- Only the fundamental oscillation is used in order to calculate the cos phi
- cos phi sign (φ):
  - \- = for delivery of effective power
  - \+ = for consumption of active power

Because no uniform phase shifting angle can be cited with harmonic loading, the power factor λ and the frequently used effective factor cos (φ_1) must not be equated with each other. Starting with the formula $\lambda = \frac{|P|}{S} = \frac{I_1}{I} \cos(\varphi_1) = g_1 \cos(\varphi_1)$ with I_1 = fundamental oscillation effective value of the current, I = total effective value of the current, g_1 = fundamental oscillation content of the current and cos(φ_1) = shifting factor, one sees that only with sinusoidal form voltage and current (g = 1) is the power factor λ the same as the shifting factor cos(φ_1). As such, exclusively with sinusoidal form currents and voltages is the power factor λ the same as the cosine of the phase shifting angle φ and is defined as $\cos(\varphi) = \frac{P}{S}$ = effective factor.

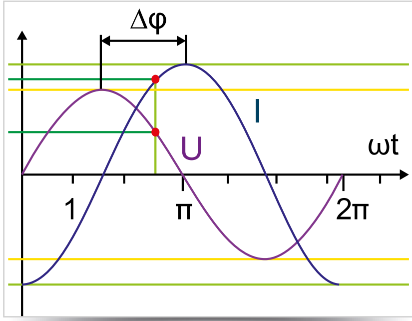


Fig.: Phase shifting between current and voltage (Δφ)

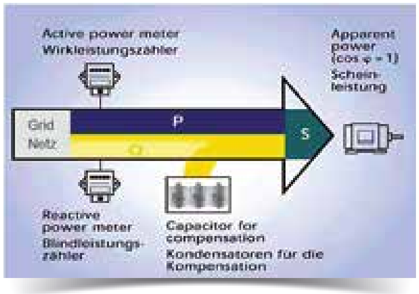


Fig.: Principle of power factor correction

$$PF_A = \frac{|P|}{S_A}$$

Fig.: Power Factor (arithmetic)

$$PF_1 = \cos(\varphi) = \frac{P_1}{S_1}$$

Fig.: cos phi – Fundamental Power Factor

RCM – Residual Current Monitoring

General information

Residual currents caused by the failure of insulation can constitute a significant risk to safety in electrical systems. Using an appropriate protective concept it is possible to detect residual currents, eliminate insulation faults in good time and therefore ensure the availability of the system.

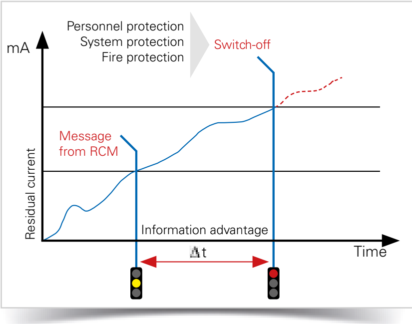


Fig.: Report prior to switching off - an aim of residual current monitoring

RCM stands for **Residual Current Monitoring** and means the monitoring of residual currents in electrical systems. This current is calculated as the sum of the currents of all conductors, apart from the protective earth (PE), which feed into the system. Residual currents are typically the result of insulation faults, leakage currents or EMC filter leakage currents for example.

Whilst RCD devices (residual current circuit breakers) switch off the power supply in the event of a certain residual current being exceeded, RCM measuring devices indicate the actual value, record the long-term development and report the exceeding of a critical value. This message can also be used in order to switch off the power supply via external switching devices (contactors, relays). Through the use of residual current measuring devices (Residual Current Monitoring, RCM) it is possible to detect and report residual currents in a timely manner. It is possible to initiate counter measures in good time, so that it is not necessary to switch the system off. This facilitates the implementation of measures in the event of slowly deteriorating insulation values or steadily rising residual currents – caused for example by ageing insulation – before the system is switched off. For example:

- Insulation faults of lines and electrical operating resources
- Residual currents from electrical loads
- Defective PP power capacitors for the PFC
- Defective components in switched mode power supplies, e.g. in computers
- Correctness of TNS systems (Terra Neutral Separate)
- Disclosure of impermissible PEN connections
- Avoidance of neutral conductor reverse currents to grounded equipment

Residual current monitoring in conjunction with energy measurement in combined energy / RCM measuring devices in electrical systems constitutes a measure for fire protection and maintenance prevention. Down times and the associated costs are thereby reduced. Timely and preventative maintenance – facilitated through the information additionally gained from an RCM measuring device – also significantly enhances the efficiency and availability of a system.

Constant RCM monitoring is of particular significance in preventing unwanted surprises in ongoing operation, and provides consistent information regarding the actual status of the electrical system.

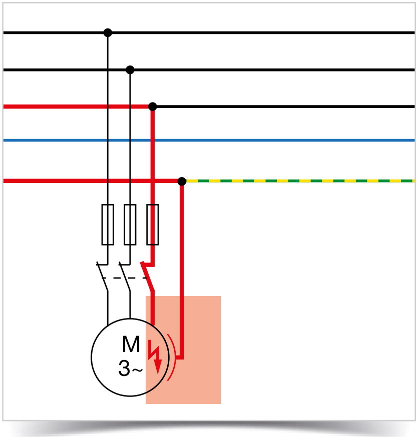
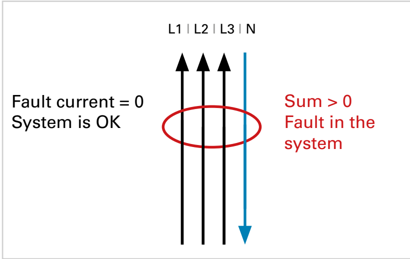


Fig.: Fault current to ground through high ohmic ground fault

Fundamental measuring process with RCM

The functionality of RCM measuring devices is based on the differential current principle. This requires that all phases be guided through a residual current transformer at the measuring point (outlet to be protected), with the exception of the protective earth. If there is no failure in the system then the sum of all currents will be nil. If, however, residual current is flowing away to ground then the difference will result in the current at the residual current transformer being evaluated by the electronics in the RCM measuring device.

The measurement process is described in IEC/TR 60755. Differentiation is made here between type A and type B.



The UMG 96RM-E can measure residual currents in accordance with IEC/TR 60755 (2008-01)

of type A and

type B.

DIN EN 62020 / VDE 0663 / IEC 62020 standard:

The standard applies to residual current monitoring devices for domestic installations and similar applications with a rated voltage of < 440 V AC and a rated current of < 125 A.

Optimum monitoring through 6 current measurement channels

Modern, highly integrated measuring devices facilitate the combined measurement of

- Electrical parameters (V, A, Hz, kW ...)
- Power quality parameters (harmonics, THD, SIs ...)
- Energy loads (kWh, kvarh ...)
- RCM residual current in just one measuring device. The following example shows a measuring device with 6 current inputs for this purpose:

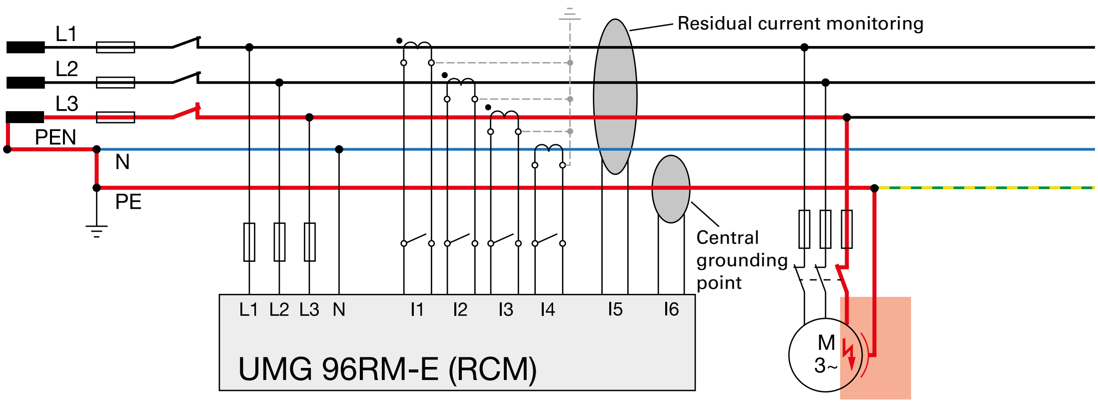


Fig.: Fault current to ground due to an insulation ageing of the motor windings. Minor current through high ohmic fault can be captured with RCM in time and remedial measures initiated to avoid a solid short circuit over time. Thus a production stop can be avoided, as well the risk of a possible fire damage in a worst case scenario.

Constant measurement

In the past

In the past, the micro-processors available on the market were not sufficiently powerful for measuring and simultaneously calculating the various parameters.

"Every measuring device measures constantly, doesn't it..."

Customer quote

It was therefore only feasible to carry out random measurements with older measuring devices. In other words measurements were taken for a number of cycles, measuring was subsequently stopped and the values were calculated. No further measurements were taken during processing. This meant that measurements were only taken for a few periods out of 50 periods.

In the present

With the new product families, such as the UMG 96RM, UMG 104, UMG 604-PRO, UMG 605-PRO, UMG 508, UMG 511, leading-edge microprocessors are used with an entirely new architecture, integrated performance scope and considerably higher capacities.

Such processors were not available in the past! These processors are more expensive than conventional processors, which are still widely used in many simple measuring devices. With the aforementioned product families, constant and gapeless measurement takes place. In this case all periods are captured, i.e. measurements are taken during 50 periods out of 50. In parallel to this, the data is processed and the various electrical, PQ and energy parameters are calculated.

It is self-evident that considerably better measurement accuracy is attained. It is also necessary to consider that random measurement can lead to considerable deviations in the measurement results and the energy measurement in the event of rapid load changes (e.g. spot welding).

Market situation

Simple measuring devices and measuring devices with economical or older measuring electronics are still available for random measurement. If one looks at the global market, random measurement is in fact dominant and remains current engineering practice!

It is also frequently the case that energy is measured constantly, although all other values are not acquired constantly but rather on a random sampling basis.

Summary

Constant measurement requires higher quality components. By constantly measuring all values, a considerably higher accuracy of measurement is attained.

Measure, calculate, store – ring buffer was yesterday!

As described in detail in the previous article, our latest generation measuring devices are equipped with highly powerful signal processors (DSP), which enable the constant and seamless determination of current and voltage, as well as the calculation of every conceivable parameter. How does this take place in detail, what is the measuring process sequence, in what form are the measured values made available, where are they saved?

Modern measuring devices such as our UMGs can essentially be considered as PCs. The average elements are the CPU (DSP), RAM, hard drive (flash memory) and communication ports (RS485, RJ45).

It is fundamentally possible to distinguish between the following measured value groups:

Online values

Online values are determined over a measurement interval of 200 ms or as a mean value of the full wave effective values over 10 periods. Online values are all values that are constantly determined and evaluated by the measuring device. Depending on the measuring device this can be up to 2,000 values available for all measuring channels per 200 ms. The significant values can be read out directly from the UMG displays. Using the GridVis® software and working in the topology screen it is possible to view the complete scope of measured values.

All measured values are constantly available in defined Modbus memory registers for external access via suitable third party software.

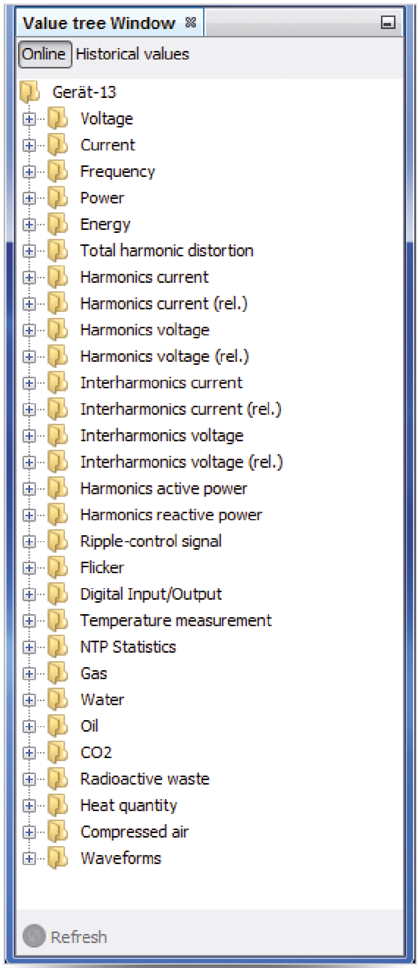


Fig.: Online values, value tree UMG 605-PRO

Historical values

Recordings
Historical values are generated using the online values. For this purpose one or more recording configurations are predefined in the device configuration. For the purpose of the respective recording a period is stipulated for the generation of a mean value, e.g. 15-minute mean value for the recording of load curves, 1-hour mean value for energy, etc. The time frames can lie between 200 ms and multiple days, depending on the type of device. In order to conduct power quality measurements per EN 50160, EN 61000-2-4 or EN 50160, IEEE519, pre-defined recording configurations are available and these can be activated at the click of a mouse button.

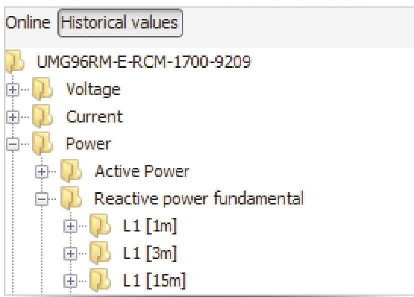


Fig.: Customer-specific historic recordings, value tree UMG 96RM

Historical values are generally initially stored in a measuring device on internal flash memory. This was formerly referred to as a ring buffer. Each stored value is assigned a time stamp. Using the GridVis® software the values are read out manually or automatically (Service). The measured value and time stamp are stored in a database. Using GridVis® or external database tools it is possible to evaluate these values on a tabular or graphical basis.

Events

Events are under- and overvoltages as well as overcurrents. The basis is 20-ms full wave effective values with UMG 604-PRO and UMG 508 or 10-ms half wave effective values with UMG 605-PRO and UMG 511. With an exceeding or undercutting of the stipulated tolerance limits the event is stored on the flash memory. Additionally, a pre- and post event period are defined, so that network incidents can be analysed directly before and after the event occurs. As such, all voltage and current channels are graphically shown as a maximum across the specified time frame.

Fig.: Event recording voltage dip / undervoltage

Transients

In order to record transients the full performance of the UMGs is required. With a sampling rate of 20 kHz it is possible to capture transients from 50 µs. Similarly to with the recording of events, threshold values as well as pre- and post periods can be defined. Likewise, it is also possible to stipulate which channels are written to a graph in waveform at the time that the transients occur.

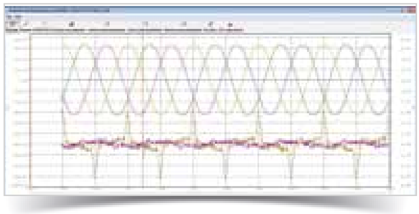


Fig.: Recording transients

Flags

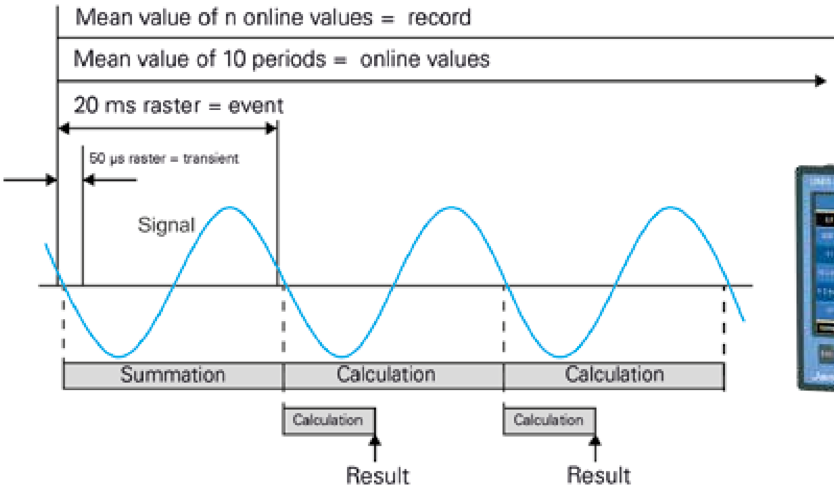
Flags are used to mark and save irregularities in measurements and recordings, in accordance with IEC 61000-4-30. In this way it is possible to recognise the causes of gaps in recordings for example.

Flag	Note
LostWindow	200 ms measurement window has been lost
LostPLL	The device has lost the grid synchronisation
OverCurrent	Overcurrent A
OverVoltage	Overvoltage V
Firmware upgrade	Firmware upgrade
Initialisation	Buffer initialisation

Fig.: Flag recording

All recordings of historical data, events, transients and flags run constantly, independently of each other and in parallel in the measuring device.

All saved data is historically sorted for storage. If the flash memory is full then the oldest data historically is overwritten. Through the regular reading out of the data to a database, values that are overwritten on the measuring device will already have been saved to the server, meaning that no measured values are lost.



DSP
- Firmware
- Measurement
- Calculation

RAM
- Online values
- Modbus register

Flash
- Web server
- Homepage
- Recordings
- Events
- Transients, flags

Collection of formulas (for UMG measurement devices)

Effective value of the current for phase conductor p

$$\mathbf{I_p} = \sqrt{\frac{\mathbf{1}}{\mathbf{N}} \cdot \sum_{\mathbf{k=0}}^{\mathbf{N-1}} \mathbf{i_{p_k}}^2}$$

Effective value of the neutral conductor current

$$I_N = \sqrt{\frac{1}{N} \cdot \sum_{k=0}^{N-1} (i_{1_k} + i_{2_k} + i_{3_k})^2}$$

Effective voltage L-N

$$U_{pN} = \sqrt{\frac{1}{N} \cdot \sum_{k=0}^{N-1} u_{pN_k}^{\;2}}$$

Effective voltage L-L

$$U_{pg} = \sqrt{\frac{1}{N} \cdot \sum_{k=0}^{N-1} (u_{gN_k} - u_{pN_k})^2}$$

Neutral voltage (vectorial)

$$U_{Neutral\ voltage} = U_{1_{rms}} + U_{2_{rms}} + U_{3_{rms}}$$

Effective power for phase conductor

$$P_p = \frac{1}{N} \cdot \sum_{k=0}^{N-1} (u_{pN_k} \times i_{p_k})$$

Apparent power for phase conductor p

- The apparent power is unsigned.

$$S_p = U_{pN} \cdot I_p$$

Total apparent power (arithmetic)

- The apparent power is unsigned.

$$S_A = S_1 + S_2 + S_3$$

Ordinal numbers of harmonics

xxx[0] = Fundamental oscillation (50Hz/60Hz)
xxx[1] = 2nd harmonic (100Hz/120Hz)
xxx[2] = 3rd harmonic (150Hz/180Hz)
etc.

THD

- THD (Total Harmonic Distortion) is the distortion factor and gives the relationship of the harmonic portions of oscillation to the fundamental oscillation.

THD for voltage

- M = Ordinal number of harmonics
- M = 40 (UMG 604-PRO, UMG 508, UMG 96RM)
- M = 63 (UMG 605-PRO, UMG 511)
- Mains frequency fund equals n = 1

$$THD_U = \frac{1}{|U_{fund}|}\sqrt{\sum_{n=2}^{M}|U_{n.Harm}|^2}$$

THD for current

- M = Ordinal number of harmonics
- M = 40 (UMG 604-PRO, UMG 508, UMG 96RM)
- M = 63 (UMG 605-PRO, UMG 511)
- Mains frequency fund equals n = 1

$$THD_I = \frac{1}{|I_{fund}|}\sqrt{\sum_{n=2}^{M}|I_{n.Harm}|^2}$$

ZHD

- ZHD is the THD for interharmonics
- Is calculated in the device series UMG 511 and UMG 605-PRO

Interharmonics

- Sinusoidal form oscillations, whose frequencies are not whole multipliers of the mains frequency (fundamental oscillation)
- Is calculated in the device series UMG 511 and UMG 605-PRO
- Calculation and measurement processes according to DIN EN 61000-4-30
- The ordinal number of an interharmonic equates to the ordinal number of the next smallest harmonic. For example, the 3rd interharmonic lies between the 3rd and 4th harmonics.

TDD (I)

- TDD (Total Demand Distortion) gives the relationship between the current harmonics (THDi) and the effective current value with full load.
- IL = Full load current
- M = 40 (UMG 604-PRO, UMG 508, UMG 96RM)
- M = 63 (UMG 605-PRO, UMG 511)

$$TDD = \frac{1}{I_L}\sqrt{\sum_{n=2}^{M} I_n^2} \times 100\%$$

Ripple control signal U (EN 61000-4-30)

The ripple control signal U (200 ms measured value) is a voltage measured with a carrier frequency specified by the user. Only frequencies below 3 kHz are taken into consideration.

Ripple control signal I

The ripple control signal I (200 ms measured value) is a current measured with a carrier frequency specified by the user. Only frequencies below 3 kHz are taken into consideration.

Positive-negative-zero sequence component

- The proportion of voltage or current unbalance in a three-phase system is labelled with the positive, negative and zero sequence components.
- The symmetry of the three-phase system strived for in normal operation is disturbed by unbalanced loads, faults and operating equipment.
  - A three-phase system is referred to as exhibiting symmetry if the three phase conductor voltages and currents are of an equal size and are phase-shifted at 120° to each other. If one or both conditions are not fulfilled then the system is deemed unbalanced. Through the calculation of the symmetrical components comprising positive sequence component, negative sequence component and zero sequence component a simplified analysis of an unbalanced fault in a three-phase system is possible.
- Unbalance is a characteristic of the power quality, for which threshold values have been stipulated in international standards (e.g. EN 50160).

Positive sequence component

$$U_{Pos} = \frac{1}{3}\left| U_{L1,fund} + U_{L2,fund} \cdot e^{j\frac{2\pi}{3}} + U_{L3,fund} \cdot e^{j\frac{4\pi}{3}} \right|$$

Negative sequence component

$$U_{Neg} = \frac{1}{3}\left| U_{L1,fund} + U_{L2,fund} \cdot e^{-j\frac{2\pi}{3}} + U_{L3,fund} \cdot e^{-j\frac{4\pi}{3}} \right|$$

Zero sequence component

A zero sequence component can only arise if a total current is able to flow back via the neutral conductor.

$$U_{\substack{\text{Zero sequence}\\ \text{component}}} = \frac{1}{3}\left|U_{L1,fund} + U_{L2,fund} + U_{L3,fund}\right|$$

Voltage unbalance

$$\text{Voltage unbalance} = \frac{U_{Neg}}{U_{Pos}}$$

Downward deviation U (EN 61000-4-30)

$$U_{down} = \frac{U_{din} - \sqrt{\frac{\sum_{i=1}^{n} U^2_{rms-down,i}}{n}}}{U_{din}} [\%]$$

Downward deviation I

$$I_{down} = \frac{I_{Rated\ current} - \sqrt{\frac{\sum_{i=1}^{n} I^2_{rms-down,i}}{n}}}{I_{Rated\ current}} [\%]$$

K factor

- The K factor describes the increase in eddy current losses with a harmonics load. In the case of sinusoidal loading of the transformer the K factor = 1. The greater the K factor, the more heavily a transformer can be loaded with harmonics without overheating.

Power Factor (arithmetic)

- The power factor is unsigned.

$$PF_A = \frac{|P|}{S_A}$$

cos phi – Fundamental Power Factor

- Only the fundamental oscillation is used in order to calculate the cos phi
- cos phi sign:
  - = for delivery of effective power
  + = for consumption of effective power

$$PF_1 = \cos(\varphi) = \frac{P_1}{S_1}$$

cos phi sum

- cos phi sign:
  - = for delivery of effective power
  + = for consumption of effective power

$$\cos(\varphi)_{Sum_3} = \frac{P_{1_{fund}} + P_{2_{fund}} + P_{3_{fund}}}{\sqrt{(P_{1_{fund}} + P_{2_{fund}} + P_{3_{fund}})^2 + (Q_{1_{fund}} + Q_{2_{fund}} + Q_{3_{fund}})^2}}$$

$$\cos(\varphi)_{Sum_4} = \frac{P_{1_{fund}} + P_{2_{fund}} + P_{3_{fund}} + P_{4_{fund}}}{\sqrt{(P_{1_{fund}} + P_{2_{fund}} + P_{3_{fund}} + P_{4_{fund}})^2 + (Q_{1_{fund}} + Q_{2_{fund}} + Q_{3_{fund}} + Q_{4_{fund}})^2}}$$

Phase angle Phi

- The phase angle between current and voltage of phase conductor p is calculated and depicted per DIN EN 61557-12.
- The sign of the phase angle corresponds with the sign of the reactive power.

Fundamental oscillation reactive power

The fundamental oscillation reactive power is the reactive power of the fundamental oscillation and is calculated with the Fourier analysis (FFT). The voltage and current do not need to be sinusoidal in form. All reactive power calculations in the device are fundamental oscillation reactive power calculations.

Reactive power sign

- Sign Q = +1 for phi in the range 0 ... 180 ° (inductive)
- Sign Q = -1 for phi in the range 180 ... 360 ° (capacitive)

$$Sign\ Q(\varphi_p) = +1\ if\ \varphi_p \in [0° - 180°]$$

$$Sign\ Q(\varphi_p) = -1\ if\ \varphi_p \in [180° - 360°]$$

Reactive power for phase conductor p

- Reactive power of the fundamental oscillation

$$Q_{fund\,p} = Sign\ Q(\varphi_p) \cdot \sqrt{S_{fund\,p}^{\,2} - P_{fund\,p}^{\,2}}$$

Total reactive power

- Reactive power of fundamental oscillation

$$Q_V = Q_1 + Q_2 + Q_3$$

Distortion reactive power

- The distortion reactive power is the reactive power of all harmonics and is calculated with the Fourier analysis (FFT).

$$D = \sqrt{S^2 - P^2 - Q_{fund}^2}$$

- The apparent power S contains the fundamental oscillation and all harmonic portions up to the Mth harmonic.
- The effective power P contains the fundamental oscillation and all harmonic portions up to the Mth harmonic.
- M = 40 (UMG 604-PRO, UMG 508, UMG 96RM)
- M = 63 (UMG 605-PRO, UMG 511)

Reactive energy per phase

$$E_{r_{L1}} = \int Q_{L1}(t) \cdot \Delta t$$

Reactive energy per phase, inductive

$$E_{r(ind)_{L1}} = \int Q_{L1}(t) \cdot \Delta t \qquad \text{for } Q_{L1}(t) > 0$$

Reactive energy per phase, capacitive

$$E_{r(cap)_{L1}} = \int Q_{L1}(t) \cdot \Delta t \qquad \text{for } Q_{L1}(t) < 0$$

Reactive energy, sum L1–L3

$$E_{r_{L1,L2,L3}} = \int (Q_{L1}(t) + Q_{L2}(t) + Q_{L3}(t)) \cdot \Delta t$$

Reactive energy, sum L1–L3, inductive

$$E_{r(ind)_{L1,L2,L3}} = \int (Q_{L1}(t) + Q_{L2}(t) + Q_{L3}(t)) \cdot \Delta t$$

for $Q_{L1}(t) + Q_{L2}(t) + Q_{L3}(t) > 0$

Reactive energy, sum L1–L3, capacitive

$$E_{r(cap)_{L1,L2,L3}} = \int (Q_{L1}(t) + Q_{L2}(t) + Q_{L3}(t)) \cdot \Delta t$$

for $Q_{L1}(t) + Q_{L2}(t) + Q_{L3}(t) < 0$

General information on current transformers

General information

Current transformers are predominantly utilised in areas in which it is not possible to measure current directly. They are a special type of transformer with a defined degree of precision (class), which translates the primary current into a (usually) smaller, standardised secondary current, as well as galvanically separating primary and secondary circuits from each other. The physical saturation (especially with monitoring CTs) of the core material additionally guarantees protection of the secondary circuit from higher currents.

Fig.: Feedthrough CTs

It is fundamentally possible to distinguish between single-phase current transformers and winding current transformers. The most frequent form of single-phase current transformer is the moulded case feed through current transformer, which is plugged onto the current-carrying phase and therefore forms a transformer with primary winding (and secondary windings in accordance with the transformation ratio).

Selecting current transformers

Transformation ratio

The transformation ratio is the relationship between the primary rated current and the secondary rated current, and is cited on the rating plate as an unsimplified fraction.

Most frequently, x / 5 A current transformers are used. The majority of measuring devices have the highest precision class at 5 A. For technical and moreover economic reasons, x / 1 A current transformers are recommended with long measuring cable lengths. The line losses with 1-A transformers is only 4 % in comparison to 5-A transformers. However, the measuring devices here frequently exhibit a lower accuracy of measurement.

Rated current

Rated or nominal current (earlier designation) is the value of the primary and secondary current cited on the rating plate (primary rated current, secondary rated current), for which the current transformer is dimensioned. Standardised rated currents are (apart from in the classes 0.2 S and 0.5 S) 10 – 12.5 – 15 – 20 – 25 – 30 – 40 – 50 – 60 – 75 A, as well as the decimal multiples and fractions thereof. Standardised secondary currents are 1 and 5 A, preferably 5 A.

Standardised rated currents for the classes 0.2 S and 0.5 S are 25 – 50 – 100 A and their decimal multiples, as well as secondary (only) 5 A.

Correct selection of the primary nominal current is important for the accuracy of measurement. Recommended is a ratio slightly beyond the measured / defined maximum load current (In).

Example: In = 1,154 A; selected transformer ratio = 1,250/5.

The nominal current can also be defined on the basis of the following considerations:

- Dependent on the mains supply transformer nominal current times approx. 1.1 (next transformer size)
- Protection (rated fuse current = CT primary current) of the measured system part (LVDSB, subdistribution boards)
- Actual nominal current times 1.2 (if the actual current lies considerably below the transformer or fuse nominal current then this approach should be selected)

Over-dimensioning the current transformer must be avoided, otherwise the accuracy of measurement significantly decrease especially with small load currents.

Rated power

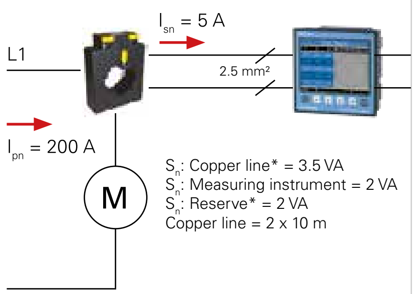
The rated power of the current transformer is the product of the rated load and the square of the secondary rated current and is quoted in VA. Standardised values are 2.5 – 5 – 10 – 15 – 30 VA. It is also permissible to select values over 30 VA according to the application case. The rated power describes the capacity of a current transformer to "drive" the secondary current within the error limits through a load.

When selecting the appropriate power it is necessary to take into consideration the following parameters: Measuring device power consumption (with connection in series), line length, line cross-section. The longer the line length and the smaller the line cross-section, the higher the losses through the supply, i.e. the nominal power of the CT must be selected such that this is sufficiently high.

The power consumption should lie close to the transformer's rated power. If the power consumption is very low (underloading) then the overcurrent factor will increase and the measuring devices will be insufficiently protected in the event of a short circuit under certain circumstances. If the power consumption is too high (overloading) then this has a negative influence on the accuracy.

Current transformers are frequently already integrated in an installation and can be used in the event of retrofitting with a measuring device. It is necessary to note the nominal power of the transformer in this case: Is this sufficient to drive the additional measuring devices?

Calculation of rated power S_n:
Copper line = 10 m



S_n: Total = S_n Copper line* +
S_n Measuring instrument + S_n Reserve**

Example: S_n Total = 3.50 VA + 2 VA + 2 VA
S_n Total = 7.50 VA

* Determination of the burden
** S_n reserve < 0.5 x (S_n copper line + S_n measuring instruments)

Fig.: Calculation of the rated power S_n
(Copper line 10 m)

Precision classes

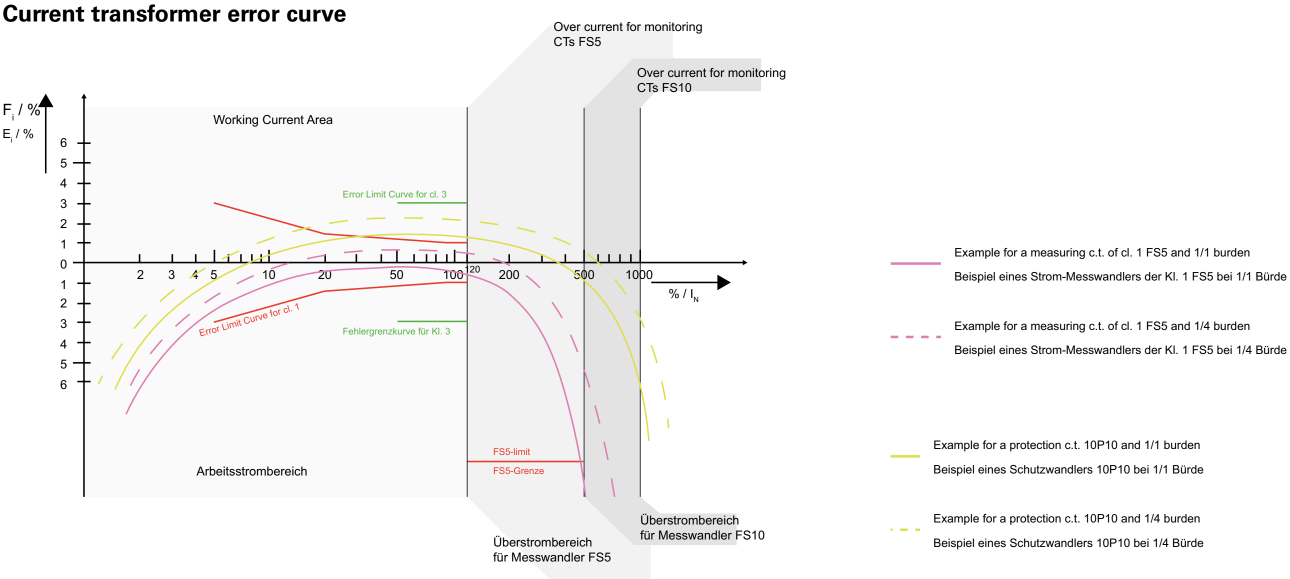
Current transformers are divided up into classes according to their precision. Standard precision classes are 0.1; 0.2; 0.5; 1; 3; 5; 0.1 S; 0.2 S; 0.5 S. The class sign equates to an error curve pertaining to current and angle errors.

The precision classes of current transformers are related to the measured value. If current transformers are operated with low current in relation to the nominal current then the accuracy of measurement declines. The following table shows the threshold error values with consideration to the nominal current values:

Precision class	Current fault Fj in % with % of the rated current							
	1 %	5 %	20 %	50 %	100 %	120 %	150 %	200 %
5				5		5		
3				3		3		
1		3	1.5		1	1		
1 ext 150		3	1.5		1		1	
1 ext 200		3	1.5		1			1
0.5		1.5	0.75		0.5	0.5		
0.5 S	1.5	0.75	0.5		0.5	0.5		
0.5 ext 150		1.5	0.75		0.5		0.5	
0.5 ext 200		1.5	0.75		0.5			0.5
0.2		0.75	0.35		0.2	0.2		
0.2 S	0.75	0.35	0.2		0.2	0.2		

We always recommend current transformers with the same precision class for the UMG measuring devices. Current transformers with a lower precision class lead in the complete system – current transformer + measuring device – to a lower accuracy of measurement, which is defined in this case by the precision class of the current transformer. However, the use of current transformers with a lower accuracy of measurement than the measuring device is technically feasible.

Current transformer error curve



Measurement current transformer vs. protection current transformer

Whilst measurement current transformers are intended to reach saturation point as quickly as possible once they exceed their operational current range (expressed by the overcurrent factor FS) – in order to avoid an increase in the secondary current with a fault (e.g. short circuit) and to protect the connected devices. With protection transformers saturation should lie as far out as possible.

Protection transformers are used for system protection in conjunction with the requisite switchgear. Standard precision classes for protection transformers are 5P and 10P. "P" stands for "protection" here. The nominal overcurrent factor is placed after the protection class designation (in %). Therefore, 10P5 for example means that with a five-fold nominal current the negative secondary-side deviation from the anticipated value will be no more than 10% according to the ratio (linear).

The use of measurement current transformers is strongly recommended for the operation of UMG measuring devices.

Standard current transformer bus bar

Type	Primary currents in A	Bus bar sizes in mm
Feedthrough current transformer		
IPA40	50 - 75	40 x 10 30 x 15 25 x 20
IPA40.5	50 - 100	40 x 10 30 x 15 25 x 20
6A315.3	100 - 600	30 x 15 20 x 20
7A412.3	800 - 1000	40 x 12 2 x 30 x 10
8A512.3	1250 - 1500	50 x 12 2 x 40 x 10
9A615.3	1000 - 2500	63 x 15 2 x 50 x 10
Split core current transformer		
Split-100	100	2 x 60 x 10 60 x 35
Split-150	150	2 x 60 x 10 60 x 35
Split-200	200	2 x 60 x 10 60 x 35
Split-250	250	2 x 60 x 10 60 x 35
Split-300	300	2 x 60 x 10 60 x 35
Split-400	400	2 x 60 x 10 60 x 35
Split-500	500	2 x 60 x 10 60 x 35
Split-600	600	2 x 60 x 10 60 x 35
Split-750	750	2 x 60 x 10 60 x 35
Split-800	800	2 x 60 x 10 60 x 35
Split-1000	1,000	2 x 80 x 10 60 x 32
Split-1200	1,200	2 x 80 x 10 60 x 32
Split-1250	1,250	2 x 80 x 10 60 x 32

Split-1500	1,500	2 x 80 x 10 60 x 32
Split-1600	1,600	2 x 80 x 10 60 x 32
Split-2000	2,000	2 x 80 x 10 60 x 32

Special version	
Deviating primary rated current	On request
Deviating secondary rated current	On request
Deviating construction type	On request
Deviating rated frequency	On request
Expanded class precision and load durability	On request
Type-approved / calibrated transformer	On request

Current transformer construction types

Moulded case feedthrough current transformer

The phase to be measured (conductor rail or line) is fed through the CT window and forms the primary circuit for the current transformer. Feedthrough transformers are predominantly used for mounting on bus bars. Through additional potting it is possible to achieve droplet-tightness, as well as greater shock and vibration resistance with mechanical loading (IEC 68). This is the most common form of current transformers, with the disadvantage that the primary conductor must be interrupted during installation. This form of transformer is therefore most commonly used in new system installations.

Split core current transformer

Split core current transformers are frequently used with retrofit applications. With these transformers the transformer core is open ready for installation, and is therefore fitted around the bus bars. This enables installation without interrupting the primary conductor.

Fig.: Split core current transformer

Cable type split core current transformer

Cable type split core current transformers are exclusively suitable for installation in isolated primary circuit conductors (supply cables) in weatherproof and dry locations. Installation is possible without interrupting the primary conductor (i.e. with ongoing operation).

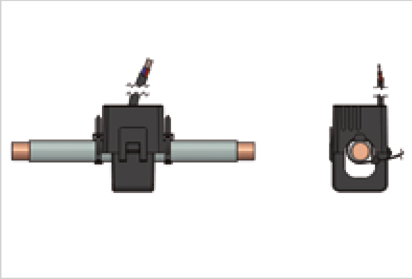


Fig.: Cable type split core current transformer

DIN rail current transformer with voltage tap and fuse

The DIN rail current transformer is a highly compact special variant with integrated voltage tap. The DIN rail current transformer comprises a terminal strip, current transformer and the voltage tap terminal with fuse. The fuse is fitted directly on the primary conductor and the unprotected part of the measurement line is therefore very short. This guarantees a high degree of intrinsic safety.

The DIN rail current transformer is simple to wire, results in low installation costs and a high degree of reliability due to few connections, and is also space-efficient and exhibits only very few connection faults.

Fig.: DIN rail current transformer

Installation of current transformers

Installation orientation

Determine the flow direction of the energy in the cable that you wish to measure. P1 indicates the side on which the current source is located, whilst P2 indicates the load side.

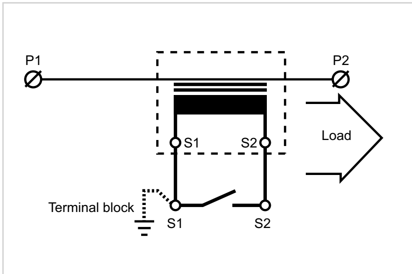


Fig.: Installation orientation

Terminals S1/S2 (k/l)

The connections of the primary winding are designated "K" and "L" or "P1" and "P2", and the connections of the secondary winding are designated "k" and "l" or "S1" and "S2". The polarity must be established such that the "flow direction of the energy" runs from K to L.

Inadvertently swapping the terminals S1/S2 leads to erroneous measurement results and can also cause incorrect control behaviour with Emax and PFC systems.

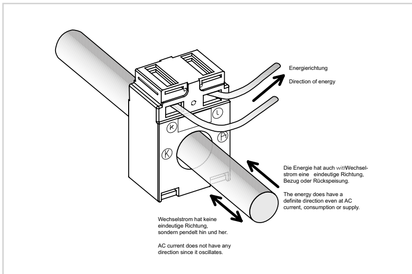


Fig.: Installation orientation of current transformers

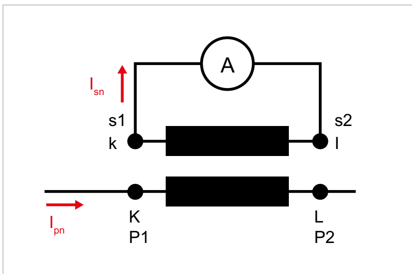


Fig.: Direction of energy flow

Line length and cross-section

The power consumption (in W) caused by the line losses is calculated as follows:

$$P = \frac{\rho \times L \times I^2}{A}$$

- specific resistance
  for CU: 0.0175 Ohm *mm² / m
  for Al: 0.0278 Ohm * mm² / m

L = Line length in m (outward and return line)
I = Current in Amperes
A = Line cross-section in mm²

Brief overview (power consumption copper line) for 5 A and 1 A:

With every temperature change of 10 °C the power consumed by the cables increases by 4 %.

Power consumption in VA at 5 A										
Nominal cross-section	**1 m**	**2 m**	**3 m**	**4 m**	**5 m**	**6 m**	**7 m**	**8 m**	**9 m**	**10 m**
2.5 mm²	0.36	0.71	1.07	1.43	1.78	2.14	2.50	2.86	3.21	3.57
4.0 mm²	0.22	0.45	0.67	0.89	1.12	1.34	1.56	1.79	2.01	2.24
6.0 mm²	0.15	0.30	0.45	0.60	0.74	0.89	1.04	1.19	1.34	1.49
10.0 mm²	0.09	0.18	0.27	0.36	0.44	0.54	0.63	0.71	0.80	0.89

Power consumption in VA at 1 A										
Nominal cross-section	**10 m**	**20 m**	**30 m**	**40 m**	**50 m**	**60 m**	**70 m**	**80 m**	**90 m**	**100 m**
1.0 mm²	0.36	0.71	1.07	1.43	1.78	2.14	2.50	2.86	3.21	3.57
2.5 mm²	0.14	0.29	0.43	0.57	0.72	0.86	1.00	1.14	1.29	1.43
4.0 mm²	0.09	0.18	0.27	0.36	0.45	0.54	0.63	0.71	0.80	0.89
6.0 mm²	0.06	0.12	0.18	0.24	0.30	0.36	0.42	0.48	0.54	0.60
10.0 mm²	0.04	0.07	0.11	0.14	0.18	0.21	0.25	0.29	0.32	0.36

Example of current transformer capacity and line length					
Secondary current = 1 A Line = 0.75 mm² Current transformer capacity / line length			**Secondary current = 5 A Line = 2.5 mm² Current transformer capacity / line length**		
Class 0.5	**Class 1**	**Class 3**	**Class 0.5**	**Class 1**	**Class 3**
0.5 VA / 5 m	0.5 VA / 5 m	0.25 VA / 1 m	0.5 VA / 0.7 m	0.5 VA / 0.7 m	0.5 VA / 0.7 m
1 VA / 15 m	1 VA / 15 m	0.5 VA / 5 m	1 VA / 2.1 m	1 VA / 2.1 m	1.5 VA / 3.5 m
2.5 VA / 47 m	1.5 VA / 26 m	1 VA / 15 m	2.5 VA / 6 m	2.5 VA / 6 m	2.5 VA / 6 m
5 VA / 100 m	2.5 VA / 47 m	1.5 VA / 26 m	5 VA / 13 m	5 VA / 13 m	
10 VA / 205 m	5 VA / 100 m			10 VA / 27 m	
	10 VA / 200 m			20 VA / 55 m	
	20 VA / 400 m				

Serial connection of measuring devices to a current transformer

Pv = UMG 1 + UMG 2 +....+ P_{Line} + $P_{Terminals}$ ....?

Operation in parallel / summation current transformer

If the current measurement is carried out via two current transformers, the overall transformer ratio of the current transformers must be programmed into the measuring device.

Example: Both current transformers have a transformer ratio of 1,000/5A. The total measurement is carried out using a summation current transformer 5+5 / 5 A.

The UMG must then be set up as follows:

Primary current: 1,000 A + 1,000 A = 2,000 A
Secondary current: 5 A

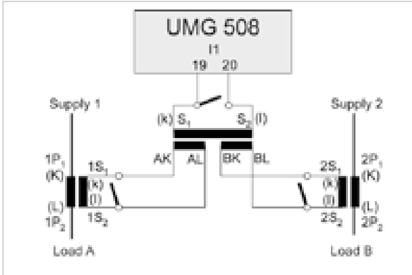


Fig.: UMG 508 Current measurement via summation transformer

Grounding of current transformers

According to VDE 0414, current and voltage transformers should be secondary grounded from a series voltage of 3.6 kV. With low voltage it is possible to dispense with grounding if the current transformers do not possess large metal contact surfaces. However, common practice is to ground low voltage transformers too. Customary is grounding on S1. However, grounding can also take place on the S1(k) terminal or S2(k) terminals. Important: Always ground on the same side!

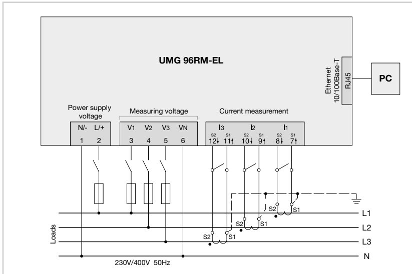


Fig.: Connection example UMG 96RM-EL

Use of protection current transformers

In the event of retrofitting a measuring device and the exclusive availability of a protective core, we recommend the use of a winding current transformer 5/5 for decoupling the protective core.

Operation of current transformers

Exchanging a measuring device (short-circuiting of current transformers)

The current transformer secondary circuit should never be opened when current is flowing into the primary circuit.

The current transformer output constitutes a current source. With an increasing burden the output voltage therefore increases (according to the relationship U = R x I) until saturation is reached. Above saturation point the peak voltage continues to rise with increasing distortion, and attains its maximum value with an endless burden, i.e. open secondary terminals. With open transformers it is therefore possible that voltage peaks may arise, which could pose a risk of danger to persons and may also destroy measuring devices when reconnected.

It is therefore the case that open operation of CTs must be avoided and unloaded current transformers must be short circuited.

Current transformer terminal block with short circuit devices

In order to short circuit current transformers and for the purpose of recurrent comparative measurements it is recommended that special terminal block for DIN rails be used. These comprise a cross-disconnect terminal with measuring and test equipment, insulated bridges for grounding and short circuiting of the current transformer terminals.

Fig.: Current transformer terminal block

Overloading of measurement CTs

Primary current overloading:
Primary current too high --> Saturation of the core material --> Precision declines dramatically.

Nominal power overloading:
Too many measuring devices or excessively long lines are connected to a transformer with its defined nominal power --> Saturation of the core material --> Precision declines dramatically.

Instance of short circuit at CT secondary side

In the event of a short circuit no signal is available. It is not possible to measure with the measuring device. Current transformers can (or must) be short circuited if no load is present (measuring device).

Operation with harmonics

Our current transformers generally measure harmonics up to 2.5 kHz (50th harmonic) and many types also measure to 3 kHz and even beyond. However, with higher frequencies the eddy current losses increase and heating up is consequently also greater. If the total harmonic distortion is too high then the current transformer must be designed with thinner sheets.

However, it is not possible to make a general statement regarding a threshold value of the total harmonic distortion because heating up is dependent on core size, transformer surface (cooling), ambient temperature, ratio, etc.

Power requirement UMGs, energy meter, measuring devices

Measuring device type	Power consumption current measurement input in VA
Analogue ammeter	1.1
UMG 103-CBM / 104 / 604-PRO / 605-PRO	0.2
UMG 96RM	0.2
UMG 96RM-E	0.2
UMG 508 / 509-PRO	0.2
UMG 511 / 512-PRO	0.2
ECSEM series energy meter	0.36

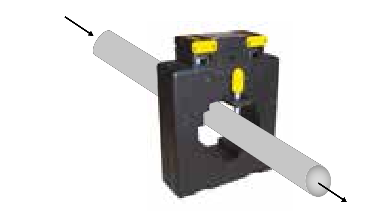
Power consumption UMG 96RM-E per current measurement input

UMG 96RM-E	0.2 VA
	+
4 metre 2-wire line 2.5 mm²	1.64 VA
	=
Gives the power consumption of the measuring equipment the CT has to be rated for	1.84 VA

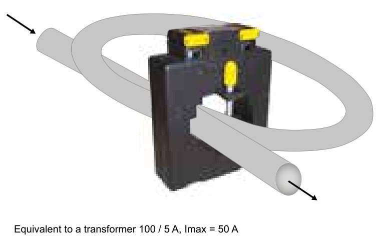
The special case: Larger current transformer – lower current

Tip:
Select a current transformer that is suitable for the measurement of a nominal current of 50 A.

In order to divide the normal current of a current transformer by two it is actually sufficient to run this current through the transformer twice.



Current transformer 50 / 5 A, Imax = 50 A



Equivalent to a transformer 100 / 5 A, Imax = 50 A

Overvoltage categories

Electrical distribution systems and loads are becoming increasingly complex. This also results in the likelihood of transient overvoltage increasing. Power electronic modules in particular (e.g. frequency converters, phase angle and trailing-edge control, PWM-controlled power switches) generate temporary voltage peaks in conjunction with inductive loads, which can be significantly higher than the respective nominal voltage. In order to guarantee user safety, four overvoltage categories (CAT I to CAT IV) are defined in DIN VDE 0110 / EN 60664.

The measurement category indicates the permissible application ranges of measuring and test devices for electrical operating equipment and systems (e.g. voltage testers, multimeters, VDE test devices) for application in low voltage network areas.

Defined categories and application purposes in IEC 61010-1:

The following categories and application purposes are defined in IEC 61010-1:	
CAT I	Measurements on current circuits that have no direct connection to the mains network (battery operation), e.g. devices in protection class 3 (operation with protective low voltage), battery-operated devices, car electrics
CAT II	Measurements on current circuits that have a direct connection by means of a plug with the low voltage network, e.g. household appliances, portable electrical appliances
CAT III	Measurements within the building installation (static loads with direct fixed connection, distribution connection, fixed installation appliances in the distribution system), e.g. sub-distribution.
CAT IV	Measurements at the source of the low voltage installation (meter, main connection, primary overcurrent protection), e.g. revenue meters, low voltage overhead lines, utility service entrance box

The category is particularly significant for safety during measurements, because low-resistance current circuits exhibit higher short circuit currents and / or the measuring device is also required to withstand disturbances in the form of load switching and other transient overvoltages, without the user being endangered by electric shocks, fire, sparks forming or explosions. Due to the low impedance of the public grid, short circuit currents are at their g reatest at the house infeed. Inside the home, the maximum short circuit currents are reduced through the system's series impedances. Technically, compliance with the category is ensured for example through the contact protection of plugs and sockets, insulation, sufficient clearance and creepage distances, the strain relief and kink protection of cables, as well as sufficient cable cross-sections.

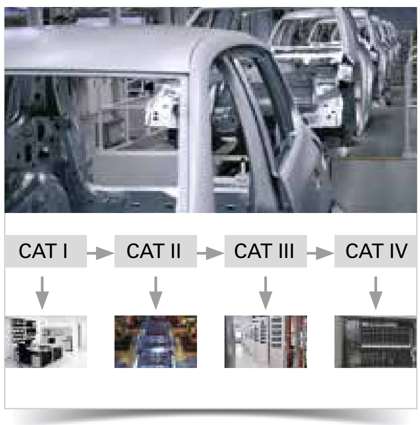


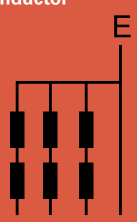
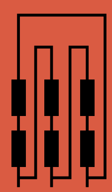
Fig.: Graphic illustration of the CAT categories

In practice

Our experience and understanding shows that many users are not sufficiently familiar with this subject. In some applications, the subject of overvoltage categories may result in a need to change from a UMG 604-PRO with 300 V CAT-III to a UMG 508 with the overvoltage category 600 V CATIII, i.e. instead of a 4,000-V measurement voltage surge, a 50 % higher measurement voltage surge of 6,000 V is attained! However, it may also result in the shifting of the measurement point. This means additional safety for man and machine!

The combination of the CAT category and the defined voltage level gives the measurement voltage surge.

Rated voltages of power supply systems (networks) with various types of overvoltage limitation

Voltage conductor to neutral conductor, taken from rated AC voltage or rated DC voltage up to and including	Rated voltages presently in use worldwide				Measurement voltage surge for operating equipment			
	Three-phase 4-conductor systems with grounded neutral conductor 	Three-phase 3-conductor systems, ungrounded 	Single-phase 2-conductor systems, AC or DC voltage 	Single-phase 3-conductor systems, AC or DC voltage 	Overvoltage categories			
V	V	V	V	V	I	II	III	IV
150	120 / 208* 127 / 220	115, 120, 127	100** 110, 220	100 – 200** 101 – 220 120 – 240	800	1,500	2,500	4,000
300	220 / 380, 230 / 400 240 / 415, 260 / 440 277 / 480	200**, 220, 230, 240, 260, 277, 347, 380, 400, 415, 440	220	220 – 400	1,500	2,500	4,000	6,000
600	347 / 600, 380 / 660 400 / 690, 417 / 720	500	480	480 – 960	2,500	4,000	6,000	8,000

* Conventional in the United States of America and Canada.
** Conventional in Japan.

Communication via the RS485 interface

If it is necessary to network economical measuring devices with each other, the RS485 interface with Modbus RTU protocol remains the benchmark. The simple topology configuration, the lack of sensitivity to EMC interference and the open protocol have been outstanding features of the combination of RS485 and Modbus RTU protocol for years. The full name of the RS485 standard is TIA / EIA-485-A. The most recent update was in March 1998 and the standard was confirmed in 2003 without changes. The standard only defines the electrical interface conditions of the sender and receiver, it does not say anything about the topology or the lines to be used. This information can either be found in the TSB89 "Application Guidelines for TIA / EIA-485-A" or in the application descriptions of the RS485 driver module manufacturers, such as Texas Instruments or Maxim. According to the OSI model (Open Systems Interconnection Reference Model)* only the "physical layer" and not the protocol is described. The protocol used may be selected on an arbitrary basis, e.g. Modbus RTU, Profibus, BACnet etc. The communication between the sender and receiver takes place on a wired basis via shielded, twisted pair cable. One cable pair should only ever be used here for A and B (Fig.: Image 1b). If the interface is not galvanically separated then the common connection must also be routed with it (Fig.: Image 1b). More on this later.

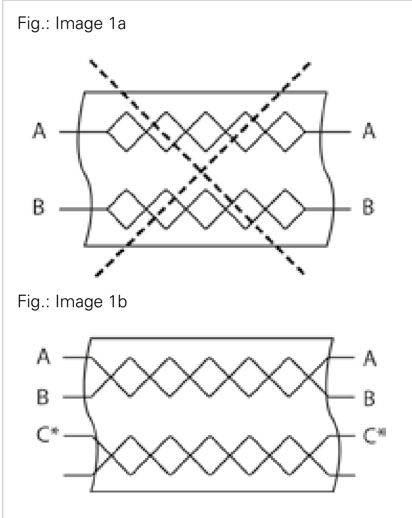


Fig.: Image 1a
Fig.: Image 1b

Fig.: Image 1

The transfer of data takes place via a differential, serial voltage signal between lines [A] and [B]. Because data is transferred on the lines between sender and receiver, one also refers here to half-duplex or alternating operation. Each receiver or sender has an inverted and a non-inverted connection. The data transfer takes place symmetrically. This means that if one line has a "high" signal then the other has a "low" signal. Line A is therefore complementary to B and vice versa. The advantage of measuring the voltage difference between A and B is that common mode interference has largely no influence. Any common mode interference is coupled on both signal lines approximately equally, and due to the differential measurement it therefore has no influence on the data that is to be transferred. The sender (driver) generates a differential output voltage of **at least 1.5 V** at 54 Ohm load. The receiver has a sensitivity of +/-200 mV (Fig. Image 2).

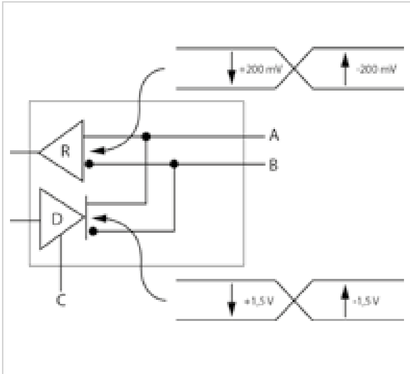


Fig.: Image 2

The state logic here is as follows (Fig. Image 3):

A–B < 0.25 V= Logic 1
A–B > 0.25 V= Logic 0

The labelling of connections A / B is often not uniform. What is A with one manufacturer, may be B with the next. Why is this the case?

The definition says:

A = "-" = T x D- / R x D - = inverted signal
B = "+" = T x D + / R x D + = non-inverted signal

Furthermore, a third line "C" = "Common" is also cited.
This line is for the reference ground.

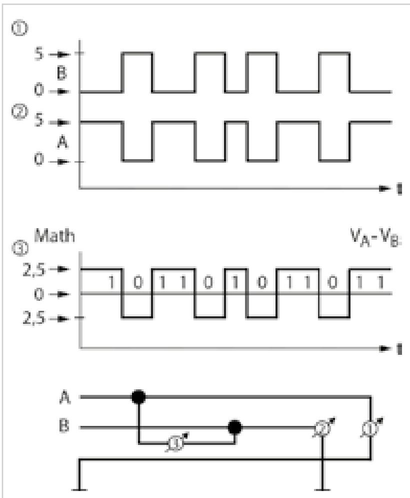


Fig.: Image 3

* Open Systems Interconnection Reference Model (OSI): Driver = Sender; Receiver = Recipient; Transceiver = Sender / Receiver

However, some RS485 chip manufacturers such as Texas Instruments, Maxim, Analog Devices etc. have always used an alternative designation, which has since also become commonplace:

A = "+" = T x D + / R x D + = non-inverted signal
B = "-" = T x D - / R x D - = inverted signal

Due to this confusion, some device manufacturers have introduced their own designations:

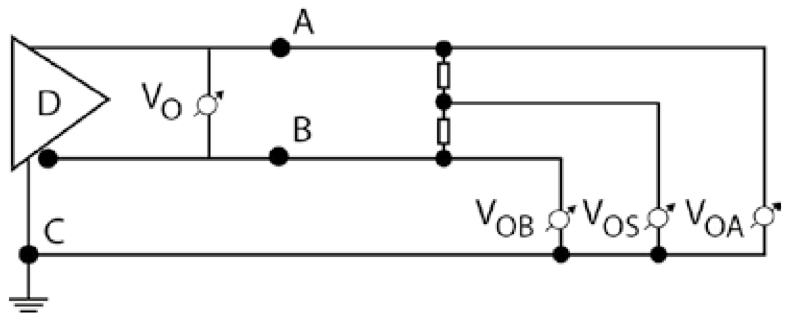
D+ = "+" = T x D + / R x D + = non-inverted signal
D- = "-" = T x D - / R x D - = inverted signal

Through the [+] and [-] sign after the letter [D] it is clear which line is providing the inverted and the non-inverted signal.

Janitza electronics GmbH predominantly uses transceiver ICs from Texas Instruments, Analog Devices or Maxim. For this reason, all of our measuring devices utilise the following designations:

A = "+" = T x D + / R x D + = non-inverted signal
B = "-" = T x D - / R x D - = inverted signal

The voltages are defined in the datasheets as follows:



V_O = Differential voltage A – B
V_{OB} = Voltage between B and C
V_{OA} = Voltage between A and C
V_{OS} = Driver offset voltage

Fig.: Image 4

The voltage VCM

The voltage VCM (Common Mode Voltage) is the sum of the GND potential differences between the RS485 participants (Fig.: Image 5), the driver offset voltage and the common mode noise (Vnoise), acting on the bus line. The RS485 driver manufacturers give a voltage range for VCM of -7 to 12 V. With communication problems, this voltage range - resulting from the potential differences between sender and receiver - is frequently impeded if the interface is not galvanically separated by configuration or no common line exists. Image 6 shows the calculation of the common mode voltage.

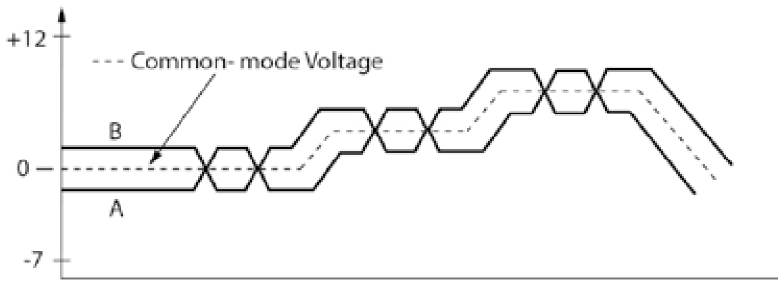


Fig.: Image 5

$$V_{OS} = \frac{V_{OA} + V_{OB}}{2}$$

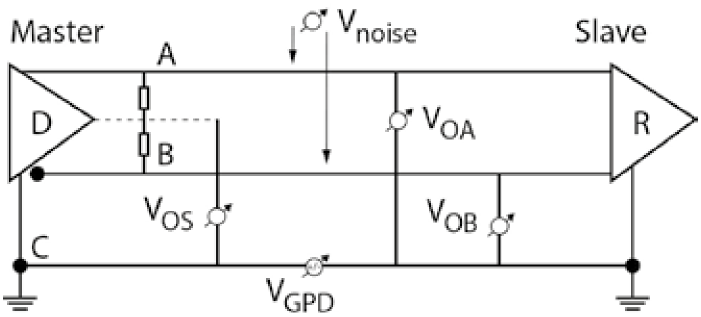


Fig.: Image 6

$$V_{CM} = V_{OS} + V_{noise} + V_{GPD}$$

V_{GPD} (Ground potential differences)

V_{GPD} is the potential difference between sender and receiver here GND (PE). Potential differences between the connections (grounding) often arise with larger spatial expansion of the RS485 bus. These potential differences arise in particular with older electrical installations, because no intermeshed potential equalisation exists in many cases. Furthermore, the effects of lightening result in the potential difference between the PE connections in the distribution system approaching hundreds or thousands of volts. It is also possible under normal conditions that potential differences of a few volts may exist due to the equalisation currents of the loads. Vnoise (common mode noise) is an interference voltage that can have the following causes:

• Interference voltage induced by a magnetic field on the bus line

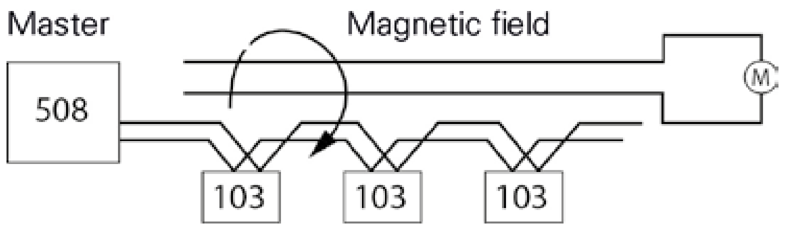


Fig.: Image 7

• Capacitive coupling with system parts that are not galvanically separated ("parasitic capacities")

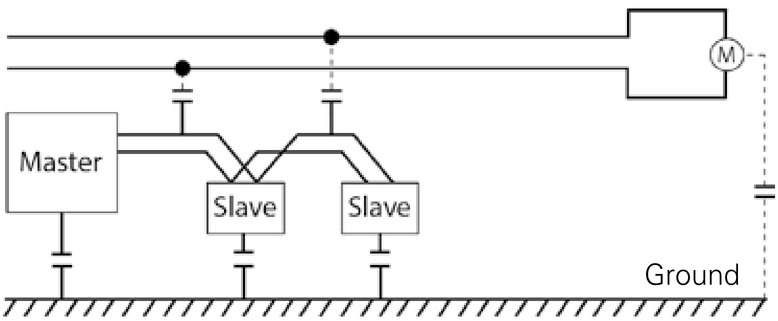


Fig.: Image 8

• Galvanic coupling
• Radiant coupling
• Electrostatic discharge

Bus topology

The bus is "multipoint-capable" and it is possible to connect up to 32 participants without a repeater. The best network topology here is the "daisy chain". This means that the bus cable runs directly from slave to slave.

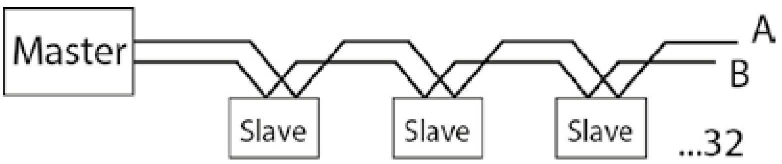


Fig.: Image 9

It is necessary to note that stub lines (branches) should be avoided in general. Stub lines cause reflections on the bus. In theory it is feasible to calculate a possible stub line depending on the transceiver used. However, this is complex in practice. The length of a possible stub line is heavily dependent on the signal rise time of the transceiver used and should be less than 1/10 of the signal rise time of the driver. The higher the possible Baud rate of the transceiver, the smaller the signal rise time of the driver. This means one must know which IC has been installed with the bus participants. Furthermore, the signal speed of the cable must also be applied in the calculation. For this reason, one should avoid stub lines in general.

Termination

A further cause of communication interruptions are bus reflections. A reflection arises if the sender signal has not been fully absorbed by the load. The source impedance should reflect the load impedance and the line surge impedance, because the full signal power is attained through this and only minimum reflections arise. Serial communication of the RS485 interface functions most efficiently when the source and load impedance are harmonised at 120 Ohm. For this reason, the RS485 standard recommends a bus line with a line surge impedance of Z_0 = 120 Ohm. In order that reflections are avoided on the bus, the bus line must be equipped with a termination resistor at the start and end, and this must reflect the line surge impedance.

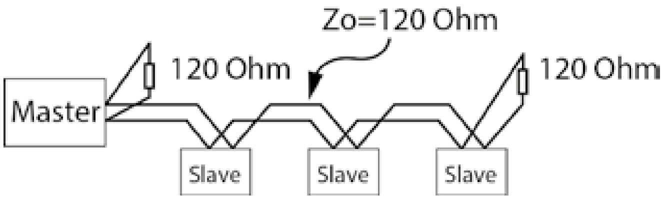


Fig.: Image 10

"Failsafe Bias" resistors

If the receiver inputs fall within the range of -200 mV to + 200 mV, the output of the receiver module is undetermined, i.e. it is not possible for an evaluation of the RS485 signal to take place.

This is the case under the following conditions:

- No sender active
- The bus line has been interrupted (e.g. line break)
- The bus line has short circuited (e.g. line damaged, etc.)

Under these conditions the RS485 bus must be brought to a defined signal status. Some communication buses do not have this problem because only one sender exists for example, which controls the line. The sender is either active or inactive. However because the RS485 bus is multipoint-capable, multiple senders can be connected.

In order that the signal status is clear under the aforementioned conditions, one generally uses a "pull up" resistor between +5 V and the signal line A and a "pull down" resistor between GND and signal line B. The resistors can theoretically be placed at an arbitrary point in the bus. However, these are generally used with a master in a potential divider group with termination resistor because readily assembled connectors exist for this purpose.

With some manufacturers one generally only finds a recommendation to install a termination resistor at the start and end, in order that reflections can be avoided (see section on termination or bus configuration UMG 604-PRO with UMG 103-CBM). Why is this the case?

In this case the manufacturers have used transceivers for the RS485 interface, which already have an integrated internal Failsafe Bias in the chip, i.e. with 0 V at the receiver input for example, the output automatically has a logical "High" state. With Maxim (as used in the UMG 604-PRO and UMG 103-CBM) the function is called "True fail-safe". An external Failsafe Bias then only remains necessary if participants are connected to the same bus, which do not possess this function. The bus load is otherwise unaffected by the "True fail-safe" function.

The "common connection" or "galvanic separation"

The bus participants generally obtain their supply voltage from different areas of the electrical installation. With older electrical installations in particular, it is therefore possible that considerable potential differences can arise between grounding. However, for fault-free communication the voltage Vcm can only lie within the range of -7 to +12 V, i.e. the voltage V_{GPD} (Ground potential differences) must be as small as possible (image 11 a, image 5). If the RS485 interface is not galvanically separated from the supply voltage then the common connection must be routed with it (image 11 b). However, connection with the common connections may result in a current loop, i.e. without additional measures a higher compensation current will flow between the bus participants and ground. Developers generally prevent this by decoupling the GND of the RS485 interface from the ground with a 100-Ohm resistor (image 11 c).

A better alternative is the galvanic separation of the RS485 interface from the supply voltage through an internal DC/DC converter and a signal isolator. This means that potential differences in the ground have no effect on the signal. The differential signal therefore "floats". Even better still is the galvanic separation of the RS485 interface in combination with a common connection.

Image 12 shows mixed operation between participants of galvanically separated and non-galvanically separated interfaces. The participants with the galvanically separated RS485 have no common connection in the example. In this case it is necessary to ensure that the common connections of the participants are connected with each other. Despite this, communication interferences can arise due to EMC coupling capacitors. This results in the non-galvanically separated participants no longer being able to interpret the signal. In this case the bus must be separated and an additional galvanic coupling must be integrated between the participant circuits.

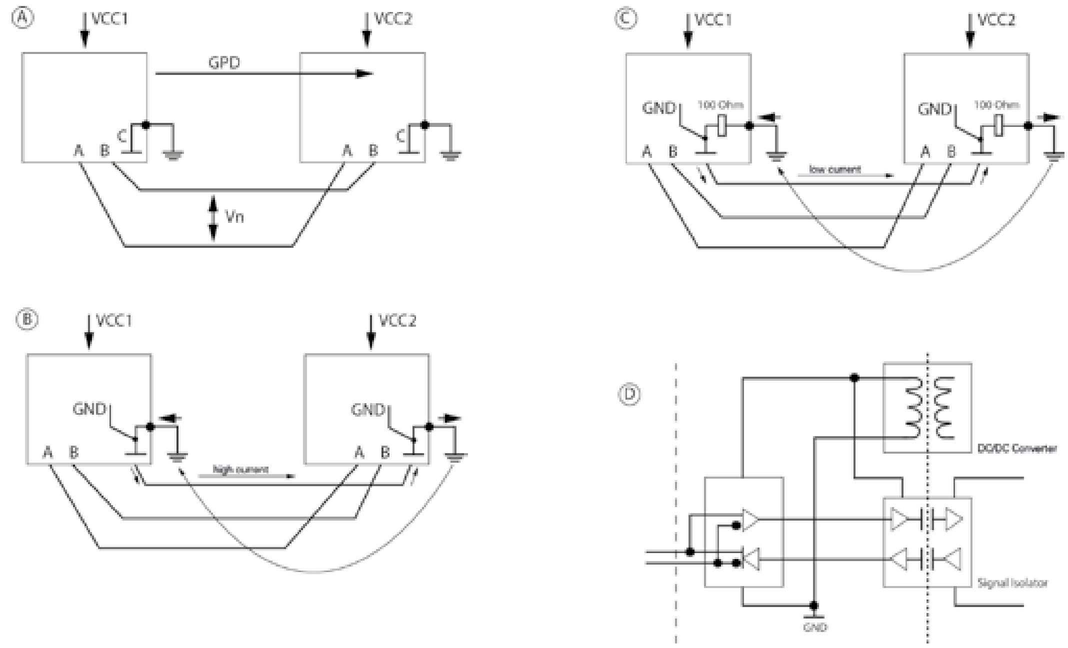


Fig.: Image 11

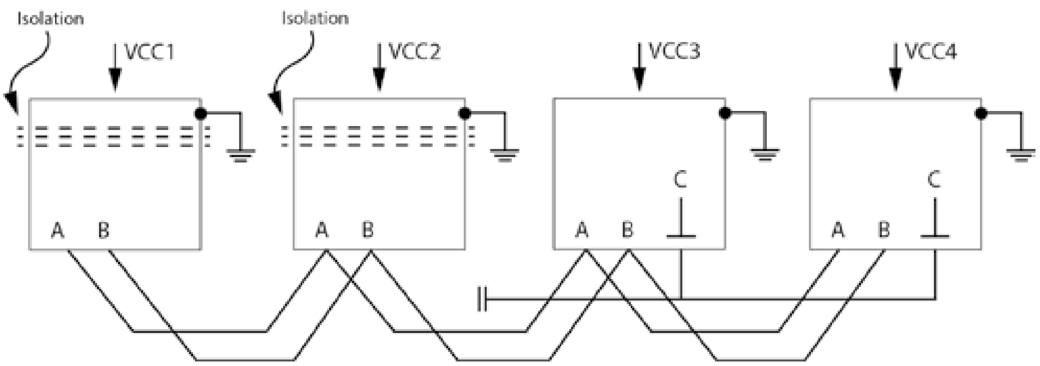


Fig.: Image 12

Note: The screening must never be connected to the common connection of the RS485 interface. This would result in faults being directly coupled with the GND of the RS485 transceiver.

Analysis and optimisation of RS422 and RS485 bus systems

Our recommendation: MSB-RS485 Analyser – The perfect combination of hardware and software analysis

- Independent analyser device, controlled and supplied via USB
- Rapid real-time signal/data processing by hardware
- Delivers data accurate to the microsecond regarding every line change
- Equipped with numerous visualisation tools, enabling a detailed insight into all RS422/485 communication
- Detects faults with bus enabling, timeouts or with incorrect/double addressing
- Variable connection types allow the complete logging of all bus activities, as well as targeted logging of the data sent by selected bus participants.
- OS-independent time logging of all events in 1 µs resolution
- Simultaneous display of the Tri-State signal level and the transferred data.
- Detection of inactive bus states and invalid line level
- Measurement and use of ALL Baud rates from 1...1 MBaud
- Automatic detection of Baud rate, data bits and parity.
- Supports 9 Bit data word protocols

Available from www.iftools.com

Ports, protocols and connections

UMG 604-PRO / UMG 605-PRO / UMG 508 / UMG 511	
Protocols	**Ports**
TFTP	1201
Modbus /TCP – Modbus / UDP	502, 4 Ports
DHCP	68
NTP	123
BACnet	47808
Nameservice	1200
HTTP	80
FTP	21
FTP data port	1024, 1025
FTP data port	1026, 1027
Modbus over Ethernet	8000, 1 Port
Service port (telnet)	1239
SNMP	161 / 162 (TRAP)
E-Mail port (actual)	25
E-Mail port (in preparation)	587

GridVis®	
Protocols	**Ports**
Modbus /TCP – Modbus / UDP	502
HTTP	80
FTP	21
FTP data port	1024, 1025
FTP data port	1026, 1027
Modbus /TCP	502
Modbus over Ethernet	8000
Read out telnet data port	1239
Update telnet data port	1236, 1237
E-Mail port (in preparation)	25
E-Mail port (in preparation)	587

UMG 103-CBM / UMG 104	
Protocols	**Ports**
The devices do not have an Ethernet connection	The devices do not have an Ethernet connection

Number of TCP/UTP connections (UMG 604-PRO / 605-PRO / 508 / 511)

- A max. total of 24 connections are possible via the TCP group. The following applies:

- Port 21 (FTP): max. 4 connections
- Port 25/587 (E-Mail): max. 8 connections
- Port 1024-1027 (data port to every FTP port): max. 4 connections
- Port 80 (HTTP): max. 24 connections
- Port 502 (Modbus TCP/IP): max. 4 connections
- Port 1239 (Debug): max. 1 connection
- Port 8000 (Modbus or TCP/IP): max. 1 connection

- Connection-free communication via the UTP group

- Port 68 (DHCP)
- Port 123 (NTP)
- Port 161/162 (SNMP)
- Port 1200 (Nameservice)
- Port 1201 (TFTP)
- Port 47808 (BACnet)

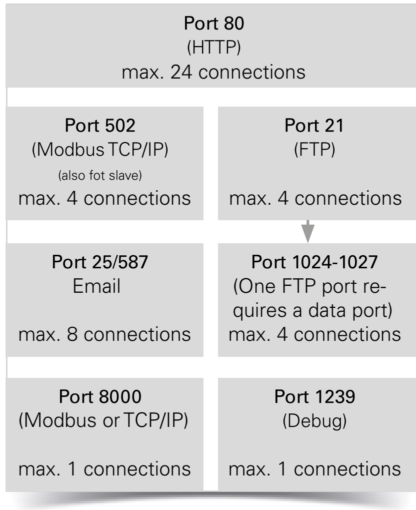


Fig.: TCP group: max. 24 connections (queue scheduling) (UMG 604-PRO / 605-PRO / 508 / 511)

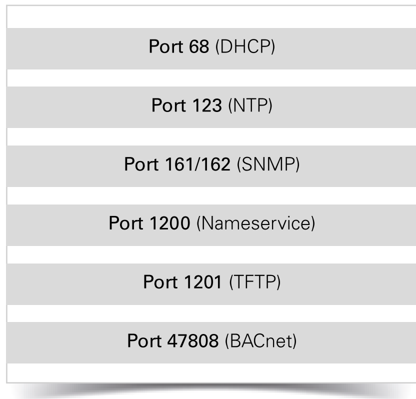


Fig.: UTP group: Connection-free communication (UMG 604-PRO / 605-PRO / 508 / 511)

The UMG 96RM-E supports the following protocols via Ethernet connection

Client services	Ports
DNS	53 (UDP /TCP)
DHCP-Client (BootP)	68 (UDP)
NTP (Client)	123 (UDP)
E-Mail (sending)	Selectable (1-65535 TCP)

Server services	Port
Ping	(ICMP / IP)
FTP	20 (TCP)*, 21 (TCP)
HTTP	80 (TCP)
NTP (only listen)	123 (UDP Broadcast)
SNMP	161 (UDP)
Modbus TCP	502 (UDP /TCP)
Device identification	1111 (UDP)
Telnet	1239 (TCP)
Modbus RTU (Ethernet encapsulated)	8000 (UDP)

* Random port (> 1023) for data transfer, if work is taking place in PASSIVE mode

The UMG 96RM-E can administrate 20 TCP connections.

Client services are contacted by a device on a server via the specified ports, the server services make the device available.

The following protocols are not supported.

BACnet (47808 / UDP)

Basics for power factor correction

Active power

If one connects an effective resistor, e.g. a heating device, in an alternating current circuit then the current and voltage are in phase. The momentary power values (P) are determined with alternating current through the multiplication of associated momentary values of current (I) and voltage (U). The course of the active power is always positive with doubled mains frequency.

The AC power has the peak value P = U x I. Through area conversion it can be converted into the equivalent DC power, the so-called active power P. In the event of effective resistance, the active power is half the size of the peak power value.

In order to determine the AC power, one always calculates using the effective values.

$$P = U \cdot I$$
$$[W]\ [V]\ [A]$$

Fig.: Active power formula

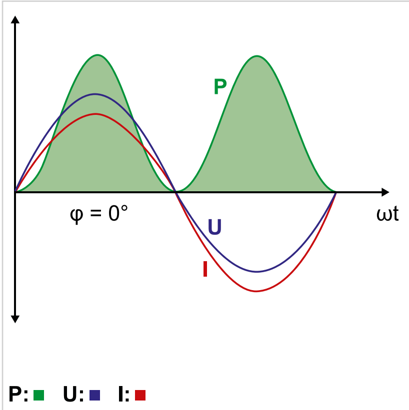


Fig.: AC power with purely ohmic load

Active and reactive power

A purely ohmic load rarely arises in practice. An inductive component usually also arises. This applies to all loads, which require a magnetic field in order to function (e.g. motors, transformers, etc.). The current used, which is required in order to generate and reverse the polarity of the magnetic field, is not dissipated but flows back and forth as reactive current between the generator and the load.

Phase shifting arises, i.e. the zero point transitions for voltage and current are no longer congruent. With an inductive load the current follows the voltage, with a capacitive load the relationship is precisely the opposite. If one now calculates the momentary power values (P = U x I), negative values will always arise if one of the two factors is negative.

Example:
Phase shifting φ = 45° (equates to an inductive cos φ = 0.707). The power curve overlaps in the negative range.

$$P = U \cdot I \cdot \cos \varphi$$
$$[W]\ [V]\ [A]$$

Fig.: Calculation of the effective power with ohmic and inductive load

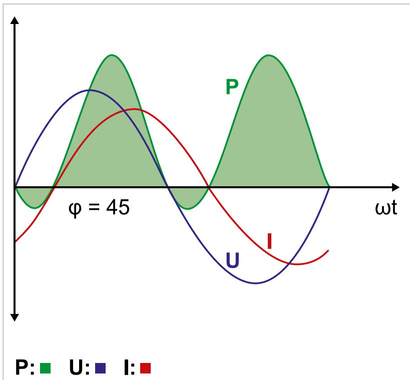


Fig.: Voltage, current and power with mixed ohmic, inductive load

Reactive power

Inductive reactive power arises for example in motors and transformers – without consideration to line, iron and friction losses.

If the phase shifting between current and voltage is 90°, e.g. with "ideal" inductance or with capacity, then the positive and negative area portions are of equal size. The effective power is then equal to the factor 0 and only reactive power arises. The entire energy shifts back and forth here between load and generator.

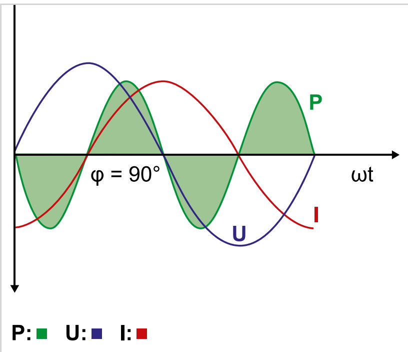


Fig.: Voltage, current and power with pure reactive load

$$Q = U \cdot I \cdot \sin\varphi$$
[var] [V] [A]

Fig.: Determination of the inductive reactive power

Apparent power

The apparent power is the electrical power that is supplied to or is to be supplied to an electrical load. The apparent power S is derived from the effective values of current I and voltage U.

In the event of insignificant reactive power, e.g. with DC voltage, the apparent power is the same as the active power. Otherwise this is greater. Electrical operating equipment (transformers, switchgear, fuses, electrical lines, etc.), which transfer power, must be appropriately configured for the apparent power to be transferred.

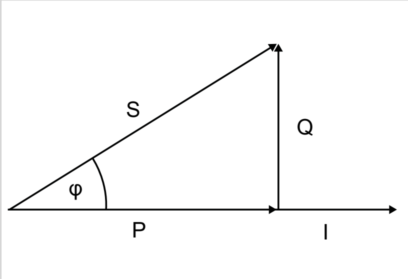


Fig.: Power diagram

$$S = U \cdot I$$
[VA] [V] [A]

Fig.: Apparent power without phase shifting

Apparent power with sinusoidal variables

With sinusoidal variables the offset reactive power Q arises, if the phases of current and voltage are shifted by an angle φ.

$$S = \sqrt{P^2 + Q^2}$$
[VA] [W] [var]

Fig.: The apparent power is the result of the geometric addition of active and reactive power.

Power factor (cos φ and tan φ)

The relationship of active power P to apparent power S is referred to as the effective power factor or effective factor. The power factor can lie between 0 and 1.

$$\cos \varphi = \frac{P}{S} \quad [W] / [VA]$$

Fig.: Determination of the power factor over effective and apparent power

With pure sinusoidal currents, the effective power factor concurs with the cosine (cos φ). It is defined from the relationship P/S. The effective power factor is a measure through which to determine what part of the apparent power is converted into effective power. With a constant effective power and constant voltage the apparent power and current are lower, the greater the active power factor cos φ.

The tangent (tan) of the phase shift angle (φ) facilitates a simple conversion of the reactive and effective unit.

$$\tan \varphi = \frac{Q}{P} \quad [var] / [W]$$

Fig.: Calculation of the phase shifting over reactive and effective power

The cosine and tangent exist in the following relationship to each other:

$$\cos \varphi = \sqrt{\frac{1}{1 + \tan \varphi^2}}$$

Fig.: Relationship to cos φ and tan φ

In power supply systems the highest possible power factor is desired, in order to avoid transfer losses. Ideally this is precisely 1, although in practical terms it is around 0.95 (inductive). Energy supply companies frequently stipulate a power factor of at least 0.9 for their customers. If this value is undercut then the reactive energy utilised is billed for separately. However, this is not relevant to private households. In order to increase the power factor, systems are used for power factor correction. If one connects the capacitor loads of a suitable size in parallel then the reactive power swings between the capacitor and the inductive load. The superordinate network is no longer additionally loaded. If, through the use of PFC, a power factor of 1 should be attained, only the effective current is still transferred.

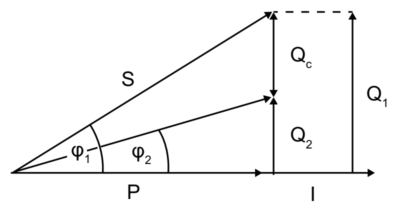


Fig.: Power diagram with application of power factor correction

The reactive power Qc, which is absorbed by the capacitor or dimensioned for this capacitor, results from the difference between the inductive reactive power Q1 before correction and Q2 after correction.

The following results: Qc = Q1 – Q2

$$Q_c = P \cdot (\tan \varphi_1 - \tan \varphi_2)$$
$$[var] \ [W]$$

Fig.: Calculation of the reactive power for the improvement of the power factor

Calculation formula for the capacitor

Capacitor output single-phase

Example: 66.5 µF with 400 V / 50 Hz
0.0000665 · 400² · 2 · 3.14 · 50 = 3,340 var = 3.34 kvar

$$Q_c = C \cdot U^2 \cdot 2 \cdot \pi \cdot f_n$$

Capacitor output with delta connection

Example: 3 x 57 µF with 480 V / 50 Hz
3 · 0.000057 · 480² · 2 · 3.14 · 50 = 12,371 var = 12.37 kvar

$$Q_c = 3 \cdot C \cdot U^2 \cdot 2 \cdot \pi \cdot f_n$$

Capacitor output with star connection

Example: 3 x 33.2 µF with 400 V / 50 Hz
3 · 0.0000332 · (400 / 1.73)² · 2 · 3.14 · 50 = 1670 var = 1.67 kvar

$$Q_c = 3 \cdot C \cdot (U / \sqrt{3})^2 \cdot 2 \cdot \pi \cdot f_n$$

Capacitor current in the phase conductor

Example: 25 kvar with 400 V
25,000 / (400 · 1.73) = 36 A

$$I = \frac{Q}{U \cdot \sqrt{3}}$$

$$Q_c = I \cdot U \cdot \sqrt{3}$$

Series resonant frequency (fr) and de-tuning factor (p)
of de-tuned capacitors

Example: p = 0.07 (7 % de-tuning) in the 50-Hz network

$$f_r = 50 \cdot \sqrt{\frac{1}{0{,}07}} = 189 \text{ Hz}$$

$$f_r = f_n \cdot \sqrt{\frac{1}{p}} \qquad p = \left(\frac{f_n}{f_r}\right)^2$$

Required nominal capacitor output three-phase in de-tuned configuration

Example: 3 x 308 µF with 400 V / 50 Hz with p = 7 % de-tuned

$$0.000308 \cdot 3 \cdot 400^2 \cdot 2 \cdot 3.14 \cdot 50 / (1 - 0.07) = 50 \text{ kvar}$$

$$Q_c = \left(1 - \frac{7}{100}\right) \bullet \frac{440^2}{400^2} \bullet 50 = 56{,}3 \text{ kvar}$$

$$Q_c = \frac{C \bullet 3 \bullet U^2 \bullet 2 \bullet \pi \bullet f_n}{1 - p}$$

Which capacitor should be used for this?
This means, for a 50-kvar stage, a 440-V-56-kvar capacitor is required.

$$Q_c = \left(1 - \frac{P}{100}\right) \bullet \frac{U_c^2}{U_N^2} \bullet N_c$$

Power factor and cos and tan conversion

$$\cos \varphi = \frac{P}{S}$$

$$\cos \varphi = \sqrt{\frac{1}{1 + \tan \varphi^2}}$$

Conversion of the capacitor power subject of the mains voltage
Determination of the reactive power Q_{new} · C is constant here.

$$Q_{new} = \left(\frac{U_{new}}{U_C}\right)^2 \bullet \frac{f_{new}}{f_R} \bullet Q_C$$

Example:

Network: 400 V, 50 Hz, 3-phase
Nominal capacitor data: 480 V, 70 kvar, 60 Hz, 3-phase, delta, un-choked
Question: Resultant nominal capacitor power?

$$Q_{new} = \left(\frac{400}{480}\right)^2 \bullet \frac{50}{60} \bullet 70 = 40{,}5 \text{ kvar}$$

The resultant correction power of this 480-V capacitor connected to a 400-V-50-Hz network is just 40.5 kvar.

Definition

Q_C	Nominal capacitor power
P	Degree of de-tuning
U_C	Capacitor voltage
U_N	Nominal voltage
N_C	Effective filter output
Q_{new}	New reactive power
U_{new}	New voltage
f_{new}	New frequency
f_R	Nominal frequency of the capacitor

Cable cross-section and fuses

With this table we provide general and non-binding information on standard practice. Connection cross-sections and the extent of protection are dependent not only on the nominal power of the PFC system but also on national regulations, the cable material used and the ambient conditions. The recommendation for the fuse current strength is for short circuit protection, HRC fuses are unsuitable for overload protection with power capacitors. The system installer or planning office are responsible for dimensioning and selecting the line cross-sections and fuses in individual cases.

PFC cable cross-sections, fuses (with networks with 400 V / 50 Hz)			
Output kvar	**Rated current A**	**Cable cross-section NYY-J mm²**	**HRC fuse in A**
5	7	4 x 2.5	16
7.5	10	4 x 4	20
10	14	4 x 4	25
12.5	18	4 x 6	35
15	22	4 x 6	35
17.5	25	4 x 10	50
20	29	4 x 10	50
25	36	4 x 16	63
30	43	4 x 16	80
37.5	54	4 x 25	100
50	72	3 x 35/16	125
55 – 65	79 – 94	3 x 35/16	160
70 – 85	101 – 123	3 x 70/35	200
86 – 100	124 – 145	3 x 95/50	250
101 – 125	146 – 181	3 x 120/70	250
126 – 160	182 – 231	2"3 x 70/35	315
161 – 180	233 – 260	2"3 x 95/50	400
181 – 200	261 – 289	2"3 x 120/70	400
201 – 250	290 – 361	2"3 x 150/70	500
251 – 300	362 – 434	2"3 x 185/95	630

Connection cross-sections only apply for the cited capacitor powers.

Important information:
When expanding existing systems, the busbar division must be carried out in advance!

Power factor correction systems with power of over 300 kvar have two separate busbar systems and require two separate feeds. The table applies to conventional and de-tuned PFC systems. It is always necessary to observe the most recent valid specifications (e.g. DIN VDE 0298).

cos phi

Calculation of the requisite kvar PFC power

This selection table has been generated for calculation of the requisite reactive power. You can determine a multiplier from the table using the actual power factor and the target power factor, and multiply this with the active power requiring correction. The result is the reactive power required for your power factor correction system. This calculation table can also be found as an MS Excel file on our homepage under http://www.janitza.com/downloads/tools/kvar-table/.

cos phi selection table

Active power	P	= 100 kW
ACTUAL cos φ		= 0.65
TARGET cos φ		= 0.95
Factor F from table		= 0.84
Correction power	Qc	= P x (tan φ1 - tan φ2)
		P * F
		100 x 0.84
		84 kvar

ACTUAL		**Target power factor**										
tan φ	**cos φ**	**cos φ**										
		0.80	**0.82**	**0.85**	**0.88**	**0.90**	**0.92**	**0.94**	**0.95**	**0.96**	**0.98**	**1.00**
		Factor F										
1.33	**0.60**	0.58	0.64	0.71	0.79	0.85	0.91	0.97	1.00	1.04	1.13	1.33
1.30	**0.61**	0.55	0.60	0.68	0.76	0.81	0.87	0.94	0.97	1.01	1.10	1.30
1.27	**0.62**	0.52	0.57	0.65	0.73	0.78	0.84	0.90	0.94	0.97	1.06	1.27
1.23	**0.63**	0.48	0.53	0.61	0.69	0.75	0.81	0.87	0.90	0.94	1.03	1.23
1.20	**0.64**	0.45	0.50	0.58	0.66	0.72	0.77	0.84	0.87	0.91	1.00	1.20
1.17	**0.65**	0.42	0.47	0.55	0.63	0.68	0.74	0.81	**0.84**	0.88	0.97	1.17
1.14	**0.66**	0.39	0.44	0.52	0.60	0.65	0.71	0.78	0.81	0.85	0.94	1.14
1.11	**0.67**	0.36	0.41	0.49	0.57	0.62	0.68	0.75	0.78	0.82	0.90	1.11
1.08	**0.68**	0.33	0.38	0.46	0.54	0.59	0.65	0.72	0.75	0.79	0.88	1.08
1.05	**0.69**	0.30	0.35	0.43	0.51	0.56	0.62	0.69	0.72	0.76	0.85	1.05
1.02	**0.70**	0.27	0.32	0.40	0.48	0.54	0.59	0.66	0.69	0.73	0.82	1.02
0.99	**0.71**	0.24	0.29	0.37	0.45	0.51	0.57	0.63	0.66	0.70	0.79	0.99
0.96	**0.72**	0.21	0.27	0.34	0.42	0.48	0.54	0.60	0.64	0.67	0.76	0.96
0.94	**0.73**	0.19	0.24	0.32	0.40	0.45	0.51	0.57	0.51	0.64	0.73	0.94
0.91	**0.74**	0.16	0.21	0.29	0.37	0.42	0.48	0.55	0.58	0.62	0.71	0.91
0.88	**0.75**	0.13	0.18	0.26	0.34	0.40	0.46	0.52	0.55	0.59	0.68	0.88
0.86	**0.76**	0.11	0.16	0.24	0.32	0.37	0.43	0.49	0.53	0.56	0.65	0.86
0.83	**0.77**	0.08	0.13	0.21	0.29	0.34	0.40	0.47	0.50	0.54	0.63	0.83
0.80	**0.78**	0.05	0.10	0.18	0.26	0.32	0.38	0.44	0.47	0.51	0.60	0.80
0.78	**0.79**	0.03	0.08	0.16	0.24	0.29	0.35	0.41	0.45	0.48	0.57	0.78
0.75	**0.80**		0.05	0.13	0.21	0.27	0.32	0.39	0.42	0.46	0.55	0.75
0.72	**0.81**		0.03	0.10	0.18	0.24	0.30	0.36	0.40	0.43	0.52	0.72
0.70	**0.82**			0.08	0.16	0.21	0.27	0.34	0.37	0.41	0.49	0.70
0.67	**0.83**			0.05	0.13	0.19	0.25	0.31	0.34	0.38	0.47	0.67
0.65	**0.84**			0.03	0.11	0.16	0.22	0.28	0.32	0.35	0.44	0.65
0.62	**0.85**				0.08	0.14	0.19	0.26	0.29	0.33	0.42	0.62
0.59	**0.86**				0.05	0.11	0.17	0.23	0.26	0.30	0.39	0.59
0.57	**0.87**				0.03	0.08	0.14	0.20	0.24	0.28	0.36	0.57
0.54	**0.88**					0.06	0.11	0.18	0.21	0.25	0.34	0.54
0.51	**0.89**					0.03	0.09	0.15	0.18	0.22	0.31	0.51
0.48	**0.90**						0.06	0.12	0.16	0.19	0.28	0.48
0.46	**0.91**						0.03	0.09	0.13	0.16	0.25	0.46
0.43	**0.92**							0.06	0.10	0.13	0.22	0.43
0.40	**0.93**							0.03	0.07	0.10	0.19	0.40
0.36	**0.94**								0.03	0.07	0.16	0.36
0.33	**0.95**									0.04	0.13	0.33
0.29	**0.96**										0.09	0.29
0.25	**0.97**										0.05	0.25

Fixed PFC

Selection table – fixed PFC of motors				
Motor power in kW	**Capacitor power when idling in kvar (dependent on rpm)**			
	3,000	**1,500**	**1,000**	**750**
1.5	0.8	1	1.1	1.2
3	1.5	1.6	1.8	2.3
5.5	2.2	2.4	2.7	3.2
7.5	3.4	3.6	4.1	4.6
11	5	5.5	6	7
15	6.5	7	8	9
18.5	8	9	10	11
22	10	11	12	13
30	14	15	17	20
45	19	21	24	28
75	28	32	37	41
90	34	39	44	49
110	40	46	52	58

Guideline values for the individual correction of motors per VDEW

Comment:
- Values only provide a guideline value
- It is essential to avoid overcorrection, in order to prevent overexcitation

Selection table – fixed PFC of transformers	
Nominal Transformer power in kVA	**Nominal capacitor power in kvar**
100	4.8
160	6.25
200	7.2
250	7.5
315	9.3
400	10
500	12.5
630	15
800	20
1,000	25
1,250	30
1,600	40
2,000	50

Comment:
- Values only provide a guideline value (with three-phase transformers with normal losses the PFC correction power is between 1 and 5 % of their nominal power depending on size)
- It is essential to observe regional energy supplier specifications.
- Ensure the appropriate back-up fuses and short circuit-proof lines

Protection classes per EN 60529

Protection of electrical operating equipment

Electrical operating equipment (e.g. lights, LED modules and operating devices) must belong to a certain protection class per EN 60529 according to their loading by foreign bodies and water. The protection classes are also referred to as IP codes. The abbreviation IP stands for "International Protection" or "Ingress Protection".

The IP code per EN 60529

The protection class afforded by a housing is verified according to standardised test procedures. The IP code is used in order to classify this protection class. This comprises the two letters IP and a two-digit characteristic number. The protection classes refer exclusively to the protection against contact and the penetration of solid foreign bodies and dust (indicated by the first characteristic number of the IP code), as well as the harmful penetration of water (indicated by the second characteristic number of the IP code). The protection classes do not provide any information regarding the protection against external influences. Furthermore, the protection classes must not be confused with the electrical protection classes, which refer to the protective measures for the prevention of an electric shock.

Important information: In addition to the protection class it is also always necessary to take into consideration the external influences and conditions.

Code letters	
IP	International Protection (Ingress Protection)

Characteristic number 1	Protection against foreign bodies	Protection against contact
0	No protection	No protection
1	Protected against solid foreign bodies with a diameter from 50 mm	Protected against access with the back of the hand
2	Protected against solid foreign bodies with a diameter from 12.5 mm	Protected against access with a finger
3	Protected against solid foreign bodies with a diameter from 2.5 mm	Protected against access with a tool
4	Protected against solid foreign bodies with a diameter from 1.0 mm	Protected against access with a wire
5	Protected against dust in harmful quantities	Full protection against contact
6	Dust-tight	Full protection against contact

Characteristic number 2	Protection against water
0	No protection
1	Protection against drops of water falling vertically
2	Protection against drops of water falling, if the housing is tilted up to 15°
3	Protection against sprayed water falling, up to 60° from vertical
4	Protection against splash water on all sides
5	Protection against water jets (nozzle) from any angle
6	Protection against powerful water jets
7	Protection against intermittent submersion
8	Protection against continuous submersion

Prerequisite and confirmation for commissioning (VBI)

General information

The prerequisite and confirmation for commissioning (VBI) is used for the preparation and advance information for commissioning by Janitza electronics GmbH. The confirmation for correct electrical installation as well as the technical prerequisite for the installation of the software is needed prior to commissioning.

General information on the electrical installation of the Janitza measurement devices

- **Access:** All devices are fully functional (auxiliary voltage, connection, etc.) and freely accessible for interface, connection and display.
- **Interfaces:** The bus connection between the devices and to the PC is correctly wired and functional. Information on the connection of the interfaces and wiring can be found in the associated operating instructions.
- **Wiring:** A stub has not been formed on the RS485 interface (see graphic). This means all devices have been connected in series to the power analyser.
- **Bus cable:** A bus cable has been used for the wiring of the RS485. The cable must be shielded and the wires (A&B) must be twisted with one another. We recommend the following bus cable: Li2YCY(TP)2x2x0.22).
- **Master:** The following structure has been adhered to in the bus lines: The Master (UMG 507 / UMG 508 / UMG 511 / UMG 604-PRO / UMG 605-PRO / UMG 96RM-E) is the first participant on the bus.
- **RS485:** With UMG 507 / UMG 508 / UMG 511 the requisite Profibus connector has been used for the RS485 interface. The Profibus connector is essential as the RS485 interface is connected to the termination resistor.
- **Set-up plan**: A set-up plan of the bus connection of all bus-participants has been transferred beforehand per e-mail/fax to the responsible technician (support@janitza.com).
- **Current transformer setting:** The current transformer settings are implemented by the customer. If the setting of the transformer is part of the commissioning (see specification sheet), a device list with name-related CT data must be transferred in advance to the responsible technician.

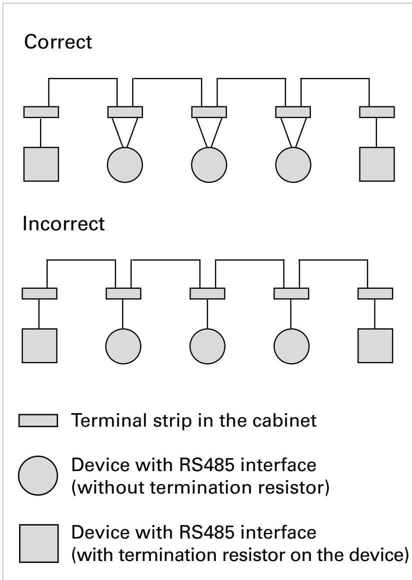


Fig.: Modbus configuration

- **IP addresses:** The device names and IP addresses must be defined, documented and communicated to the responsible technician prior to the commissioning.

http://download.janitza.de/download_direkt/VBI-INFO/IP_Liste_Beispiel.xls

- **Settings:** For measurement devices with an Ethernet connection, the IP addresses must be assigned. If the setting of the IP address is part of the commissioning (see specification sheet), a device list with IP address, subnet mask and gateway must be given in advance to the responsible technician.

- **Termination resistor:** A termination resistor of 120 Ohm must be placed at the beginning and end of a bus line between A and B. Devices with Profibus connectors are switched to ON.

- **Connection:** After connecting the measurement devices, the following measurement values must be checked:

- The effective power of the individual phases should be positive. If this is not the case, there is a power feedback or a wrong CT connection (k and l miswired).

- The cos phi of the individual phases should be above a realistic value of 0.5 (reference value). If this is not the case, the phase assignments of the current and voltage measurement must be checked. The current and voltage connection must be assigned correctly to the phases.

- **Database:** The database MySQL / MS SQL is installed and administrated.

For the commissioning, it is important that a local responsible electrician / installer is present on site during the commissioning.

Software installation and network administration

The following points show the prerequisite and properties of the GridVis® evaluation and configuration software (status vers. 4) from Janitza electronics GmbH.

- **GridVis® licence:** In order to activate GridVis® an account is required on the Janitza licence server (https://license.janitza.de/). The account should be created prior to commissioning by the person responsible. For the Professional, Enterprise, Service editions, an activation code is required. The activation code can be purchased from a sales partner or from Janitza electronics. Internet access is required for the activation. Further information at:

  https://wiki.janitza.de/display/GRIDVIS50EN/GridVis-Documentation+6.0

- **GridVis® licence system in conjunction with VMware**

GridVis® checks the licence system for the following parameters:

- CPU: Key: HKLM\HARDWARE\DESCRIPTION\System\CentralProcessor\0
  Values: "Identifier", "VendorIdentifier"
- Machine: Key: HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion
  Values: "ProductId", "CurrentVersion"

DISK: Size of the root partition
This value is determined by Java and can be viewed in the error report (file "SystemInfo.xml")

filesystem\root\drive = hard drive name
filesystem\root\totalspace = the value

MAC: List of all MAC addresses (of the computer but only percentages)
without a loopback and without a PointToPoint.

- **System prerequisites:** The GridVis® evaluation and configuration software requires the following system prerequisites:

- Up-to-date processor
- Min. 4 GB RAM (standard database)
- Min. 16 GB RAM (MySQL, MS SQL database)
- Screen resolution min. 1,280 x 960 pixels
- Installation storage space: 1 GB

- **Supported operating systems:** The following operating systems are supported by the GridVis® evaluation and configuration software:

- Windows XP® (from Service Pack 3)
- Windows Vista®(from Service Pack 1)
- Windows 7® , Windows 8®
- Windows Server® (from Version 2003 R1)
- Linux (x86, x64; from Java 7) (Note: no support)

- **Memory reserves:** The memory capacity required for archiving the data depends on the number of measurement devices. Approx. 500 MB memory per year can be assumed for one measurement device. (Number of devices times 500 MB times the years of archiving). A precise calculation can be carried out with the following Excel sheet:

http://download.janitza.de/download_direkt/VBI-INFO/Speicher-UMG.xlsx

- GridVis®-Basic: GridVis®-Basic is supplied with the Derby and Janitza database as standard. A maximum of 5 devices can be integrated in the software.

- The installation / administration of the database MySQL / MS SQL is not a component of commissioning. The following data must be provided to the individual who commissions the system:

- IP database
- Port number
- Name of the database
- User and password

- **GridVis® license model / software variants:**

Description	Basic	Professional	Service	Ultimate
Installations (desktop)	1	3	5	5
Installations (service / virtual server)	0	0	2	2
Number of measurement devices	5	not limited	not limited	not limited
Update period	not limited	1 year	1 year	1 year
Telephone support	not limited	not limited	not limited	not limited
Graphs	•	•	•*2	•*2
Data base Janitza DB / Derby DB	•	•	•	•
Manual reports	•	•	•*2	•*2
Graphical programming	•	•	•*2	•*2
Topology	•	•	•*2	•*2
Data base support MS-SQL / MySQL*1	-	•	•	•
Automatic reading	-	•	•	•
Virtual device	-	•	•	•
User administration	-	•	•	•
Scheduling points in time	-	•	•	•
CSV data import	-	•	•	•
RCM report	-	•	•	•
Scheduling time periods	-	-	•	•
PQ report	-	-	•	•
Automatic Excel export	-	-	•	•
Generic Modbus	-	-	•	•
Graphic programming module (write/read Modbus)	-	-	•*2	•*2
Automatic reports	-	-	•*2	•*2
Online recording	-	-	•	•
Service	-	-	•	•
Alarm management	-	-	•	•
REST-API	-	-	•	•
Web visualization GridVis®-Energy	-	-	-	•
Item number	**51.00.116**	**51.00.160**	**51.00.180**	**51.00.190**
Item number extension update per year	**-**	**51.00.161**	**51.00.181**	**51.00.191**
Item number upgrade to next higher suite	**-**	**51.00.162**	**51.00.182**	**-**

*1 SQL data base is not included.
*2 This feature is only available in conjunction with the GridVis® installation on the desktop.

Number of devices:	Max. number of simultaneously loaded devices (e.g. in the Basic version: One project with 5 devices or 5 projects with one device).
Update time frame:	Time frame within which the new version can be installed free of charge.
Automatic reading:	Device reading according to freely configurable schedules.
Inputting online:	Measured data from devices without memory is determined in the GridVis® software.
Service:	The GridVis® software runs in the background and will be started automatically. Devices can be readout time-independent and automatically. For configuration and data processing the desktop installation is required.

- **Supported databases:**
  The GridVis® software supports the following databases:

- Derby database included in the scope of supply
- Janitza DB included in the scope of supply
- MySQL (optional), from Version 5
- MS SQL (optional), from 2005 no Express versions

- **Database information:**

- The database users require write and read rights.
- The database structure is generated by GridVis® when the project is created
- Ownership rights are required to create a project
- The "root" or "SA" root should not be used for GridVis® projects
- The database structure is open and documented

http://download.janitza.de/download_direkt/VBI-INFO/FAQ-GridVis-GB.pdf
http://download.janitza.de/download_direkt/VBI-INFO/Description-of-Database-GridVis-4.pdf

- **Standard database:**

- The standard Derby database can only be used locally. Multiple access is not possible.
- The standard database Janitza DB can only be used locally, multiple access is only possible locally (e.g. GridVis® Service in the background and GridVis® Professional on one computer)!

- **Installation directories:** The installation directory and the project directory can be freely selected. If several users require access, the installation and the project must be in one directory area where access rights are granted to all users.

- **Port information:** The following communication ports are required for the transfer of data between the measurement device and the software:

- HTTP 80
- FTP command port 21, (data port 1024, 1025, 1026, 1027)
- Modbus/TCP 502 (4 ports)
- Modbus RTU via Ethernet 8000 (1 port)
- Telnet 1239
- NTP 123

The following communication ports can also be used:

- SNMP 161
- BaCnet 47808

- **Automatic ring buffer reading:** The GridVis® software has an automatic read function which can be activated. The GridVis® software must run continuously for this function. GridVis®-Service can take over the automatic reading. This feature is available from the GridVis®-Professional.

• **GridVis®-Service information:**

- The Service edition includes at least one installation for the Desktop and one for the Service.
- Automatic ring buffer reading and online reading can be taken over by GridVis®-Service.
- One Service instance supports the management of 300 measurement instruments.
- The takeover of measurement devices must take place via the web server. GridVis® -Service is accessible under localhost:8080 with a web browser.
- The web server port can be changed during the installation.
- Service is managed by Windows and does not need a user login. When a restart is carried out, the Service is restarted.

• **Online reading:** The GridVis® software provides a possibility for recording and archiving measurement values online. This function can be used for measurement devices without ring buffer (memory), for example. The polling time is not adjustable and as fast as possible. Online reading is available from the GridVis®-Service Edition.

• **Server-Client principle:** Multiple access to a database depends on the database type. The standard Derby database only supports local access. MySQL and MS SQL databases support multiple accesses. The read and write right must, however, be assigned a GridVis®-Desktop instance or a GridVis®-Service instance.

• **NTP – time synchronisation:** Measuring devices of type UMG 604-PRO, UMG 605-PRO, UMG 508, UMG 511 or UMG 96RM-E are equipped with an NTP Client for time synchronisation. The following modes are supported by the devices:

- Active (IP is addressed directly)
- Listen (broadcast)

Time synchronisation without an NTP server can take place from GridVis®-Professional Edition using the computer time.

• **Historical evaluation:** Devices with ring buffer (memory) are required for a historical evaluation (period evaluation). An alternative is the GridVis®-Service edition, online recording for archiving can be used here.

Administrative rights are needed for the installation during commissioning. Internet access should be available for the GridVis® activation. It is advisable to have a responsible person from the on-site IT department present during the commissioning to answer any questions directly.

Special instructions for the electrical installation of the Janitza measurement devices

If commissioning includes the ProData (consumption pulse recording) or an Emax system (peak load management), the following points must be noted:

- **ProData special instruction®:** The pulse values for the ProData® (consumption data recording of water/heat amounts, etc.) must be known before commissioning and must also be sent in advance to the responsible technician per e-mail.

Example: ProData®

Digital input 1 = auxiliary building water meter = 1 m^3 per pulse
Digital input 2 = main building heat meter = 1 kWh per pulse
etc.

- **Emax special instruction (peak load optimisation):** The system is installed fully functional and completely wired. This includes:

  a) For direct measurement
  - Connection of the voltage measurement
  - Connection of the current measurement
  - Connection of the supply voltage
  - Connection of the digital outputs to the switchgear (e.g. protection)
  - Connection of the reset pulse of the supplier for synchronisation with the applicable measurement interval (in most cases, a 15-minute measurement interval)
  - Optional connection of the additional switching modules (FBM) for switching channels 1 ... 64

  b) For indirect measurement of quantity signals
  - Power pulses of the supplier on a digital input
  - Connection of the digital outputs to the switchgear (e.g. protection)
  - Connection of the reset pulse of the supplier for synchronisation with the applicable measurement interval (in most cases, a 15-minute measurement interval)
  - Optional connection of the additional switching modules (FBM) for switching channels 1 ... 64

The following filled-out documents are required for commissioning:
http://download.janitza.de/download_direkt/VBI-INFO/Emax_508_511_DE_V1.1.docx
ttp://download.janitza.de/download_direkt/VBI-INFO/Emax_604_605_DE_V1.1.docx

Instruction

After commissioning, the operating personnel should be given instruction on the GridVis® evaluation and configuration software. The instruction should be given on the configured computer with access to all measurement points. The instruction includes the following topics:

• Software navigation
• Configuration of the measurement devices
• Evaluation of the historical data (graph, reports)
• Creation of the topology
• Administration of automatic reading / time setting

Contents of the commissioning (specification sheet)

The commissioning tasks are clearly defined. Tasks which are not part of the standard commissioning must also be recorded in the order. The number of measurement points to be integrated as well as the number of software instances to be installed must be defined before commissioning.

• Number of measurement points
• Number of GridVis®-Desktop instances
• Number of GridVis®-Service instances

Tasks of standard commissioning:

• **Installation:**

Installing the latest GridVis® software (creating a project, importing a project)

• **Configuration:**

- Integration of all Janitza measurement points in the GridVis® software (connection configuration)
- Configuring the device-specific application (pulse outputs, alarm outputs)
- Configuring automatic reading / online reading
- Software / Firmware update

• **Instruction on the GridVis® software:**

- Device management
- Graph function
- Topology generation

Additional commissioning performance:

• **Configuration:**

- Implement all transformer settings
- Assign device addresses and IP addresses

• **Installation:**

- Emax (peak load optimisation) commissioning, configuration

• **Configuration:**

- Create customer-specific topology
- Integrate customer-specific Jasic® program
- Fault-finding, support
- Creation of virtual measurement points

It is advisable to have the responsible local electrician / installer present during commissioning, in order to answer any questions directly. It would also be desirable if the operator of the system were present to receive instruction. To ensure the smooth running of the commissioning, all points should be completed.

High availability through 3-in-1-Monitoring

Highly automated production systems, computer centres and systems with constant processes (e.g. food sector, cable fabrication, paper production) require a reliable power supply - often even high availability, i.e. an availability of at least 99.9%. The numerous servers, monitors, storage media and network components rarely tolerate voltage dips or other deviations in power quality from the standard (e.g. EN 50160). However, electrical energy does not only need to be reliably available for information and communication technology; this is also the case with infrastructure tasks such as air-conditioning, fire prevention, EMC, safety engineering, lighting, lifts and drives.

3-in-1 monitoring for safety and efficiency

It is no wonder, with all of these applications, that the demand for a safe power supply comes even before the ubiquitous energy efficiency. Constant monitoring with corresponding integrated measuring equipment for energy management, power quality and residual current monitoring fulfils this requirement; indeed it serves both purposes. At the same time, residual current monitoring also improves preventative fire protection. However, in practice it is highly complex to acquire, evaluate and document all of the measurement data. All of this must take place extremely quickly, e.g. if one wishes to detect an insulation fault that has just arisen before a system failure occurs.

Janitza - the specialist when it comes to digital measuring technology and monitoring systems in energy supply - has specially developed its new UMG 512-PRO, UMG 96RM-E and UMG 20CM ranges here, for monitoring over 3 levels (see section „Monitoring solutions in practice“). Together with the GridVis® software and the integrated alarm management, solutions for three areas are united within a common system environment and just one measuring device per measurement point:

3-in-1 monitoring
- Energy management according to ISO 50001 (acquisition of V, A, Hz, kWh, kW, kVArh, kvar ...)
- Power quality monitoring (harmonics, flicker, voltage dips, transients, etc.)
- Residual current monitoring (in short RCM)

This consolidation of the three different functions within a single measuring device brings with it the major advantage that both the assembly and installation, as well as the remaining infrastructure (current transformer, communication lines and equipment, database, software, analysis tools and reporting software, etc.) are only required once. Furthermore, all data is logged centrally in a database and can be conveniently processed with a single software. This not only saves direct costs during purchasing but also simplifies integration: No interfaces are required between the various systems – because there is just one system. This also reduces the scope of training measures and induction required, which in turn increases the acceptance amongst the electrical engineers responsible.

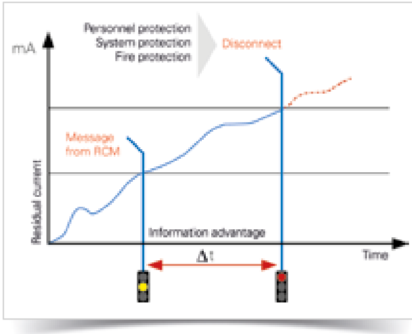


Fig. 1: Report prior to switching off - an aim of residual current monitoring (RCM)

Signal before failure

A significant advantage of this integrated data acquisition is its speed and the comprehensive overview of all data. This facilitates the detection of faults, which would only be partially perceived – or even entirely missed – by a single system. The user is therefore able to react before fuses or residual current devices (RCD) switch off affected systems or socket power circuits. This applies in particular to quietly rising residual currents (e.g. triggered by an insulation fault), overly high operating currents and any other overloading of system parts and loads (image 1).
Other sources of faults are massive grid feedback effects or resonance effects due to a growing number of non-linear electrical loads. If one detects irregular grid parameters such as excessively high harmonics or residual currents in a timely manner, it is still possible to commission repair measures before a device fails and in doing so avoid downtimes, or at least plan for these and reduce them.

Universal tool RCM: Increased safety, increased system availability, reduced risk of fire

As previously mentioned, RCM is playing an increasingly important role with high availability power supplies, which are now found in almost all market segments. Constant processes and especially sensitive applications such as computer centres, hospitals and semiconductor factories are depending on RCM in particular. Furthermore, RCM measurement offers a good alternative in all areas in which it is not possible to utilise insulation resistance measurements and residual current devices due to local or operational circumstances. The „foresighted“ monitoring described also helps to reduce alarms, as required for example with alarm management according to EEMUA 191 or NAMUR NA 102.

However, RCM can do even more - namely reduce the risk of fire! Residual current, triggered by defective insulation, can be treacherous. The current level is determined by the power of the supply network, the insulation fault resistance and the resistance to ground. With a sufficiently high current flow (with a dead earth short or corresponding low-resistance short) the upstream protective device disconnects the electrical consumers from the mains. However, if the residual current is too low then the protective device will not trigger. If the recorded fault power exceeds a value of approx. 60 Watt (approx. 261 mA at 230 V), a risk of fire exists. Residual current monitoring therefore also serves as fire prevention. The next section explains how RCM works in detail.

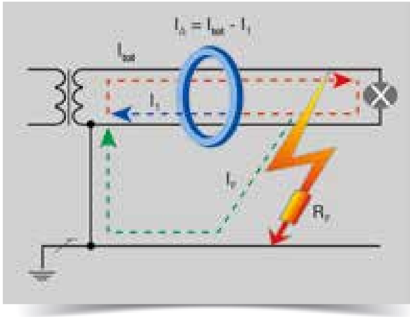


Fig. 2: Principle of residual current monitoring

RCM – the functionality

The basic functionality of the residual current principle is shown in image 2. Here, the phase and neutral conductor of the protected output are fed through the summation current transformer, the ground wire is left out. The image provides a better overview due to the highly simplified wiring. In practical terms, all three phases and the neutral conductor run through the summation current transformer. If the system is in fault-free condition, the summation current is zero or close to zero (within a tolerable range), meaning that the current induced in the secondary circuit is also zero or close to zero. If, however, residual current flows away to ground due to a fault, the current differential in the secondary circuit will result in a current being logged and evaluated by the RCM measuring device (image 3).

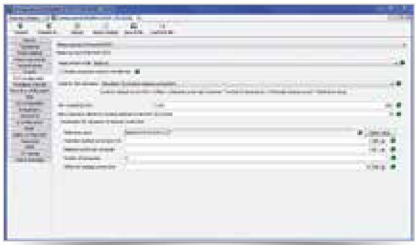


Fig. 4: (Comprehensive configuration options for RCM threshold value formation (e.g. dynamic threshold value formation) in the software GridVis®)

Modern RCM devices accept different threshold value settings here (image 4). A static threshold value has the disadvantage that it is either too high with a part load, or too low with a full load, i.e. either insufficient protection is provided or erroneous alarms are issued, which may have negative effects on the attentiveness of the monitoring personnel over time. For this reason it is advisable to use RCM measuring devices with dynamic threshold value formation. In this case the residual current threshold value is formed on the basis of the actual load conditions and is therefore optimally aligned with the respective applicable load (image 5).
Through parameterisation (i.e. stipulation of the typical residual current in „GOOD“ condition) of the system in new condition and constant monitoring, all changes to the system state after the point of start-up can be detected. This also enables detection of creeping residual currents

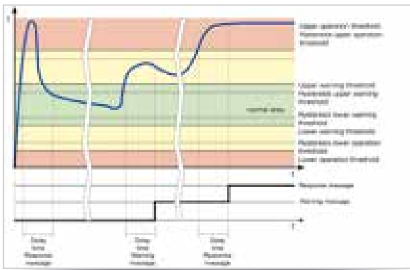


Fig. 5: Parameters of residual and operating current monitoring

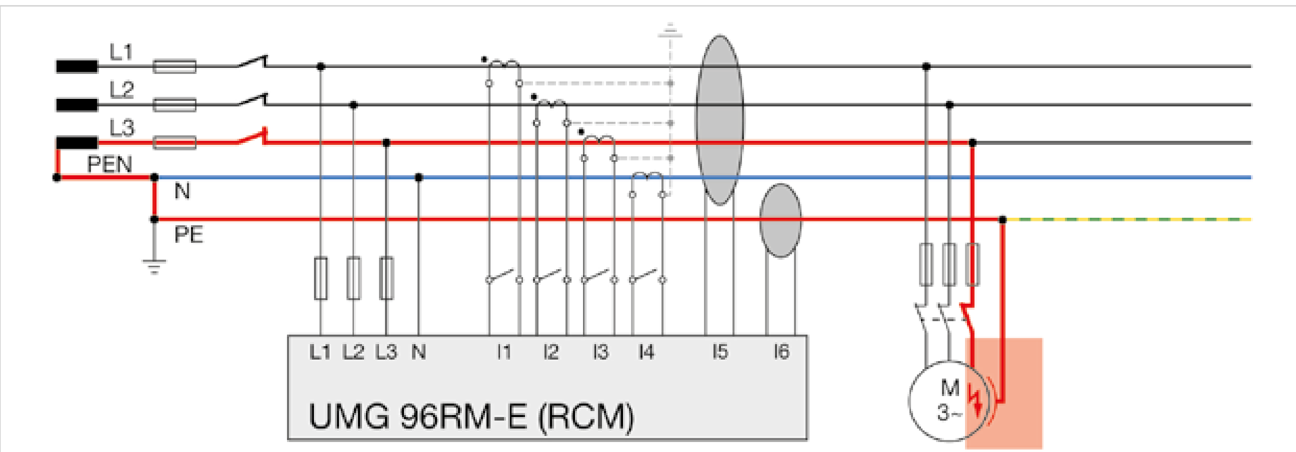


Fig. 3: Defective motor insulation leads to a short circuit to ground and residual current against the PE phase.

New technology, new fault sources

Examples of „modern fault sources“ include collapsing polypropylene PFC capa-citors. These serve to com-pensate for reactive currents, which can be generated for example with three-phase motors. Paradoxically, a fault therefore arises due to equipment that is actually intended to improve the energy supply. With these capacitors, an overload or excessively high tempera-ture frequently results in a melting of the PP winding. The melt in turn causes a high-resistance short circuit to ground. It is not possible to shut off such short circuits to ground with conventional protection measures (HRC fuse, circuit breaker). The constant residual current usually leads in the mid-term to a dead earth short circuit and may pose a considerable risk of fire or endanger safety under certain circumstances (image 6). The residual current measurement detects such faults and enables rapid countermeasures. In this way it is possible to avoid costly and dangerous system failures.

Fig. 6: Destroyed PP reactive power compensation capacitor: A creeping high-resistance short circuit to ground has caused a complete melting of the capacitor and a local fire

Errors such as impermissible connections between the N and PE phase also frequently arise during installation. The two are sometimes simply interchanged. Image 7 shows a typical connection error, which can easily result in a residual current of 5000 mA. With RCM, such errors are detected immediately during the installation phase and are reported via the alarm management.
A further and rather more recent fault source is a large number of single-phase loads, such as switched mode power supplies from servers in computer centres or PCs in office buildings. These generate a high proportion of 3rd harmonics. These harmonic portions bring with them the significant disadvantage that they superimpose themselves on the neutral conductor rather than being nullified via the transformer windings. This can result in overloads on the N phase. Integrated measuring devices, such as the UMG 96RM-E, enable comprehensive monitoring of all phases and are therefore able to report increased neutral conductor currents in a timely manner.

Fig. 7: The N and PE have been interchanged here

In this context, reference is also made to the safety specifications of the VdS (association of insurers in Germany) for electrical systems up to 1000 Volt:

„VdS 2046 : 2010-06 (11)
3.2.4 In order to increase the safety of electrical systems in which numerous non-linear loads (such as frequency converters, phase angle-controls e.g. in lighting systems) are operated, measurement of the current in the neutral conductor should take place regularly - e.g. once annually and additionally after any significant changes to the electrical system or the type and quantity of electrical loads. If the safety of the system is at risk due to excessively high harmonic currents, measures must be implemented in order to protect the harmonics according to the publication „Low-fault electrical installations“ (VdS 2349).“

Challenge of high availability

IT technology itself places high demands on the supply. However, particularly critical are applications in which the loss of data simply cannot be allowed to occur. BITKOM therefore writes the following in its guidelines for „Operationally reliable computer centres“: „In computer centres the maximum availability requirements apply. The energy supply must therefore be permanently guaranteed. Therefore comprehensible is the requirement that the power supply to the computer centre itself, and to all areas in the same building to which data cables run, must be designed as a TN-S system. Essential for assured operation is permanent self-monitoring of a “clean“ TN-S system and the issuance of signals to a permanently manned desk, e.g. in the control centre. The electrical engineer will then detect any action requirements on the basis of signals received, and can avoid damages through targeted service measures.“
With the Janitza solution, the safety criteria „RCM residual current monitoring“ can be realised through this type of EMC-optimised TN-S system (image 8).

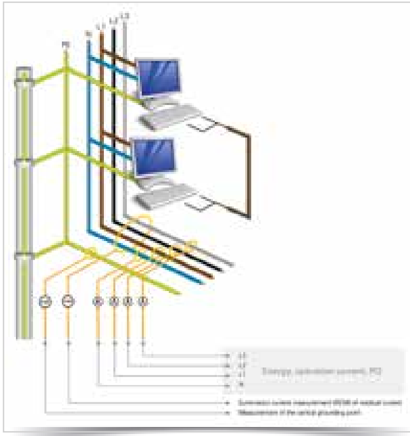


Fig. 8: Constant 3-in-1 monitoring (EnMs-RCM-PQ) of an EMC-optimised TN-S system

Reduced testing costs with RCM

Recurrent testing, as prescribed for example in BGV A3 – Electrical systems and operating equipment, is time-intensive and therefore costly. RCM monitoring systems can reduce these test costs, whilst also ensuring increased safety. Fixed electrical systems and operating equipment are considered to be monitored constantly if they are permanently maintained by electrical engineers and tested by measuring equipment within the framework of operations (e.g. monitoring of the insulation resistance). Through permanent RCM measurement, monitoring systems are able to deliver the required degree of constant testing.

Particularly noteworthy here is that RCM renders the cost-intensive measurement of insulation resistances at least partially superfluous, whilst constant testing of the insulation characteristics takes place. In order to carry out conventional insulation measurements, fixed systems or loads must be switched off and the neutral conductor disconnected. Furthermore, there is a risk that the high test voltage used for the insulation measurement may damage sensitive electronic components. The test accuracy and scope can be reduced by constant monitoring. However, this must be determined on an application-specific basis. Discussions with the operator and if necessary also with experts and / or the employers‘ liability insurance association are essential here!
It is also explicitly noted at this point that the following work must be carried out despite constant RCM measurement:

- Visual inspection for externally visible defects
- Protective measures and switch-off conditions
- Loop resistances and testing of the continuity of ground wires
- Functional testing

The association of insurers (Germany) requires RCM

The VdS has said the following on the subject of harmonics / the installation of power supply systems:

„In the case of power supply systems with PEN phase, operational currents – which may cause damage – flow through the entire ground and potential equalisation system (see section 3.3). With new electrical system installations it is therefore necessary to plan TN systems as TN-S systems. In the case of existing TN-C systems, modification to a TS-S system is advised. TN-S systems must be realised from the supply (handover) point where possible.

In order to guarantee the functionality of a TN-S system on a permanent basis (no conductor short between the N and PE phase, interchanging of the N and PE phase) this must be monitored by a residual current measurement device (RCM).

If the set trigger value is reached, a perceivable optical and acoustic error signal must be issued, in order that the defect can be eliminated immediately. In order that signal issuance is successful, this should be sent to a manned desk where applicable. If signalling is dispensed with then the forced shut-down of the faulty current circuit is required...“

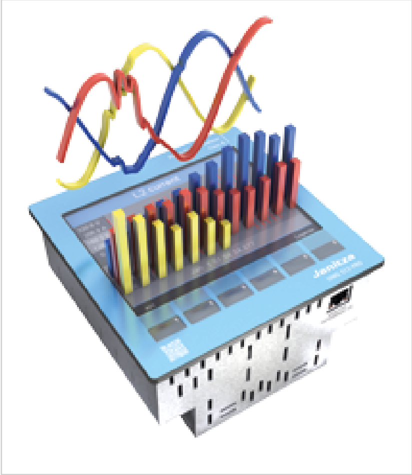


Fig. 9: The „3-in-1“ measuring device from Janitza: UMG 512-PRO

Elsewhere, with respect to the safety regulations for electrical systems up to 1000 Volt, the VdS prescribes:

„VdS 2046 : 2010-06 (11)
3.2 Compliance with proper condition
3.2.3 In order to guarantee safety in electrical systems on a permanent basis, if it is not possible to carry out insulation resistance measurements due to local or operational circumstances then it is necessary to implement substitute measures. Such measures are described in the publication „Protection with insulation faults“ (VdS 2349).

An adequate substitute measure here is permanent RCM monitoring!

Energy measurement and electrical standard parameters

RCM plays a dominant role in system monitoring by the Janitza system. Despite this, the following additional points should not go unmentioned: In addition to a safe energy supply, energy efficiency is playing an increasingly significant role. A milestone was set in place here with the implementation of the ISO 50001 standard. ISO 50001 is the standardised basis for the introduction of an energy management system - whereby the focus here lies on the term management system. This is a methodology, applied in conjunction with other management systems such as ISO 9001 or ISO 14001, through which to set objectives, implement these systematically and in doing so eliminate the chance factor insofar as possible. The term „objective“ should essentially be understood here in the sense of „the route is the objective“. As an example, the following is a quote from the resolution of the IT representatives council from February 2013:
(Page 2, Resolution No. 2013/2, Point 2)

„The IT council shall continue to strive towards a high proportion of constant measurements by the end of 2013 and asks the division to continue promoting the use of permanent measuring devices with consideration to the principle of cost efficiency.“ With all of its UMG measuring devices and electricity meters, Janitza offers the possibility of capturing and recording standard electrical parameters, as well as power and energy consumptions (image 9).

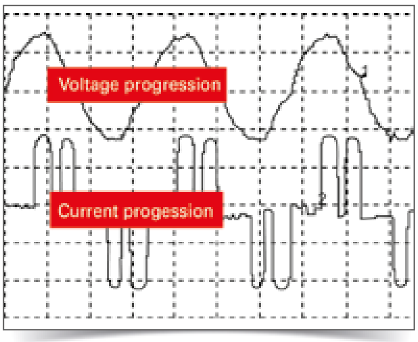


Fig. 10: Grid feedback effects through frequency converters

Monitoring the power quality

RCM, as well as the requirements of Bitkom and the association of insurers, were dealt with in the first two parts. The final point of 3-in-1 monitoring is the power quality. The reliable operation of modern plants and systems always demands a high degree of supply reliability and good power quality. However, in modern energy supply a wide range of single and three-phase, non-linear loads are used in industrial networks right through to office blocks. These include lighting equipment such as lighting controls for headlamps or low energy bulbs, numerous frequency converters for heating, air-conditioning and ventilation systems, frequency converters for automation technology or lifts, as well as the entire IT infrastructure with the typically used regulated switched mode power supplies.
Today, one also commonly finds inverters for photovoltaic systems (PV) and uninterruptible power supplies (UPS).
All of these non-linear electrical loads cause grid feedback effects to a greater or lesser extent with a distortion of the original „clean“ sinusoidal form. This results in the current or voltage waveform being distorted in the same way (image 10 and image 11).
The load on the network infrastructure through the described electrical and electronic loads with grid feedback effects has increased significantly in recent years. Depending on the type of generation system and the operating equipment (mains feed with converter, generator), mains rigidity at the connection point and the relative size of the non-linear loads, varying grid feedback effects and influences arise. For safeguarded power supplies in computer centres, the power quality must reflect EN 61000-2-4 (Class 1).

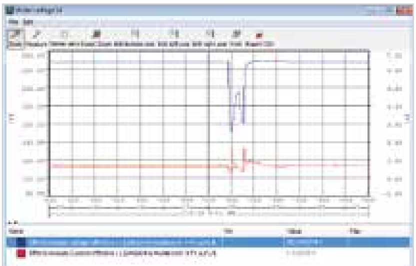


Fig. 11: Critical voltage dip with production standstill

With its broad palette of UMG measuring devices, Janitza offers the option of capturing and analysing the various parameters of power quality. Standardised power quality reports in the GridVis® software (e.g. for EN 50160, EN 61000-2-4 and ITIC: „CBEMA Curve“) facilitate report generation for conventional standards at the touch of a button.

Monitoring solutions in practice

The aim of 3-in-1 monitoring solutions – the integrated measurement of energy, power quality and RCM – requires the measurement of all phases (L1, L2, L3, N) + CEP (central earth point) + RCM with a single measuring device.
A high performance measuring device with 6 measuring current inputs for the 3-in-1 measurement is the UMG 96RM-E for intermediate distributors, or the UMG 512-PRO for main nodes and CEP from Janitza. The IP-based measuring devices can be easily integrated into existing communication networks via Ethernet. Numerous IP protocols, on-board homepage and SNMP protocol simplify the work of administrators.

The 20-channel UMG 20CM is ideal for complex electrical installations with a large number of monitoring points. The measuring devices are able to acquire (in arbitrary combinations), constantly log and analyse residual, earth leakage and operating currents via the associated measuring current transformers (e.g. CT-6-20).

Special residual current transformers in practical special designs are also suitable for cost-efficient retrofitting to existing systems, without the need to switch off electrical consumers.

Alarm in the right place

Alarms must never sound unheard. An acoustic signal from the switch cabinet in the main distribution is of little use in the control room.
Through the integration of the RCM measuring devices in the GridVis® software, with its comprehensive alarm management signalling options, it is possible to ensure that the signal quickly reaches the right recipient. With arbitrary escalation levels and logbook function, the monitoring control room has access to all the tools required for efficient monitoring. In this way it is possible for the responsible electrical engineer to detect and evaluate any residual current increases, and if necessary initiate remedial measures as quickly as possible.

Stray currents impair EMC

Connections between the N and PE phase result in „stray“ operating currents being distributed across the PE system, via data lines and all metal building parts. Because these currents are not equalised, they generate electromagnetic fields. Diverse currents in the electrical systems, IT networks and pipe systems of building installations are the consequence. Image 12 shows how the operating current can distribute at the PEN bridge and flow back via multiple paths, whereby the sum of the supply and return conductor current is no longer 0. This can bring the following faults with it:

- Change in the operating behaviour of frequency-dependent parts (e.g. capacitors draw increased current)
- Data transfer disturbances due to magnetic and inductive influences
- Transfer of lightening influences to the electrical system
- Corrosion of metal lines
- Adverse effects on personnel

The supply and return conductors, also in distribution systems, must be positioned close to each other in order to minimise magnetic fields. At every node point in a current circuit the sum of the currents must be equal to zero, in order to avoid residual currents. Additionally, the sub-distribution or current circuit should be monitored by an RCM. The UMG 96RM-E is very well suited for monitoring sub-distribution or larger loads. Individual current circuits, in which no residual current circuit breakers can be used for operational reasons, can be monitored with the UMG 20CM. A signalling RCM in combination with the specialist personnel on location provides for the maximum alternative safety.

Neutral conductor and CEP (Central earthing point)

The neutral conductor (operating current return conductor) has become the most important phase. It is to be treated as a phase conductor. In order that the earthing system remains „clean“, the current-loaded N phase must be positioned far from the PE phase. No galvanic operating currents may be permitted to flow via the earthing system because these would cause inductive couplings. These measures must be implemented right to the supply source.

In the TN-S system, the N phase must only be connected at a suitable point with the earthing system once – at the so-called CEP (central earth point from N to PE) – and monitored. Undesirable insulation faults or galvanic connections between N and PE are detected immediately with monitoring of the CEP. Deviations are reported in a timely manner and analysed with temporal dependencies.

It is possible to check that the TN-S system is functioning fault-free, e.g. with the UMG 512-PRO. This allows a holistic appraisal of the power quality and EMC. It is even possible to record and analyse the trigger phase of an earth short fault. The phase current increases in parallel to the CEP current in this case. The current at the CEP must always be appraised depending on the overall power of the TN-S system. On the one hand this means that operation-dependent leakage currents are tolerated, whilst abnormal deviations at the CEP are reported by the RCM.

Summary and outlook

Increasingly high demands will continue to be placed on future power supplies, because power failures result in high costs and huge disruption! Constant RCM monitoring for high availability power supplies with high EMC demands and also for preventative fire protection is becoming increasingly established. In order to account for this trend, Janitza brought the new 20-channel UMG 20CM range to the market in 2013, and will be presenting two further products in 2014 – in the form of the UMG 509-PRO and UMG 512-PRO. The aim here is RCM monitoring of the power supply across all four levels (supply [PCC], main distribution [transformer outputs], sub-distribution, individual loads [e.g. server cabinets]).

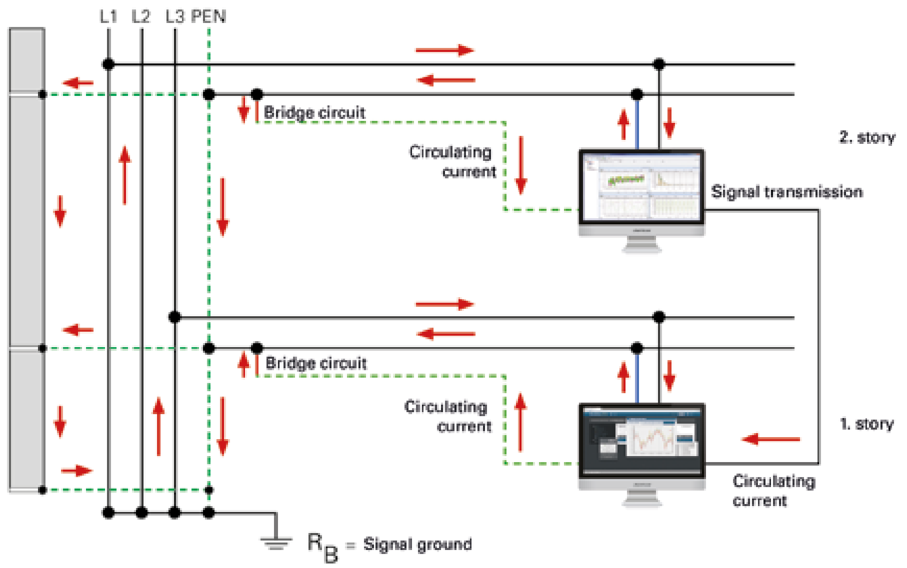


Fig. 12: Operating currents on earthing systems

11 Logistics information and T&Cs

Logistics information and T&Cs

Logistics information

Unit carton						
Type	**Dimensions in mm (H x W x D)**	**Net weight of unit in kg**	**Gross device weight in kg (ready for dispatch: incl. packaging and operation manual etc.)**	**Device type**	**Number units in package**	**Item no.**
Unit carton 1	85 x 180 x 145	0.3	0.4	UMG 96L / 96	1	**31.01.035**
Unit carton 1	85 x 180 x 145	0.5	0.6	UMG 96RM / -M / -EL, ProData®	1	**31.01.035**
Unit carton 1	85 x 180 x 145	0.2	0.3	UMG 103-CBM	1	**31.01.035**
Unit carton 2	140 x 180 x 170	0.4	1.0	UMG 96RM-P / -CBM / -E	1	**31.01.034**
Unit carton 2	140 x 180 x 170	0.3	0.8	UMG 104 / UMG 604-PRO / UMG 605-PRO	1	**31.01.034**
Unit carton 2	140 x 180 x 170	1.0	1.2	Prophi®	1	**31.01.034**
Unit carton 2	140 x 180 x 170	1.5	1.7	UMG 508 / UMG 509-PRO / UMG 511 / UMG 512-PRO	1	**31.01.034**

Cardboard packaging sizes											
				Total weight in kg with the respective device type*4				**Total weight in kg with the respective device type*4**			
Type	**Dimensions in mm (H x W x D)**		**Max. number of unit carton 1 (see tab. 1)**		**UMG 96RM / -M / -EL, ProData®**	**UMG 103-CBM**	**Max. number of unit carton 2 (see tab. 1)**	**UMG 96RM-P / -CBM / -E**	**UMG 104 / UMG 604-PRO / UMG 605-PRO**	**Prophi®**	**UMG 508 / UMG 509-PRO / UMG 511 / UMG 512-PRO**
			1				**2**				
Master carton 1	190 x 315 x 225	0.2	**4**	1.4	1.9	1.1	**2**	1.9	1.6	2.7	3.3
Master carton 2	250 x 400 x 300	0.4	**10**	4.2	6.0	3.4	**4**	5.0	3.5	5.9	6.9
Master carton 3	280 x 340 x 240	0.3	**8**	3.3	4.8	2.7	**4**	4.1	3.4	5.0	6.8
Master carton 4	390 x 395 x 340	0.8	**20**	7.7	11.0	6.3	**8**	8.5	7.1	10.3	13.9
Master carton 5	390 x 440 x 395	0.9	**26**	10.8	15.5	8.7	**12**	12.4	10.3	15.1	20.4
Master carton 6	400 x 700 x 400	1.4	**40**	16.6	23.8	13.4	**20**	20.5	17.0	25.1	33.8
Master carton 7	400 x 800 x 400	1.5	**46**	19.0	27.3	15.3	**20**	20.6	17.1	25.1	33.9
Master carton 8 on disposable pallet*3	400 x 800 x 600	7.3	**72**	34.6	47.6	28.9	**34**	39.6	33.8	47.4	62.6
Master carton 9 on disposable pallet*3	675 x 1,180 x 780	11.5	**210**	95.9	135.1	80.9	**96**	109.0	92.5	131.0	173.0
Master carton 10 on disposable pallet*3	905 x 1,180 x 780	14.8	**280**	123.1	175.4	102.6	**128**	140.2	118.4	169.6	226.0

*3 Disposable pallets are IPPC-certified.
*4 The total weight specified with the respective device type applies to unmixed products. Individual packaging 1 and 2 is also used inside the outer packaging.

Cardboard packaging sizes for 10 units project packaging (Art. No.: 31.01.040)							
Shipping packaging				**Total weight in kg with the respective device type**			
Type	**Dimensions in mm (H x W x D)**	**Max. number of unit**	**10 % accessories (unit) Instructions, GridVis® Basic, Crossover cable (only with UMG 96RM-EL)**	**UMG 96**	**UMG 96L**	**UMG 96RM / -M / -EL, ProData®**	**UMG 103-CBM**
Master carton 5	390 x 440 x 395	60 (6 x 10 units)	6	18	18	21	12
Master carton 6	400 x 700 x 400	90 (9 x 10 units)	9	27	27	32	18
Master carton 8 on disposable pallet*1	400 x 800 x 600	150 (15 x 10 units)	15	50	50	57	34
Master carton 9 on disposable pallet*1	675 x 1,180 x 780	600 (60 x 10 units)	60	190	190	223	131
Master carton 10 on disposable pallet*1	905 x 1,180 x 780	840 (84 x 10 units)	84	260	260	306	177

- Dimensions 10 device project packaging (H x W x D in mm): 105 x 225 x 315.
- Project packaging will be packed with devices from one type only.
- Project packaging contains 100 % patch cable and 10 % further accessories! 100 % mounting brackets. will be consiting of 100 %.

*1 Disposable pallets are IPPC-certified.

Cardboard packaging sizes for 12 units project packaging (Art. No.: 31.01.042)								
Shipping packaging								
Type	**Dimensions in mm (H x W x D)**	**Max. unit quantity**	**10 % accessories (unit) Instructions, GridVis® Basic, Crossover cable, screwdriver (only with UMG 104 / UMG 604-PRO / UMG 605-PRO)**	**UMG 96RM-CBM / -P**	**UMG 96RM-E**	**UMG 104**	**UMG 604-PRO**	**UMG 605-PRO**
Master carton 5	390 x 440 x 395	36 (3 x 12 units)	4	18	18	15	16	16
Master carton 8 on disposable pallet*2	400 x 800 x 600	96 (8 x 12 units)	10	50	51	45	45	45
Master carton 9 on disposable pallet*2	675 x 1,180 x 780	336 (28 x 12 units)	34	205	206	180	183	183
Master carton 10 on disposable pallet*2	905 x 1,180 x 780	468 (39 x 12 units)	47	235	238	207	210	210

- Dimensions 12 device project packaging with foam insert (H x W x D in mm): 150 x 450 x 330.-
- Project packaging will be packed with devices from one type only.
- Project packaging contains 100 % patch cable and 10 % further accessories! 100 % mounting brackets.

*2 Disposable pallets are IPPC-certified.

Standard Terms and Conditions of Janitza electronics GmbH for the Sale of Standard Software

§ 1 Applicability of the Terms and Conditions of Contract

(1) Unless otherwise agreed, exclusively these Standard Terms and Conditions of Contract apply for the sale in business dealings of standard software by Janitza electronics GmbH, business domicile Vor dem Polstück 1, 35663 Lahnau, Germany (hereinafter called "JANITZA") and for pre-contractual obligations in this connection. Deviating terms and conditions of contract of the customer shall not form an integral part of the contract, even if JANITZA does not expressly contradict the same.

(2) Even if no reference is made to them once more upon the conclusion of similar contracts, exclusively the Standard Terms and Conditions of Contract of Janitza electronics GmbH for the Sale of Standard Software shall apply in the version applicable when the customer made his declaration (retrievable under www.janitza.de) unless the parties expressly agree otherwise in writing.

(3) Supplemental hereto, the statutory provisions apply; for the supply of the standard software, §§ 433 et seq. German Civil Code [Bürgerliches Gesetzbuch] (BGB), for separately ordered services (e.g. installation, parameterisation, training), §§ 611 et seq. BGB.

§ 2 Conclusion of the contract

(1) Unless the offer is designated in writing as being binding, all offers of JANITZA are subject to confirmation and without obligation. A legal obligation only arises through a contract signed by both parties or by a written confirmation of order from JANITZA, or through JANITZA commencing with the performance in accordance with the terms of the contract. JANITZA may demand written confirmation of verbal declarations of contract by the customer.

(2) The customer shall be bound by declarations directed at the conclusion of a contract (offers of contracts) for a period of four weeks.

(3) For other types of deliveries and services (e.g. delivery of hardware, software support, set-up and installation of software) separate contracts are to be concluded.

§ 3 Object of the contract; Scope of performance

(1) The object of these Terms and Conditions of Contract is only the delivery of standard software and the grant of rights of use in accordance with § 4, as well as training (if ordered) in accordance with § 15.

(2) Prior to the conclusion of the contract, the customer shall verify that the specifications of the software conform with his wishes and requirements. He is familiar with the essential functional features and conditions of the software.

(3) The scope, nature and quality of the deliveries and services shall be determined by the contract signed by both parties or the confirmation of order from JANITZA, or otherwise the offer from JANITZA. Other details or requirements shall only become an integral part of the contract if the parties agree this in writing or if JANITZA has confirmed them in writing. Subsequent changes to the scope of performance require written agreement or the written confirmation of JANITZA.

(4) Product descriptions, illustrations, test programmes etc. are performance specifications, but do not constitute any guarantees. A guarantee requires a written declaration by the management of JANITZA.

(5) The customer receives the software consisting of the machine programme and the user manual. The method of delivery of the software shall be determined by the agreements; in the absence of any other agreement, the programme and user manual will be delivered on a CDROM. The customer has no claim to be provided with the source programme.

(6) JANITZA will provide all deliveries and services using state-of-the-art systems and technologies.

§ 4 Rights of the customer to the software

(1) The software (programme and user manual) is legally protected. The copyright, patent rights, trademark rights and all other ancillary copyrights in the software, as well as all other items which JANITZA provides or makes available to the customer within the framework of the contractual negotiations and performance of the contract shall, in the relationship of the parties inter se, remain the sole property of JANITZA. Where such rights are held by third parties, JANITZA has the corresponding rights of use and exploitation.

(2) The customer shall only be entitled to process his own data himself and in his own operations and for his own purposes using the programme. All data processing equipment (e.g. hard disks and central processing units) on which the programmes are copied or transferred, either in whole or in part, either temporarily or permanently, must be located in the premises of the customer and be in his direct possession. Further contractual provisions governing use (e.g. the limitation to a number of workplaces or persons) are to be implemented in technical terms and complied with in practice. JANITZA hereby grants the customer the powers necessary for this use as a simple right of use, including the right to rectify faults. § 13 applies in respect of the period of the right of use.

(3) The customer may prepare such backup copies of the programmes as are necessary for his safe operations. The backup copies must be safely stored and, in so far as technically feasible, labelled with the copyright notice of the original data carrier. Copyright notices may not be deleted, altered or suppressed.

Copies which are no longer required must be deleted or destroyed. The user manual and other documents provided by JANITZA may only be copied for internal business purposes.

(4) The customer shall only be entitled to pass on the software or parts thereof to third parties in accordance with the following provisions and after carrying out the following procedures:

a) Only an original data carrier (see § 3 (5)) may be passed on. Other software or software in another version may not be passed on.

b) The customer must delete all other copies of the software (irrespective of the version), in particular on data carriers and on solid state memories or random access memories (RAM). He shall relinquish the use of the same. He undertakes to carry out these procedures prior to passing on the original data carrier to third parties and to confirm this to JANITZA in writing without delay.

c) The transfer to third parties is permanent, that is to say without any claim for return or any option of repurchase.

d) The third party must give a written declaration to JANITZA that it will comply with § 4, § 13 (2) and (3), § 14 and § 16 of these Standard Terms and Conditions of Contract directly vis-à-vis JANITZA.

e) The written consent of JANITZA has been received. JANITZA shall be obliged to grant consent unless compelling reasons preclude the same (e.g. protection from competition).

In the case of any breach of these provisions by the customer, he shall be liable to pay JANITZA a contractual penalty equivalent to the amount that the third party would have to have paid for the software in accordance with the current price list of JANITZA, but at least the amount of the purchase price agreed hereunder. Further-reaching claims by JANITZA are reserved.

(5) The provisions under paragraphs (2), (3) and (4) (d) and (e) also apply where the customer rectifies a fault or (in so far as admissible) carries out any other modification of the programmes or uses the software for training purposes.

(6) The customer may only decompile the interface information of the programmes within the limits defined by § 69e German Copyright Act [Urheberrechtsgesetz] (UrhG), and then only after informing JANITZA in writing of his intent together with a request for the necessary information to be provided within a period of at least two weeks. § 14 shall apply to all knowledge and information which the customer may obtain in relation to the software during the decompiling process. Each time before involving third parties, the customer shall provide JANITZA with a written declaration from the third party that the latter undertakes directly vis-à-vis JANITZA to comply with the provisions laid down in §§ 4 and 14.

(7) No other forms of exploitation, in particular the leasing, rental or distribution in tangible or intangible form, the use of the software by and for third parties (e.g. outsourcing, computer centre operations, application service providing) are permitted without the prior written consent of JANITZA.

(8) Objects of the contract, documents, suggestions, test programmes etc. from JANITZA which become available to the customer either before or following the conclusion of the contract are deemed to be intellectual property and business and company secrets of JANITZA. They may not be used in any manner without the written permission of JANITZA and must be kept confidential in accordance with § 14.

§ 5 Performance periods; Delays; Place of performance

(1) Details concerning times for delivery and performance are non-binding unless they are designated by JANITZA in writing as being binding. JANITZA may render partial performance if the parts delivered can expediently be used by the customer.

(2)The periods for delivery and performance shall be extended by such periods during which the customer is in default of payment under the contract and by any periods during which JANITZA is prevented from delivery or performance by circumstances for which JANITZA is not responsible, plus a reasonable start-up time following the end of the circumstances causing the prevention. Such circumstances also include force majeure and labour disputes. Periods for delivery and performance shall also be extended by any such period during which the customer, in breach of contract, fails to comply with his obligations of cooperation, e.g. fails to provide information, to grant access, to supply materials or facilities or to make staff available.

(3) Should the parties subsequently agree upon different or additional performances which affect the periods agreed, these periods shall be extended by a reasonable period of time.

(4) Formal warnings and the setting of time limits by the customer shall only be effective if made in writing. Any extension of the time for performance must be reasonable. A period of less than two weeks shall only be deemed to be reasonable in cases of special urgency.

(5)The place of performance for training sessions shall be the location where the training sessions are to take place. In all other cases, the place of performance for all performances under and in connection with this contract shall be the location of the head office of JANITZA.

§ 6 Contractual commitment and termination of the contract

(1) Any termination of the further exchange of performances (e.g. rescission of the contract, claim to a reduction in price, termination for compelling reasons, claim for damages in lieu of performance) must always be threatened specifying the grounds and setting a reasonable period for rectification (as a rule, at least two weeks) and may only be declared within two weeks of the notice having elapsed. In the cases stipulated by law (see § 323 (2) BGB) the setting of a deadline may be dispensed with. The party who is entirely or predominantly responsible for the disturbance shall not be entitled to demand rescission of the contract.

(2) All declarations in this connection must be made in writing in order to be effective.

§ 7 Remuneration; Payment

(1) The agreed remuneration shall become due and payable without any deduction within 14 days of delivery of the software (in the case of training sessions, after completion of the training course) and receipt of the invoice by the customer.

(2) Unless otherwise agreed, the respective price list of JANITZA, which can be requested from JANITZA, applies.

(3) Travel costs, expenses, accessories, shipping costs and telecommunication costs are to be reimbursed in addition according to time and material expended. Any additional performances or services demanded by the customer (e.g. advice and support in the programme installation) will be invoiced in accordance with the respective current price list of JANITZA. Any increase in the list price shall be limited to 3 % per year.

(4) Value added tax will be added to all prices.

(5) The customer may only set off claims of his own against claims of JANITZA if such claims are undisputed or have been judicially decided and are final and legally binding. Except as provided in § 354 a German Commercial Code [Handelsgesetzbuch] (HGB), the customer may only assign claims under this contract to third parties with the previous written consent of JANITZA. The customer shall only be entitled to exercise a right of withholding or to raise the defence of non-performance of the contract within the scope of this contractual relationship.

§ 8 Duties of the customer

(1) The customer shall, in accordance with the commercial law provisions (§ 377 German Commercial Code (HGB)), be obliged to have a competent employee inspect all items delivered by JANITZA immediately following delivery or upon their becoming accessible and to notify JANITZA in writing of any flaws discovered, giving a precise description of the defect. The customer shall thoroughly test each module as to its usability in the specific situation before commencing productive use. This also applies to programmes which the customer receives within the scope of the warranty or a service contract.

(2) The customer shall take reasonable precautions (e.g. through data back-ups, fault diagnosis, regular examination of the results, emergency planning) in order to deal with a situation in which the programme, either in whole or in part, does not work properly. It is the responsibility of the customer to ensure the functionality of the working environment of the programme.

§ 9 Material defects

(1) The software has the agreed features and is suitable for the contractually specified use or, in the absence of any such agreement, for normal use. It satisfies the criterion of practical fitness for its purpose and has the quality typical of software of this type; however, it is not free from faults. Any impairment in the functioning of the programme which results from hardware defects, environmental conditions, faulty operation or such like does not constitute a defect. A negligible reduction in quality is to be disregarded.

(2) In the case of material defects, JANITZA may in the first instance provide subsequent performance. Subsequent performance shall, at the option of JANITZA, be effected through rectification of the defect, through delivery of software which is free from defects, or through JANITZA demonstrating possibilities of avoiding the effects of the defect. The customer shall acquiesce in at least three attempts to remedy the defect. The customer shall accept an

equivalent new programme version or the equivalent previous programme version which did not contain the fault where this is conscionable for him.

(3) The customer shall support JANITZA in the analysis of faults and the rectification of defects, in particular through providing a detailed description of the problems arising. He shall provide JANITZA with comprehensive information and grant JANITZA the time and opportunity necessary to rectify the defect. JANITZA may, at its option, rectify the defect on site or at the business premises of JANITZA. JANITZA may also provide services by means of remote maintenance. The customer shall at his own expense ensure that the necessary technical pre-requisites are available and, following corresponding notice, grant JANITZA access to his EDP system.

(4) The parties agree the following error classes and reaction times:

a) Error class 1: Operation-impeding defects: the error prevents the business operations of the customer; no work-around solution is available: JANITZA shall start with the rectification of the error immediately, no later than within six hours following the error notification, and shall continue with appropriate commitment until the error is rectified, in so far as can reasonably be expected also outside normal working hours (workdays from 8:00 am to 5:00 pm).

b) Error class 2: Operation-hindering defects: the error considerably hinders the business operations of the customer; however, the use of the software is possible with work-around solutions or with temporarily acceptable limitations or difficulties: Where the error notification is received before 10:00 am, JANITZA shall start with the rectification of the error on the same day; where the error notification is received later, JANITZA shall start with the rectification of the error at the beginning of the following working day and shall continue within normal working hours until the error has been rectified. JANITZA may in the first instance demonstrate a work-around solution and rectify the error later if this is conscionable for the customer.

c) Error class 3: Other defects: JANITZA shall start with the rectification of the error within one week or shall rectify the error with the next programme version if this is conscionable for the customer.

(5) The time periods under para. (4) begin with an error notification in accordance with § 8 (1). § 5 (2) and (3) apply for the purpose of calculation of the time periods. In the case of a difference of opinion on the assignment of an error into the classes in accordance with para. (4), the customer may demand classification into a higher error class. Should the customer fail to prove that his classification was correct, he shall reimburse JANITZA the additional expenditure.

(6) JANITZA may make additional charges which arise from the software having been modified, used outside the prescribed environment or improperly operated. JANITZA may demand reimbursement of its expense if no defect is found. The burden of proof lies with the customer. § 254 German Civil Code (BGB) applies correspondingly.

(7) If JANITZA ultimately refuses to rectify the defect or such rectification is ultimately unsuccessful or is unconscionable for the customer, the customer may, within the scope of § 6, either cancel the contract or curtail the remuneration

by a reasonable amount and additionally demand damages or reimbursement of his expenses in accordance with § 11. The claims shall lapse by limitation in accordance with the terms of § 12.

§ 10 Flaws in legal title

(1) JANITZA warrants that no rights of third parties preclude the use of the software by the customer in accordance with the terms of the contract. In the case of flaws in legal title, JANITZA warrants that it will, at the option of JANITZA, procure for the customer a legally unchallengeable possibility of use of the software or of equivalent software.

(2) The customer shall inform JANITZA in writing without delay if any third party asserts industrial property rights (e.g. copyright or patent rights) against him in respect of the software. The customer authorises JANITZA to conduct the dispute with the third party alone. So long as JANITZA avails itself of this authorisation, the customer may not of his own initiative acknowledge the claims of the third party without the consent of JANITZA; JANITZA shall then at its own expense avert the claims of the third party and shall indemnify the customer from all costs associated with averting such claims except in so far as these result from conduct on the part of the customer in breach of duty (e.g. use of the programmes in breach of the terms of the contract).

(3) § 9 (2), (6) and (7) apply correspondingly. § 6 shall apply for the discontinuance of the exchange of performances. § 11 shall apply in relation to liability; § 12 in relation to the limitation period.

§ 11 Liability

(1) JANITZA shall be liable in accordance with the statutory provisions in so far as the customer asserts claims for damages based on deliberate intent or gross negligence, including the deliberate intent or gross negligence of representatives or vicarious agents of JANITZA.

(2) In the case of ordinary (that is to say, not grossly) negligent breaches of such contractual duties, the fulfilment of which actually enables the contract to be properly performed at all and upon compliance with which a client regularly relies and is entitled to rely (cardinal duties, fundamental contractual duties) JANITZA shall be liable in accordance with the statutory provisions. In such case, however, the liability of JANITZA shall be limited to the damage foreseeable and typically arising according to the nature of the performance; the reimbursement of consequential damage such as e.g. loss of profit is excluded. The same shall apply to grossly negligent breaches of non-fundamental contractual duties committed by the simple vicarious agents of JANITZA.

(3) JANITZA shall not be liable for ordinary (that is to say, not grossly) negligent breaches of non-fundamental contractual duties.

(4) The limitations and exclusions of liability in accordance with paras. (1), (2) and (3) shall also apply for claims arising for liability in connection with the conclusion of the contract (culpa in contrahendo), other breaches of duty or in tort. They shall not apply to injury to life, limb or health attributable to JANITZA or to claims under the Product Liability Act [Produkthaftungsgesetz].

(5) JANITZA shall be free to raise the defence of contributory negligence. The customer is, in particular, under an obligation to prepare data back-ups and to protect his system from malicious software in accordance with the latest state of technology.

§ 12 Limitation period

(1) The period of limitation shall be:

a) one year starting with the delivery of the software for claims to repayment of the purchase price arising from cancellation of the contract or curtailment of the purchase price, however not less than three months as from the issue of the legally effective declaration of cancellation or curtailment of the price in the case of properly lodged complaints;

b) one year for other claims arising from material defects;

c) two years in the case of claims arising from flaws in legal title if the flaw lies in a right in rem of a third party by reason of which it may demand the surrender of the items specified in § 3 (5) or demand that the customer desists from using the same;

d) two years in the case of claims for damages not based on material defects or flaws in legal title or for reimbursement of expenditure incurred in vain, commencing at the point in time at which the customer obtained knowledge of the circumstances substantiating the claim or must have attained knowledge of the same without gross negligence on his part.

The claims shall be barred by limitation no later than upon the expiration of the maximum periods specified in § 199 German Civil Code (BGB).

(2) However, the statutory periods of limitation shall always apply in the case of claims for damages and reimbursement of expenditure incurred in vain arising from deliberate intent, gross negligence, guarantee, fraudulent intent and in the cases mentioned in § 11 (3).

§ 13 Commencement and end of the rights of the customer

(1) Ownership of items delivered and the rights pursuant to § 4 hereof shall only pass to the customer upon payment in full of the remuneration in accordance with the terms of the contract. Prior to this, the customer shall only have a temporary, contractual right of use which is revocable in accordance with para. (2).

(2) JANITZA may revoke the rights under § 4 for compelling reasons in accordance with the conditions of § 6. A compelling reason exists in particular if JANITZA cannot reasonably be expected to continue to maintain the contract in force, in particular where the customer fails to pay the remuneration or commits a significant breach of § 4.

(3) Should the rights under § 4 not come into existence or should they end, JANITZA may demand of the customer that he return the items provided or submit a written declaration that they have been destroyed, as well as the deletion or destruction of all copies of the items provided and a written assurance that this has taken place.

§ 14 Confidentiality

(1) Each party to the contract undertakes, also beyond the end of the contract, to treat as confidential all items provided to it by the respective other party or which have otherwise become known to it before or during the performance of the contract (e.g. software, documents, information) and which are legally protected or contain business or company secrets or are otherwise designated as being confidential unless such items are already in the public domain without any breach of the duty of confidentiality. The parties shall store and secure these items in such a way as to ensure that no third party has access to them.

(2) The customer shall only make the objects of the contract accessible to those employees and other third parties who require access to the same for the performance of their contractual duties. The customer shall instruct these persons regarding the necessity of maintaining confidentiality in relation to the items in question.

(3) JANITZA shall process the necessary customer data relevant for handling the business transaction in due compliance with the data protection provisions. JANITZA may name the customer as a reference customer following the successful conclusion of its services.

§ 15 Training

(1) In so far as training courses are contractually agreed, these shall, at the option of JANITZA, be held at the premises of the customer or at another location designated in agreement with the customer. Where the training courses are held at the premises of the customer, the latter shall, following consultation with JANITZA, provide the necessary rooms and technical equipment. Where training courses are held elsewhere, the customer shall rent the premises and make the necessary hardware and software available on site.

(2) JANITZA may cancel a training session for compelling reasons. JANITZA shall notify the customer of any cancelation in due time and offer substitute dates.

(3) In the case of justified dissatisfaction of the customer, JANITZA shall be given the opportunity to remedy the matter. In further respects, § 6 shall apply.

§ 16 Final provisions

(1) Any amendments and supplements to the contract need to be made in writing in order to be effective. The requirement of the written form may only be revoked in writing. Transmission in text form, in particular by fax or e-mail, shall suffice to satisfy the requirement of the written form.

(2) The customer may only set off claims of his own against claims of JANITZA if such claims are undisputed or have been judicially decided and are final and legally binding. Except as provided in § 354 a German Commercial Code [Handelsgesetzbuch] (HGB), the customer may only assign claims under this contract to third parties with the previous written consent of JANITZA. The customer shall only be entitled to exercise a right of withholding or to raise the

defence of non-performance of the contract within the scope of this contractual relationship.

(3) These Terms and Conditions of Contract shall be governed by the law of the Federal Republic of Germany to the exclusion of the UN Convention on Contracts for the International Sale of Goods.

(4) In the case of contracts with business persons, public legal entities or bodies of public assets the place of performance and court venue for all disputes arising under and in connection with this contract shall be the location of the head office of JANITZA.

(5) In the case of any inconsistencies between the German version of these Terms and Conditions of Contract and any translations, the German version of these Terms and Conditions of Cantract is binding.

Standard Terms and Conditions of Janitza electronics GmbH for the Provision of Software Free of Charge

§ 1 Applicability of the Terms and Conditions of Contract

(1) Unless otherwise agreed, exclusively these Standard Terms and Conditions of Contract apply for the provision of software free of charge to the user by Janitza electronics GmbH, business domicile Vor dem Polstück 1, 35663 Lahnau, Germany (hereinafter called "JANITZA"). Deviating terms and conditions of contract of the user shall not form an integral part of the contract, even if JANITZA does not expressly contradict the same.

(2) Even if no reference is made to them once more upon the conclusion of similar contracts, exclusively the Standard Terms and Conditions of Contract of Janitza electronics GmbH for the Provision of Software Free of Charge shall apply in the version applicable when the user made his declaration (retrievable under www.janitza.com) unless the parties expressly agree otherwise in writing.

(3) Supplemental hereto, the statutory provisions apply; for this provision of software free of charge, in particular § 516 et seq. German Civil Code [Bürgerliches Gesetzbuch] BGB (gift).

§ 2 Conclusion of the contract

(1) The contract is concluded in such manner that JANITZA, at the request of the user for the provision of the software free of charge, sends him an e-mail in confirmation and subsequently does actually provide the user with the free software (including the pertinent data carrier, in so far as available).

(2) Both parties are in agreement that the provision / gratuitous transfer of the software (and of the pertinent data carrier, in so far as relevant) is made free of charge.

(3) A binding contract is not formed until the software is actually provided (in accordance with § 518 (1) German Civil Code (BGB), a promise of a gift needs to be recorded before a notary; this deficiency in form is only cured through the actual transfer, § 518 (2) BGB).

(4) For other types of deliveries and services (e.g. delivery of hardware, software support, set-up and installation of software, training sessions) separate contracts are to be concluded.

§ 3 Object of the contract; Scope of performance

(1) The object of these Terms and Conditions of Contract is the provision of software free of charge (including the pertinent data carrier, in so far as available) to the user and the grant of the rights of use in accordance with § 4.

(2) The free software (including the pertinent data carrier, in so far as available) is transferred in the status in which it is available to JANITZA at the point in time of the transfer ("as is").

(3) Prior to the conclusion of the contract, the user shall verify that the specifications of the software conform with his wishes and requirements. He is familiar with the essential functional features and conditions of the software corresponding to the product description of JANITZA.

(4) According to the current state of technology, it is not possible to prepare software programmes which work without faults in all cases of application. Product descriptions, illustrations, test programmes etc. are therefore general performance specifications, but do not constitute any guarantees. A guarantee requires a written declaration by the management of JANITZA.

(5) The user will receive the software consisting of the machine programme and, in so far as available for the relevant software, a user manual in the form of a file. The method of the delivery of the software shall be determined by the agreements; in the absence of any other agreement, the programme and user manual will be delivered on a USB stick by post. The user has no claim to be provided with the source programme.

§ 4 Rights of the user to the software

(1) The software provided free of charge (programme and user manual) is legally protected. The copyright, patent rights, trademark rights and all other ancillary copyrights in the software, as well as all other items which JANITZA provides or makes available to the user within the framework of the contractual negotiations and performance of the contract shall, in the relationship of the parties inter se, remain the sole property of JANITZA. Where such rights are held by third parties, JANITZA has the corresponding rights of use and exploitation.

(2) The user shall only be entitled to process his own data himself and in his own operations and for his own purposes using the programme. All data processing equipment (e.g. hard disks and central processing units) on which the programmes are copied or transferred, either in whole or in part, either temporarily or permanently, must be located in the premises of the user and be in his direct possession. Further contractual provisions governing use (e.g. the limitation to a number of workplaces or persons) are to be implemented in

technical terms and complied with in practice. JANITZA hereby grants the user the powers necessary for this use as a simple right of use, including the right to rectify faults. § 10 applies in respect of the period of the right of use.

(3) The user may prepare such backup copies of the programmes, as are necessary for his safe operations. The backup copies must be safely stored and, in so far as technically feasible, labelled with the copyright notice of the original data carrier. Copyright notices may not be deleted, altered or suppressed. Copies which are no longer required must be deleted or destroyed. The user manual and other documents provided by JANITZA may only be copied for internal business purposes.

(4) The user shall only be entitled to pass on the software or parts thereof free of charge to third parties in accordance with the following provisions and after carrying out the following procedures:

a) Only one original data carrier may be passed on. Other software or software in another version may not be passed on.

b) The user must delete all other copies of the software (irrespective of the version), in particular on data carriers and on solid state memories or random access memories (RAM). He shall relinquish the use of the same. He undertakes to carry out these procedures prior to passing on the original data carrier to third parties and to confirm this to JANITZA in writing without delay.

c) The transfer to third parties is permanent, that is to say without any claim for return or any option of repurchase.

d) The third party must give a written declaration to JANITZA that it will comply with § 4, § 10 (2) and (3), § 11 and § 12 of these Standard Terms and Conditions of Contract directly vis-à-vis JANITZA.

e) The written consent of JANITZA has been received. JANITZA shall be obliged to grant consent unless compelling reasons preclude the same (e.g. protection from competition).

In the event of any breach of these provisions by the user, JANITZA reserves the right to claim damages.

(5) The provisions under paras. (2), (3) and (4 d), (e) also apply where the user eliminates the fault or (in so far as admissible) carries out any other modification of the programmes or uses the software for training purposes.

(6) The user may only decompile the interface information of the programmes within the limits defined by § 69 e German Copyright Act [Urheberrechtsgesetz] (UrhG), and then only after informing JANITZA in writing of his intent together with a request for the necessary information to be provided within a period of at least two weeks. § 11 shall apply to all knowledge and information which the user may obtain in relation to the software during the decompiling process. Each time before involving third parties, the user shall provide JANITZA with a written declaration from the third party that the latter undertakes directly vis-à-vis JANITZA to comply with the provisions laid down in §§ 4 and 11.

(7) No other forms of exploitation, in particular the sale, leasing, rental or distribution in tangible or intangible form, the use of the software by and for third parties (e.g. outsourcing, computer centre operations, application service providing) are permitted without the prior written consent of JANITZA.

(8) Objects of the contract, documents, suggestions, test programmes etc. from JANITZA which become available to the user either before or following the conclusion of the contract are deemed to be intellectual property and business and company secrets of JANITZA. They may not be used in any manner without the written permission of JANITZA and must be kept confidential in accordance with § 11.

§ 5 Place of performance

The place of performance for all performances under and in connection with this contract shall be the location of the head office of JANITZA.

§ 6 Duties of the user

(1)The user shall be obliged to test the programme thoroughly as to its usability in the specific situation before commencing any productive use.

(2) The user shall be obliged to take reasonable precautions (e.g. through data back-ups, fault diagnosis, regular examination of the results, emergency planning) in order to deal with a situation in which the programme, either in whole or in part, does not work properly. It is the responsibility of the user to ensure the functionality of the working environment of the programme.

§ 7 Material defects

(1) The liability of JANITZA as towards the user for material defects in the software provided (including the pertinent data carrier, in so far as available) shall be restricted to the case of JANITZA fraudulently concealing from the user any material defect in the software. In such case, JANITZA shall reimburse the user the damage arising therefrom in accordance with § 524 (1) German Civil Code (BGB).

(2)The user shall have no claim to have defects rectified by JANITZA in the case of software provided free of charge.

§ 8 Flaws in legal title

(1) The liability of JANITZA as towards the user for flaws in the rights to the software provided (including the pertinent data carrier, in so far as available) shall be restricted to the case of JANITZA fraudulently concealing from the user any flaw in the rights to the software. In such case, JANITZA shall reimburse the user the damage arising therefrom in accordance with § 523 (1) German Civil Code (BGB).

(2) The user shall inform JANITZA in writing without delay if any third party asserts industrial property rights (e.g. copyright or patent rights) against him in respect of the software. The user authorises JANITZA to conduct the dispute with the third party alone. So long as JANITZA avails itself of this authorisation, the user may not of his own initiative acknowledge the claims of the third

party without the consent of JANITZA; JANITZA shall then at its own expense avert the claims of the third party and shall indemnify the user from all costs associated with averting such claims except in so far as these result from conduct on the part of the user in breach of duty (e.g. use of the programmes in breach of the terms of the contract).

§ 9 Liability

(1) With the exception of liability for material defects and flaws in legal title (see above §§ 7, 8), JANITZA shall only be liable in accordance with § 521 BGB in so far as the user asserts claims for damages based on deliberate intent or gross negligence, including the deliberate intent or gross negligence of representatives or vicarious agents of JANITZA.

(2) JANITZA shall be free in each case to raise the defence of contributory negligence. The user is, in particular, under an obligation to prepare data back-ups and to protect his system from malicious software in accordance with the latest state of technology.

§ 10 Commencement and end of the rights of the user

(1) Ownership of the items provided and the rights pursuant to § 4 hereof shall pass to the user upon the transfer of the same.

(2) JANITZA may revoke the rights under § 4 for compelling reasons. A compelling reason exists in particular if JANITZA cannot be reasonably expected to continue to maintain the contract in force, in particular where the user commits a significant breach of § 4.

(3) Should the rights under § 4 not come into existence or should they end, JANITZA may demand of the user that he return the software provided or submit a written declaration that it has been destroyed, as well as the deletion or destruction of all copies of the software and a written assurance that this has taken place.

§ 11 Confidentiality

(1) Each party to the contract undertakes, also beyond the end of the contract, to treat as confidential all items provided to it by the respective other party or which have otherwise become known to it before or during the performance of the contract (e.g. software, documents, information) and which are legally protected or contain business or company secrets or are otherwise designated as being confidential, unless such items are already in the public domain without any breach of the duty of confidentiality. The parties shall store and secure these items in such a way as to ensure that no third party has access to them.

(2) The user shall only make the objects of the contract accessible to those employees and other third parties who require access to the same for the performance of their contractual duties. The user shall instruct these persons regarding the necessity of maintaining confidentiality in relation to the items in question.

(3) JANITZA shall process the necessary user data relevant for handling the business transaction in due compliance with the data protection provisions. JANITZA may name the user as a reference user following the successful conclusion of its services.

§ 12 Final provisions

(1) Any amendments and supplements to the contract need to be made in writing in order to be effective. The requirement of the written form may only be revoked in writing. Transmission in text form, in particular by fax or e-mail, shall suffice to satisfy the requirement of the written form.

(2) These Terms and Conditions of Contract shall be governed by the law of the Federal Republic of Germany to the exclusion of the UN Convention on Contracts for the International Sale of Goods.

(3) The user may only set off claims of his own against claims of JANITZA if such claims are undisputed or have been judicially decided and are final and legally binding. Except as provided in § 354 a German Commercial Code [Handelsgesetzbuch] (HGB), the user may only assign claims under this contract to third parties with the previous written consent of JANITZA. The user shall only be entitled to exercise a right of withholding or to raise the defence of non-performance of the contract within the scope of this contractual relationship.

(4) In the case of contracts with business persons, public legal entities or bodies of public assets the place of performance and court venue for all disputes arising under and in connection with this contract shall be the location of the head office of JANITZA.

(5) In the case of any inconsistencies between the German version of these Terms and Conditions of Contract and any translations, the German version of these Terms and Conditions of Cantract is binding.

Green delivery conditions of the ZVEI

The "Green delivery conditions" published by ZVEI constitute an industry standard due to their broad distribution and are recognised well beyond the boundaries of the electrical industry.

The "Green delivery conditions" are comprised as follows:

1. General conditions for the Supply of Products and Services of the Electrical and Electronics Industry
2. Supplementary Clause: Extended Retention of Title

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