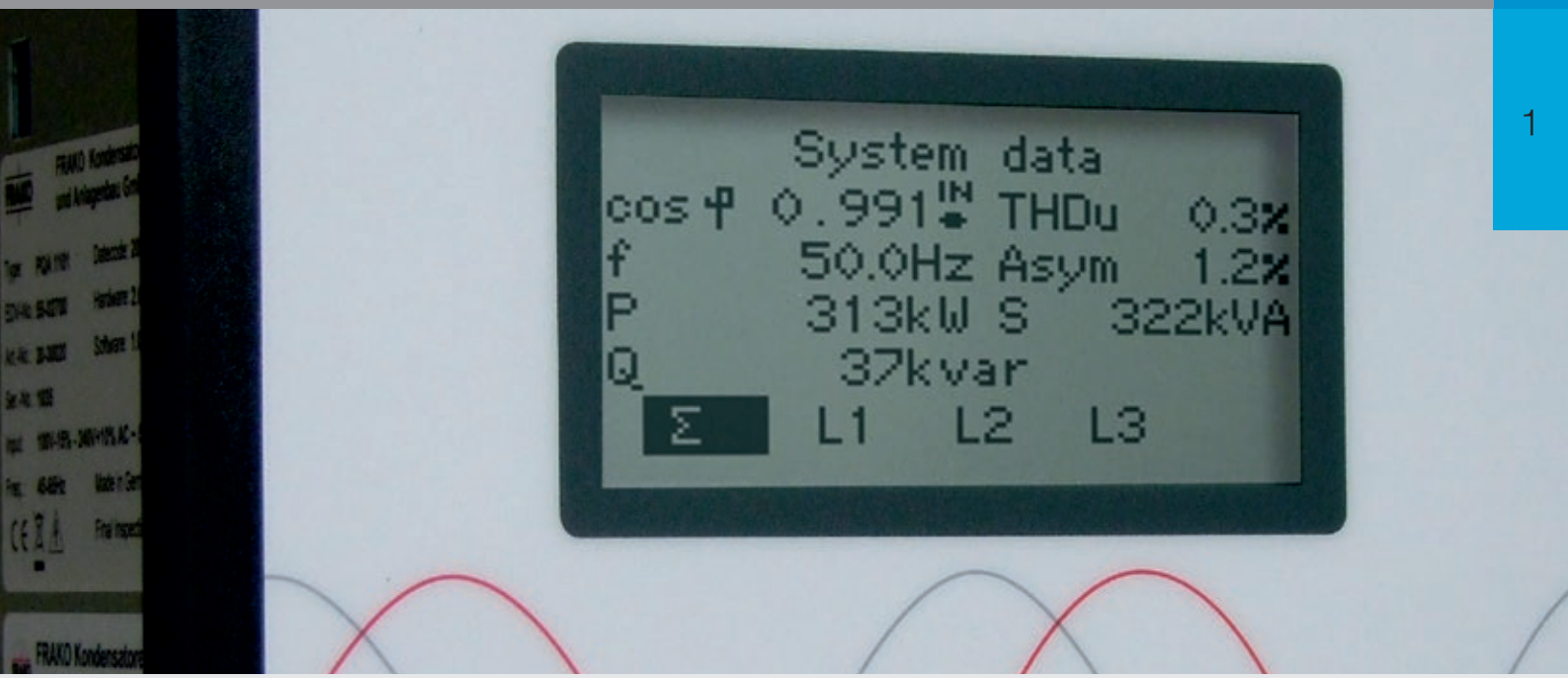


Mains Analysis Device

**The power quality of electrical supply networks plays an increasingly important role for the operational safety of electrical infrastructure.
Therefore it becomes more and more important to take appropriate measures to monitor the power quality.**

Unlike in the past, it is no longer sufficient to measure once and not pay any further attention to power quality if the values are inconspicuous.

Due to complex manufacturing processes, fluctuating load conditions and also due to an increasing degree of automation of industrial plants it is more important than ever to continuously monitor the quality of the product “current”.

Regardless of whether a single analyzer is used to monitor individual machines or consumption, or whether the entire electrical equiment is monitored and analyzed by means of an energy management system – FRAKO offers the optimal solution.

In order to facilitate the control of the “Power Quality” or its legal limit values, various alarm channels are available, such as warning lights, e-mail, SMS etc.

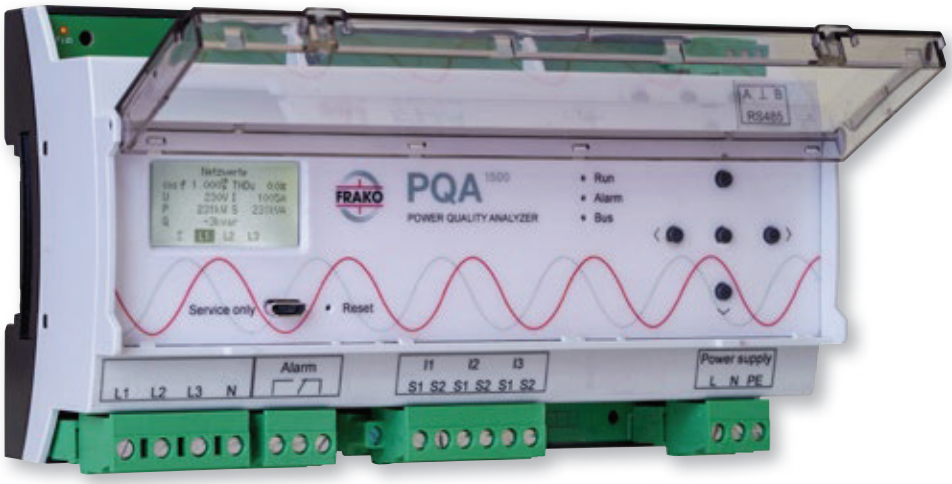
Depending on type and version this can be achieved already by a single device or – even better – in combination with the FRAKO Energy Management System.

Measurement of residual current, PE-monitoring, monitoring of transformers, measurements at low voltage distribution boards as well as monitoring of individual machines and consumers …. FRAKO has the solution for every application.

Devices of the PQ Series

Power Quality Analyzer

	PQA 1500	PQA 1101
		
Voltage	85-267 V AC or 100-377 V DC	85-267 V AC or 100-377 V DC
Frequency	85-267 V AC or 100-377 V DC	45-65 Hz
Power consumption	Max. 7 VA	Max. 7 VA
Contact temination 3/4/5-wire	• / • / -	• / • / -
Current measurements	3 x X/5A (Transformer current > 15 mA), electrically isolated	3 x X/5A (Transformer current > 15 mA), electrically isolated
Voltage measurements	3 x 60-400 V AC (external/neutral conductor) 3 x 115-525 V AC (external/external conductor)	3 x 60-400 V AC (external/neutral conductor) 3 x 115-690 V AC (external/external conductor)
Harmonics V/A	1-19	1-19
Short term interruptions	•	•
Active energy class	1	1
Analogue In-/Outputs	-	2 temperature / -
Digital In-/Outputs	1 alarm signalling contact 250 V AC, max. 3 A	Tariff input for selection of 2 profiles / 1 alarm signalling contact 250 V AC, max. 3 A
Memory Min./Max. values	•	•
Interfaces		
Ethernet	•	•
FRAKO Energy Management System	• via FRAKO Starkstrombus	• via FRAKO Starkstrombus
RS-485	•	•
Webserver	•	•
Recommended applications	Machine disposals / transformer	Machine disposals / transformer
Article-No.	20-30030	PQA 1101 FRAKO Starkstrombus: 20-30020 PQA 1101 with Ethernet interface: 20-30022



PQA 1500
Power Quality Analyzer

Meter for active and reactive power of transformers and machine outlets in low-voltage main distributions with FRAKO bus connection and network connection for integration into the FRAKO data acquisition system according to EN 50001. The expanded measurement functions of Power Quality assist in reliably monitoring the increasingly challenging network conditions and thereby enhancing the supply reliability of the electrical installation.

Description
- Monitoring and evaluation of the mains quality; measurement of all relevant mains data in low and medium voltage mains
- Energy meter for active power (input and output) and reactive power
- Integrated alarm management with different output configurations: contact outputs, display, LED
- Connection to the FRAKO Energy Management System via FRAKO Starkstrombus (RS 485) and TCP/IP
- Top hat rail mounting

Measurement functions:
- Voltages of the phase-to-phase / phase-to-neutral
- Currents of the 3 phases and in N / PEN
- Power factor (cos-φ), active, reactive, and apparent power of the phases
- Frequency and asymmetry (unbalanced load)
- THD of voltage and current of the phases
- Portion of harmonic voltage/current U2/I2...U19/I19
- Manual recording of voltage and current up to the 50th harmonic

Measurement value and Min. Max. memory:

Measurement data per phase
- Voltage
- Current
- Powers (Active, Reactive, and Apparent Power)
- Mains frequency
- Voltage harmonics
- Current harmonics
- Temperatures
- Measurement via three external current transformers
- Menu guidance in plain text and display of up to 8 measurement values simultaneously
- Menu-driven programming with user guidance
- Backlit display
- Backup of meter readings and limit values in the event of a power outage

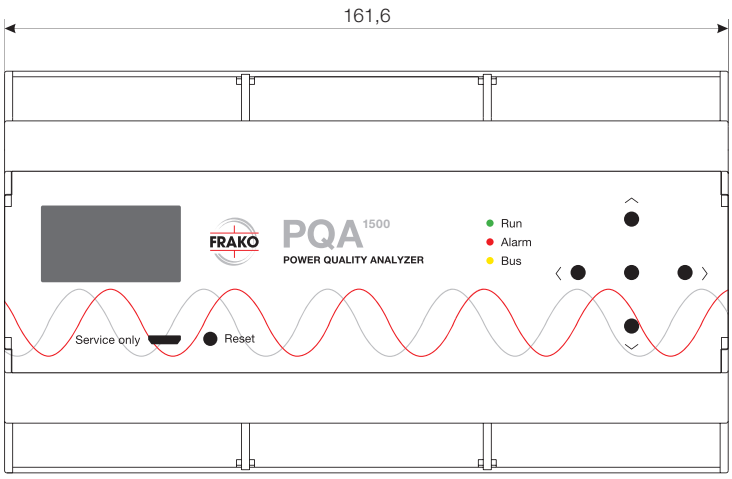
Technical Data

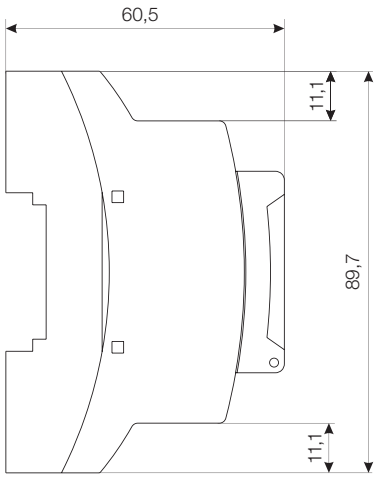
Measurement inputs	
Voltage path	0 V AC – maximum 580 V AC (phase – phase, absolute limits), suitable for 115 – 525 V AC systems, electrically interconnected via high resistances, measurement of medium voltages possible using an x/100 V transformer; In areas where UL / CSA standards apply in systems with nominal voltages 115 – 600 V AC; power failure detection after duration of a half-wave
Frequency	45-65 Hz
Power consumption	Max. 5 VA
Fuse protection	Max. 2 A external protection required
Current path	x/5 A AC or x/1 A AC (transformer secondary current > 15 mA), electrically isolated, power draw maximum 1 VA per transformer connection, continuous overload rating up to 6 A AC, transient overload maximum 10 A AC for 10 seconds
Power consumption	Max. 1 VA each transformer connection
Outputs	
Alarm contact	Potential-free changeover contact, AC-14 250 V AC, maximum 3 A, or DC-13 30 V DC, maximum 3 A. Note: Utilization category AC-14 / DC-13 according to IEC 60947-5-1.
Interfaces	
1 FRAKO Starkstrombus	For connection to FRAKO Energy Management System, according to EN 50170 (P-Net) standardised fieldbus, RS 485 Transfer rate: 76.8 kbit/s Type/ Protocol: RS-485 / P-Net
Display	internal
Ethernet interface	Modbus TCP, Webserver
Controls	5 buttons
Display	Illuminated LCD display with 128 x 64 pixels
Connections	Pluggable via connector strips (included in delivery)
Mechanical construction	
Dimensions	161,6 x 89,7 x 60,5 mm (W x H x D)
Ingress protection	Housing/clamps: according to DIN EN 60529 IP 30 / IP 20
Version	Protection class 1 according to DIN EN 61140
Housing	Flame-retardant UL94-V0
Installation	On standard rail 35 mm according to DIN EN 50022
Mounting position	Optional
Weight	Approx. 0.5 kg
Operating conditions	
Ambient temperature	-20 °C...+60 °C

Optional Accessories

Article-No.	Type	Description
20-10317	EM-PQ-SW	Software for the configuration and online display of data from the EM-PQ 1500 Power Quality Monitor. Access via: data collector. **Note:** included with FRAKO-NET when supplied on CD-ROM

Dimensions





Dimensional drawing PQA 1500

All dimensions in mm

PQA 1101
Power Quality Analyzer

A measuring and monitoring instrument for the acquisition, analysis and supervision of all key electrical data in low voltage 3-phase systems from 115 V to 690 V.

Description

Measurement functions:

- Phase-phase and phase-neutral voltages
- Currents in the 3 phases and N / PEN conductors
- cos φ, active, reactive and apparent power for each phase
- Frequency and asymmetry (load unbalance)
- THD of voltage and current for each phase
- Proportion of voltage/current harmonics V2 – V19 / I2 – I19
- Manual acquisition of voltage and current up to the 50th harmonic

Selectable options:

- 2x active and reactive energy via external tariff switching, or:
  - 1x active and reactive energy (imported)
  - 1x active energy (power feed-in / in-house generation)
- 2x temperature via external PT100 RTD probes

Measurement data and Min/Max memory:

Measurement data per phase

- Voltage
- Storage
- Power (active, reactive and apparent power)
- Supply frequency
- Voltage harmonics
- Current harmonics
- Temperatures

- Measurement via three external current transformers
- Menu-driven user interface in plain language with display of up to 8 measurement readings simultaneously
- Menu-driven configuration with user dialogue
- Backlit display
- Meter readings and alarm limits saved on power failure

Technical Data

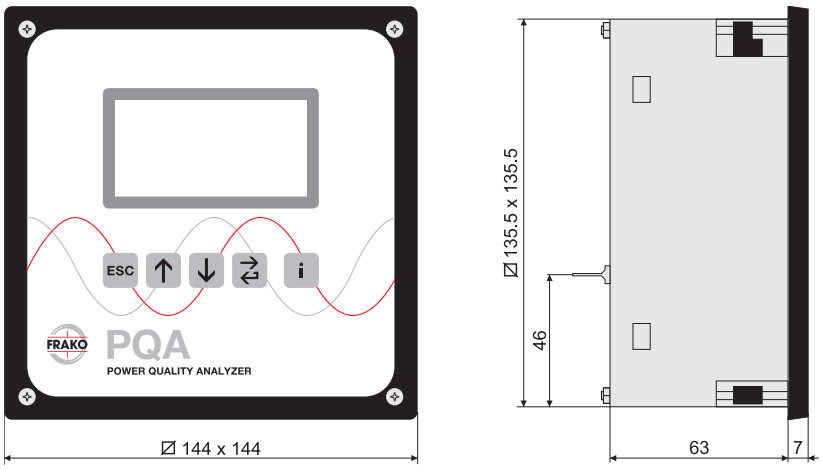
Power supply	
Mains voltage	85 V AC – 267 V AC (absolute limits), Frequency 45 – 65 Hz or 100 V DC – 377 V DC (absolute limits)
Power consumption	Max. 5 VA
Fuse protection	2 A external protection required
Measurement input	
Voltage path	80 V AC – maximum 760 V AC (phase – phase, absolute limits), suitable for 115 – 690 V AC systems, electrically interconnected via high resistances, measurement of medium voltages possible using an x/100 V transformer; In areas where UL / CSA standards apply in systems with nominal voltages 115 – 600 V AC; power failure detection after duration of a half-wave
Current path	x/5 A AC or x/1 A AC (transformer secondary current > 15 mA), electrically isolated, power draw maximum 1 VA per transformer connection, continuous overload rating up to 6 A AC, transient overload maximum 10 A AC for 10 seconds
Outputs	
1 Alarm signalling contact	Volt-free NO contact, AC-14 250 V AC, maximum 3 A or DC-13 – 30 V DC, maximum 3 A, Note: utilization category AC-/DC- as per IEC 60947-5-1
Inputs	
Tariff inputs	2 profiles selectable (e.g. HT/NT) Control via open collector output. Voltage withstand rating required: 10 V.

Interfaces (mode can be selected)	
Ethernet Interface	Modbus TCP, Webserver
FRAKO Starkstrombus	For connection to the FRAKO Energy Management System, standardized fieldbus, RS 485, Protocol P-Net
Operating elements	Membrane keyboard with 5 keys
Display elements	Backlit LC Display with 128 x 64 pixel
Connections	Plug-in connecting strips (included with delivery)
Mechanical construction	
Dimensions	Dimensions of front panel: 144 x 144 mm (DIN 43700), panel cut-out: 138 x 138 mm (DIN 43700), installation depth: 75 mm
Ingress protection	Front of instrument IP40 (with seal set IP54), rear of instrument IP20 all as per 60529, contamination level 2 as per EN 61010-1:2011-07
Version	Housing protection class 1 according to DIN EN 61140
Installation	From front panel with screwdriver
Weight	Approx. 0.77 kg
Operating conditions	
Ambient temperature	0 °C up to +55 °C

Optional Accessories

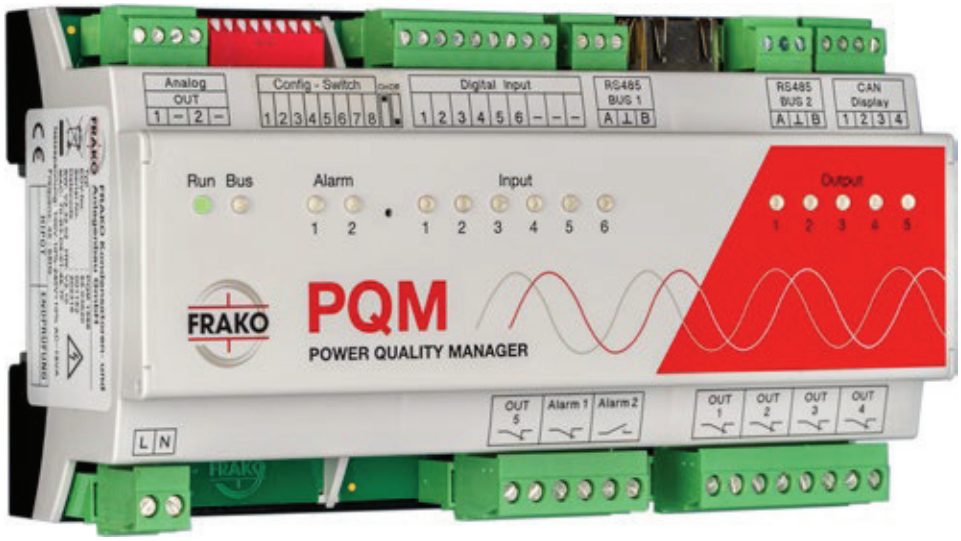
Article-no.	Type	Description
20-10311 EMA-SW	EMA-SW	Software for configuration and online display for EMA 1101. Access through: Data collector. **Note:** Included in the scope of delivery for FRAKO-NET (with CD shipment).

Dimensions



Dimensional Drawing PQA 1101

all dimensions in mm



Version 3 – Now even better!

Including 6 x S0 pulse inputs

PQM
Power Quality Manager

With the new PQM 3.0 as a central unit, all requirements for capturing parameters related to energy and power quality are fulfilled. Version 3.0 impresses with higher computing power while simultaneously reducing energy consumption. This results in increased reliability and improved security in processing the invaluable energy data. Enhanced communication capabilities, in addition to the proven OPC-UA server and REST interface, include support for the MQTT protocol and the Influx-DB protocol. This further improves access to cloud systems and enhances IoT capability. The update of the operating system ensures an increase in IT security and secures the future viability of the FRAKO data acquisition system.

Description
The PQM Power Quality Manager is a versatile all-rounder that even just as a gateway offers a variety of uses. Its integrated RS-485 and RJ45 interfaces and its built-in flexibility enable the PQM to interpret diverse protocols and access fieldbus instruments through the communications network.

Protocol options for connection to measuring instruments:
- FRAKO Starkstrombus
- Modbus RTU
- Modbus TCP

Using an external coupler:
- M-BUS
- KNX

If additional system points are acquired, the Power Quality Manager will automatically activate its data collector function plus some other useful features:
- OPC UA server
- S0 pulse inputs (6x)
- Numerous alarm functions:
  – Alarm limits (lower/upper) for registered metering and analogue channels
  – Alarm function, individually or in groups via various alarm routes: contacts on the PQM, e-mail, alarm report

User benefits:
- EMVIS 3000 visualization software (included with appropriate system points)
- Web interface for basic configuration
- Software updates to expand range of functions
- Simple data exchange via OPC UA
- IoT compatible, REST interface (machine to machine)

A specified number of system points are required for collecting data from the measuring instruments. These devices can be combined at will up to the limiting number for each type of device.

1

Your easy access to Power Quality Management 4.0

PQM as bus gateway:
- FRAKO Starkstrombus
- Modbus RTU

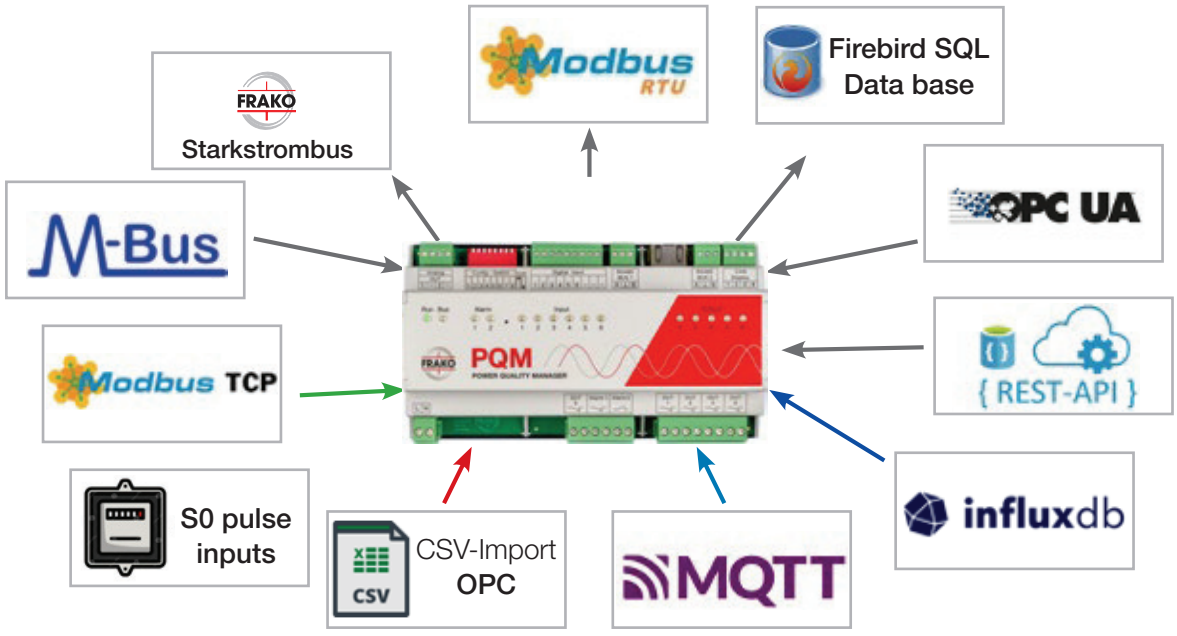
PQM as universal data acquisition system:
- Reception and collection of measurement readings and other data from connected devices via Modbus, M-Bus, S0 pulses and TCP/IP
- Monitoring of data with individually configurable alarm limits
- Alerting when variables go outside set limits using various media such as alarm relays or e-mail
- Optimum scalability, providing solutions for all, from the smallest applications right up to major businesses

PQM as remote monitoring unit:
- Monitoring
- Generating alarms

PQM as data collector incl. synchronization:
- Data transfer to third-party systems
- Collation of machine and energy data
- Visualization with any desired software

6 x S0 pulse inputs, freely programmable, can be used as/for:
- Meter
- Operating hours (seconds) counter
- Status channel
- Pulse input for time synchronization with utilities
- Collector of impulses from transducers which convert process variables into a frequency, for example, temperature, humidity mg/m² etc.
- Power calculation from meter pulses
- OPC UA Server (integrated in the device)
- To increase processing power – more stable data transfer via bus and Ethernet
- Pulse acquisition (S0 pulse inputs) for another PQM
- Complete small system incl. data collection of pulse meters

Interfaces such as OPC UA and REST



Software for the display/ evaluation of the data:
- including EMVIS 3000 to enable total visualization
- Comprehensive data evaluation
- CSV export facility

Software according to BAFA suitable for EN 50001

OPC UA

Interface for:
- Industry 4.0
- All types of data
- Free choice of database
- Free choice of visualization
- Customized solutions
- Third-party systems

Technical Data

Power Supply	
Supply voltage	100 V AC – 253 V AC (absolute limits), 230 V DC (absolute limits)
Frequency	45 up to 65 Hz
Power consumption	Max. 7 W / 18 VA
Fuse protection	Max. 2 A (slow acting) external protection required
Interfaces	
Ethernet interface	10/100 MBit/s, RJ45 RS-485 Bus 1 | Modbus RTU RS-485 Bus 2 | FRAKO Starkstrombus
Outputs	
Relay contact	5 contacts – bistable, 250 V / 2 A AC or 30 V / 2 A DC
Alarm contact	1 contact – bistable, 250 V / 2 A AC or 30 V / 2 A DC 1 NC, 250 V / 2 A AC or 30 V / 2 A DC
Inputs	
6 pulse inputs	S0 pulse inputs (DIN 43864) for connecting to volt-free contacts, Open-contact voltage: 15 V, Max. line resistance: 800 Ohm, Short-circuit current: 18 mA, Pulse frequency: 0.1 to 20 Hz
Connections	
via plug-in type screw terminals	Conductor cross-section max. 1.5 mm², min. 0.14 mm², Relay-, alarm contacts and supply: Conductor cross-section max. 2.5 mm², min. 0.2 mm², Rated value insulation: 250 V AC, 80 °C
Control elements	
DIP switch	8 pieces
Display elements	
LED	15 pieces
Mechanical Construction	
Dimensions	161.6 mm x 89.7 mm x 60.5 mm (W x H x D)
Installation	On standard rail 35 mm according to DIN EN 50022
Weight	approx. 0.4 kg without packaging
Ingress protection	Enclosure IP30, terminals IP10 according to DIN EN 60529 pollution degree 2 according to EN 61010-1:2011-07
Version	Enclosure protection class II according to DIN EN 61010
Housing	Flammability according to UL 94 V0 as declared by the manufacturer

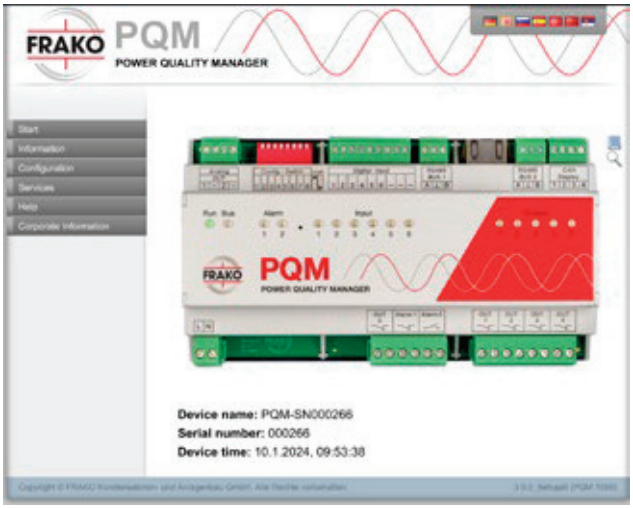
Mechanical Construction	
EMV	EN 55022 Class B : 2010 + AC : 2011 EN 61000-3-2 : 2014 EN 61000-3-3 : 2013 EN 61000-6-3 : 2007 + A1 : 2011 EN 61000-6-2 : 2005 EN 61000-4-2 : 2009 EN 61000-4-3 : 2006 + A1 : 2008 + A2 : 2010 EN 61000-4-4 : 2012 EN 61000-4-5 : 2014 EN 61000-4-6 : 2014 EN 61000-4-8 : 2010 EN 61000-4-11 : 2004
Operating conditions	
Temperature range	0 °C…45 °C
Installation height	Geographical height max. 2000 m above sea level
Article-No.	20-10090 without system points
PC requirements for FRAKO-NET software package	
Hardware	• Min. Intel Core I5 • Main memory min. 4 GB RAM • 10 GB free hard drive space • Ethernet 10/100 Mbit/s network connection or/and one free serial interface • DVD drive • SVGA graphics adapter • Colour screen with minimum resolution of 1024 x 768
Software	• Microsoft® Windows®* 10 • Microsoft® Windows®* 7 (x32/x64) • Microsoft® Windows®* Server 2008 R2 • current browser for example, Mozilla Firefox * Registered trademarks of Microsoft Corporation

Optional accessories

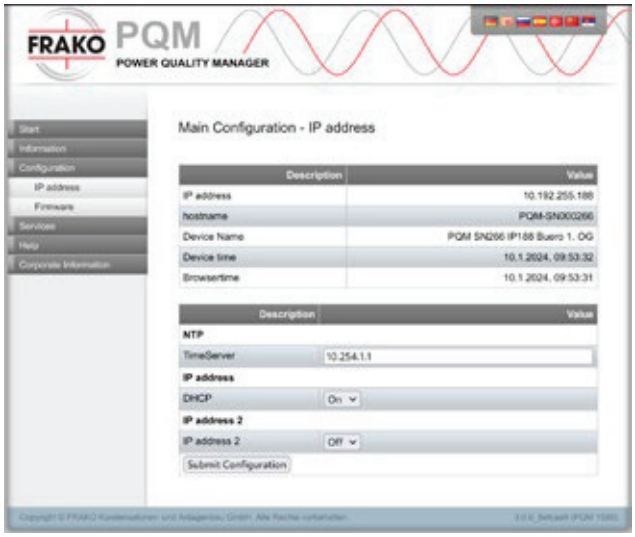
Article-No.	Type	Description
20-10495	System points upgrading package PQM	10 system points incl. system visualization EMVIS 3000
20-10496		50 system points
20-10497		100 system points

System points per integrated device	Upper limits
30 System points per EM-MC 2200	Max. 4 units EM-MC 2200 per PQM
15 System points per EM-PQ 2300	Max. 32 units EM-PQ 2300 per PQM in Slavemode, or max. 8 in Mastermode
15 System points per PQA 1101	Max. 32 units PQA 1101 per PQM
7 System points per PQC (single phase)	
10 System points per PQC (three phase)	
7 System points per EM-PQ 1500	Max. 32 units EM-PQ 1500 per PQM
1 System point per channel of EM-MC 2200, PQA 1101, EM-PQ, EMF 1102 or PQM	Max. 550 metering-, analogue-, status- or alarm channels per PQM
10 System points to activate the S0 function of the PQM	
7 System points per PQA 1500 Limit: Max. 32 points per PQM	

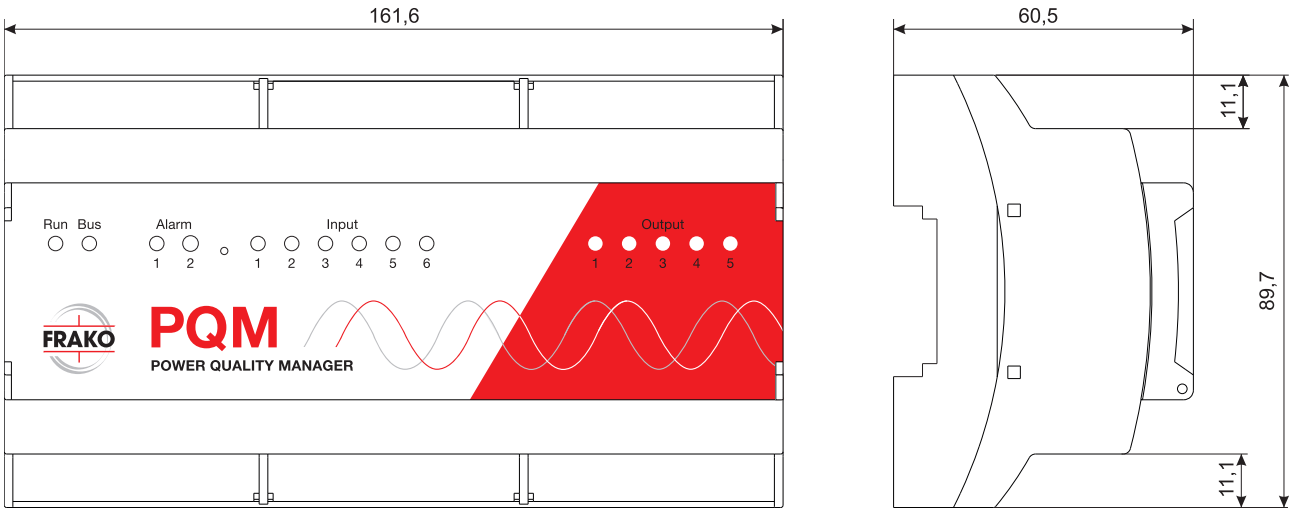
Web interface Start screen



Web interface Main Configuration – IP address



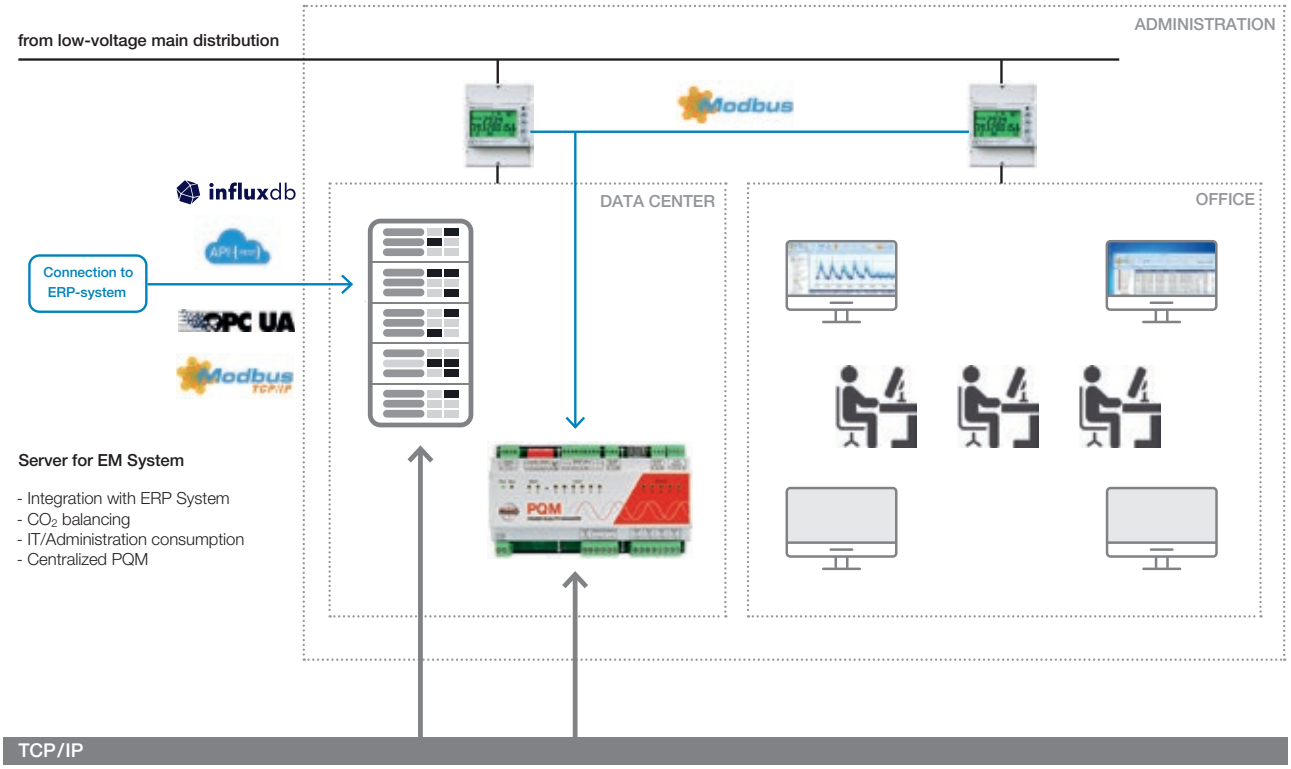
Dimensions



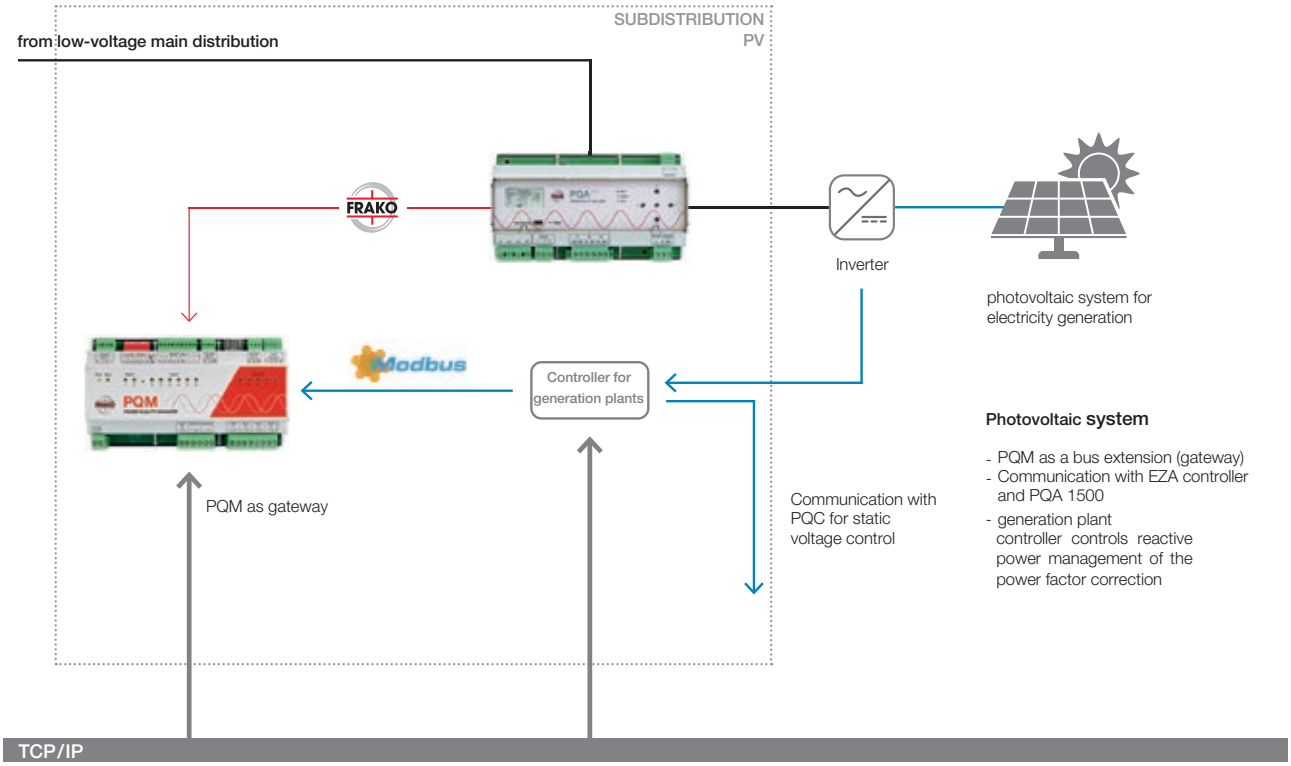
Dimensional drawing PQM

All dimensions in mm

OFFICE BUILDING



PHOTOVOLTAIC SYSTEM



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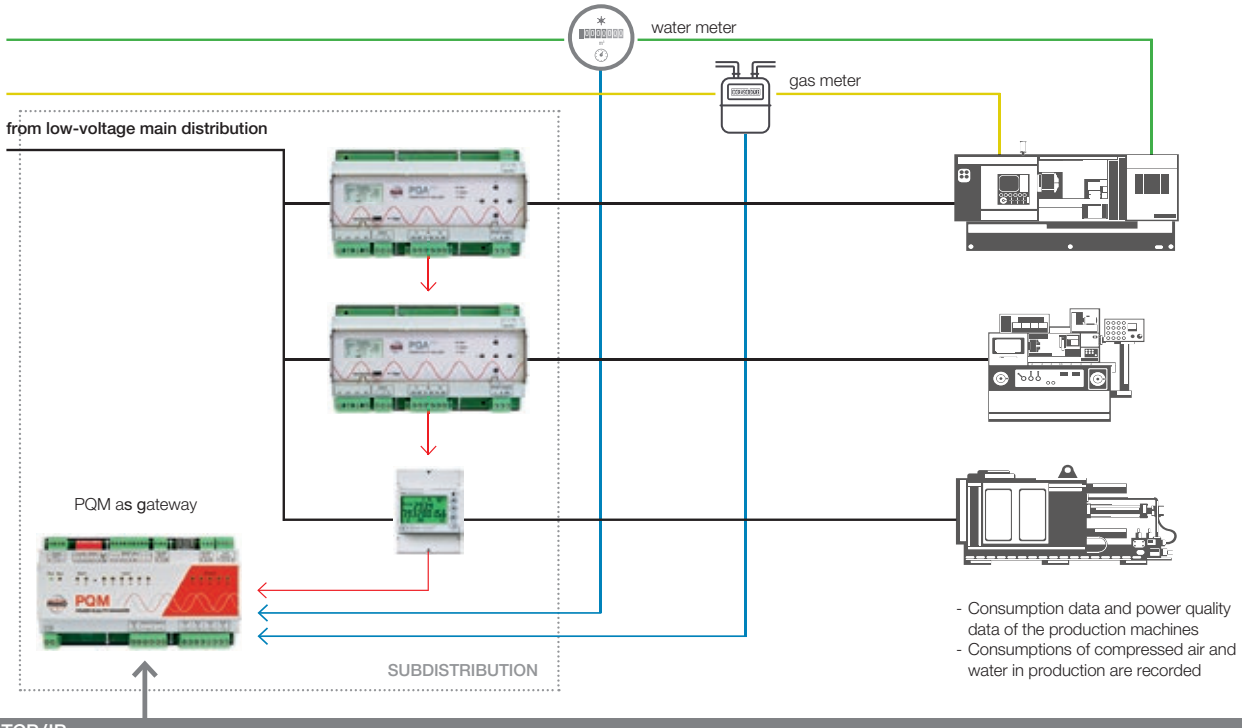
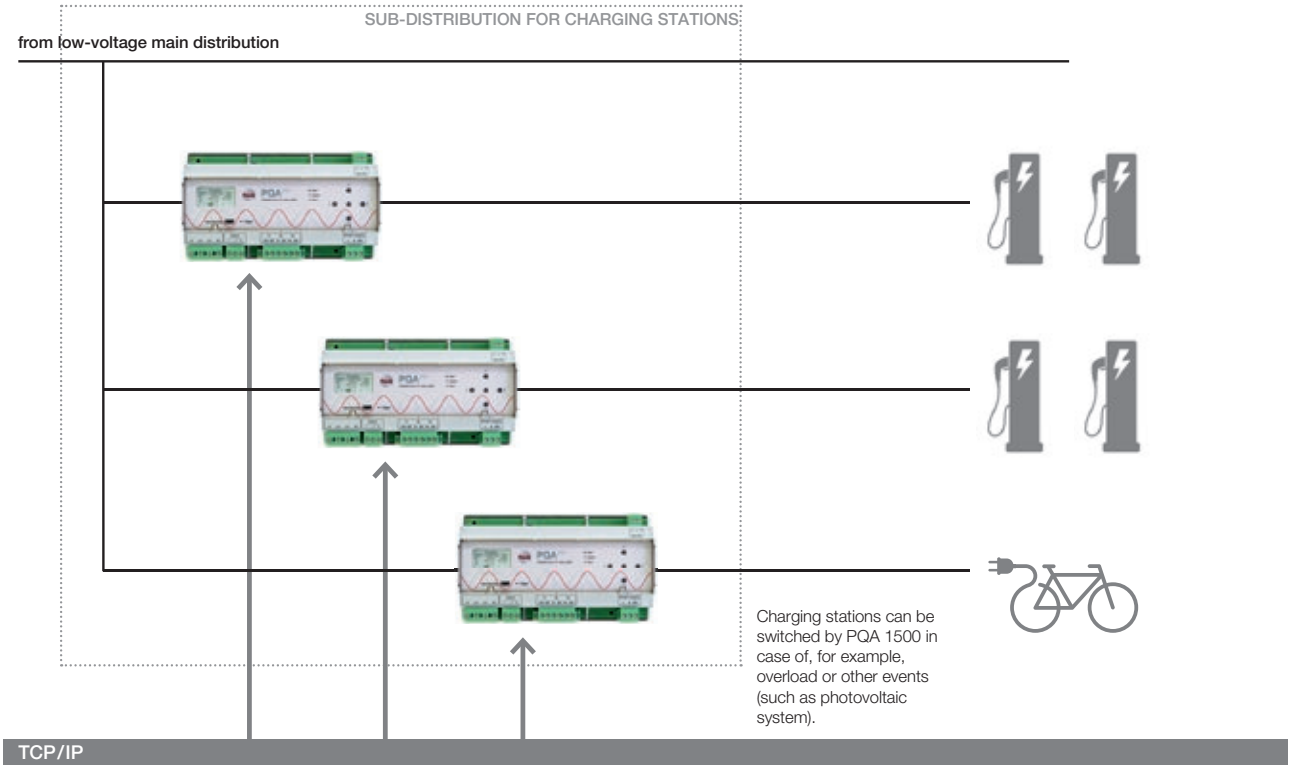
PRODUCTION



CHARGING STATIONS



Devices of the PQ Series

Power Quality Manager

1

PQ Analysis

2

Visualization Software

Page 205

Software for Cost Centre Analysis

Page 211

EMG-OPC-Server

Page 213

Customized Software Tools

Page 215

System visualization is INCLUDED if a PQM with system points is purchased!

Customer-specific evaluations based on EMVIS 3000 can be individually programmed.
Please ask our sales department for individual solutions.

2

suitable for evaluations according to EN 50001

Eligible for funding according to BAFA

EMVIS 3000
System-Visualization

In the Energy Management System, the measured variables, statuses and events in the entire in-house energy supply system are acquired, processed centrally and saved. They are presented graphically by the visualization facility and evaluated. The EMVIS 3000 software is a powerful tool for displaying and documenting all the measurement readings from the devices connected to the system. A client management function is available, which enables individual organizational system trees to be assigned to different users, who therefore receive exactly those data that they require for their separate purposes. There are two types of installation: either the single workstation or the server version, the latter with access to up to 5 clients simultaneously via a web browser, with no additional installation necessary in the client systems.

EMVIS 3000 comprises the following functional modules:

EMVIS 3000 Project

The project planning tool ...

- Unrestricted configuration and compilation of evaluations of all data processed by the system
- New functions such as alarm visualization, status, history, ranking
- Server version with access via browser
- User administration, the administrator defines user rights and accesses
- Calculation of **performance figures**
  Performance figures are virtual data points calculated from other data points, an arithmetic computation from measured or imported data, e.g.: “Active energy A x factor + Water quantity B x factor + Compressed air volume C x factor / No. of items D”
- Creation of **benchmarking** charts
  Benchmarking makes a direct comparison of measurement data or performance figures possible, e.g. energy costs of products or company sites
- Creation of **Sankey** diagrams
  A Sankey diagram gives a clear overview of any type of flow, e.g. the flow of utilities. The width of each stream into and out of a location is proportional to the quantity flowing, absolute and percentage values also being stated
- Easy Customizing – individual planning of views – simple and intuitive (the basic package includes 3 views with up to 20 online data points in total)

EMVIS 3000 Report

The reporting tool ...

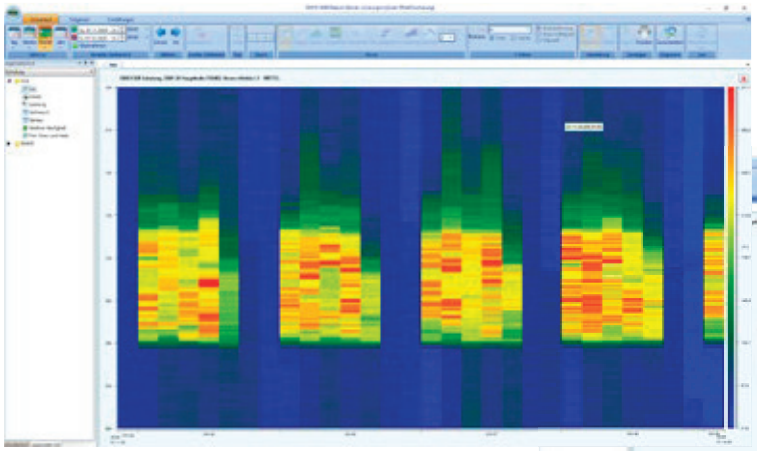
- To simplify navigation, a clear overview of the entire system is displayed in two system trees, either of which can be selected:
  – **Physical:** standard evaluations of all the instruments and channels registered with the system
  – **Organizational:** all evaluations that have been compiled with EMVIS 3000 Project
- Presentation of historical data for analysis and comparison purposes, e.g. different locations or different periods of time
- For example diagrams showing the time course or diagrams without timeline such as **carpetplot, scatter diagram and heatmap**
- The historical data can be exported directly from the chart or consumption table for further processing. Possible export formats are CSV, Excel, Word and PDF
- Direct access to the momentary readings of the connected instruments

- Visualization of the alarms occured is possible through display of the status, history and statistical evaluation in the ranking

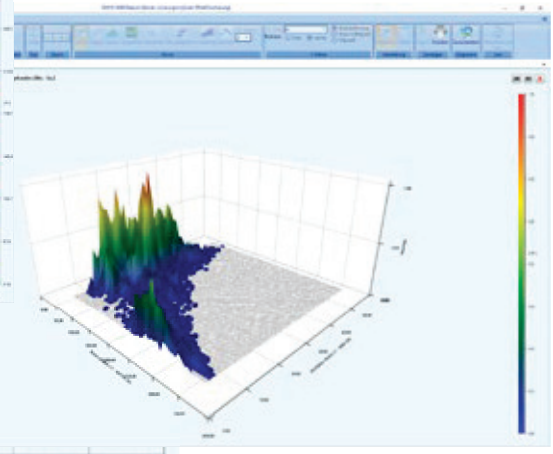
EMVIS 3000 Live

- Views created individually – from site layout drawings right down to the distribution board
- Display of the momentary measurement readings and statuses

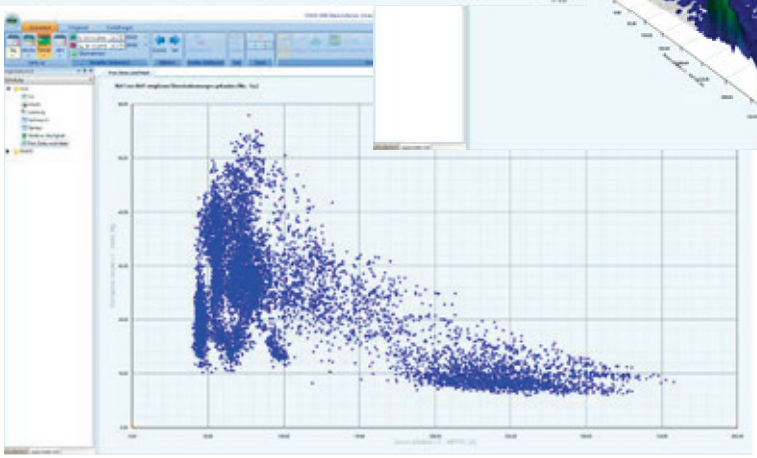
The EMVIS 3000 license enables the software to be installed on several PCs (server and clients). It allows access to the Power Quality Manager PQM and the Central Unit EMIS1500.



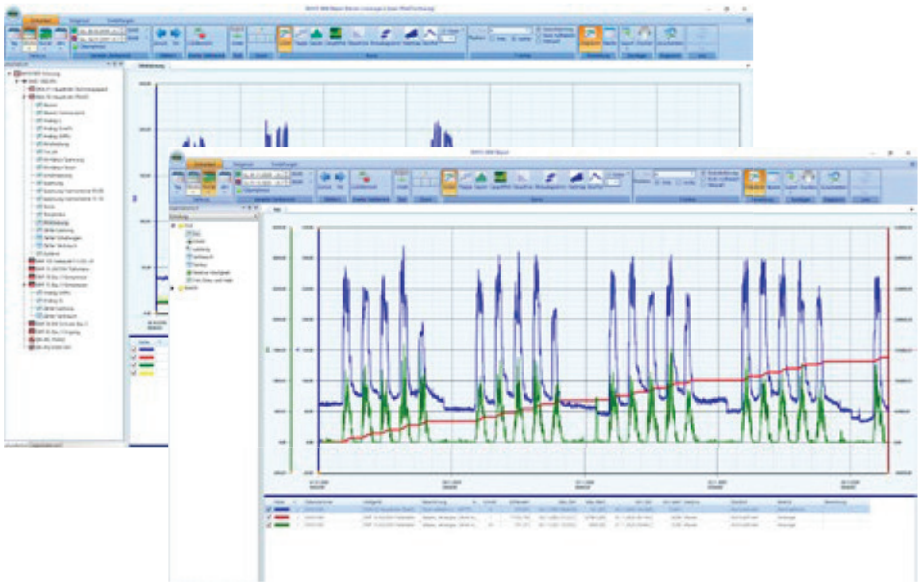
Carpetplot



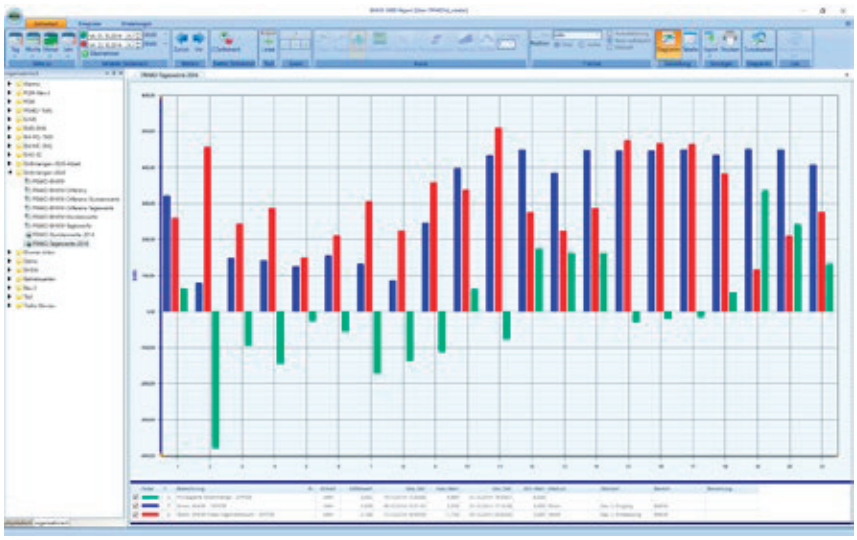
Heatmap 3-D



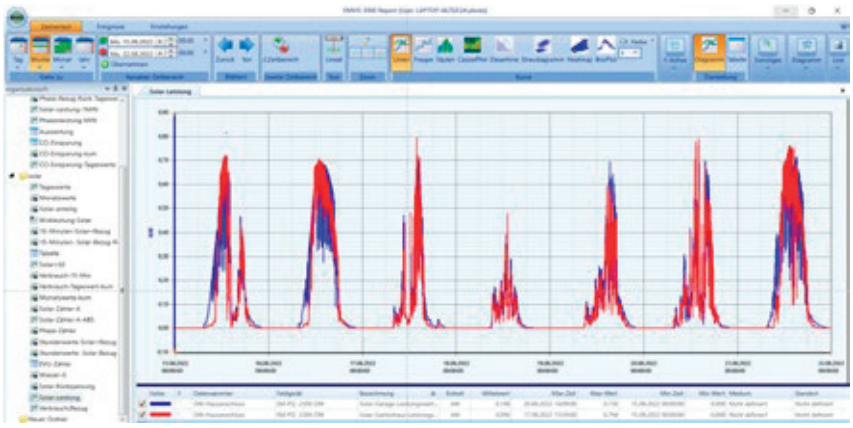
Scatter diagram 2-D



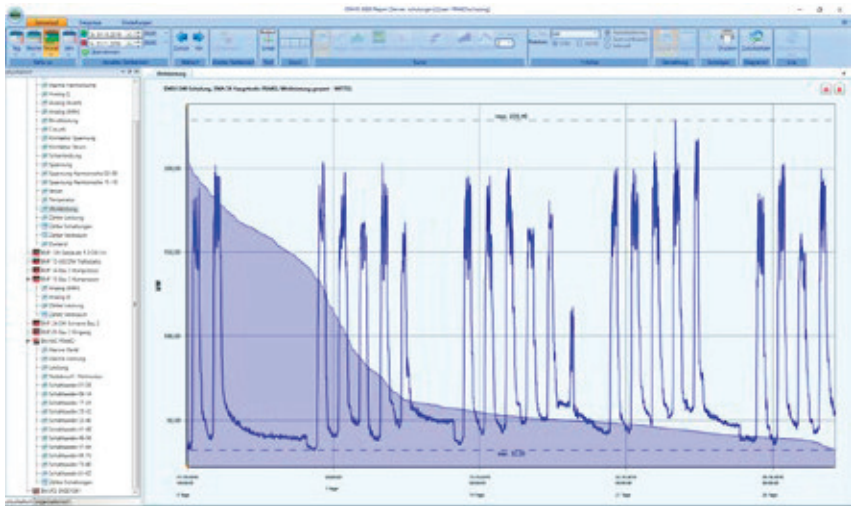
In the physical system tree prepared standard evaluations are deposited for all Energy Management devices. This allows the user to visualize the recorded historical data.



graphical representation
of energy differences



Sankey graphic – shows the
flow of energy

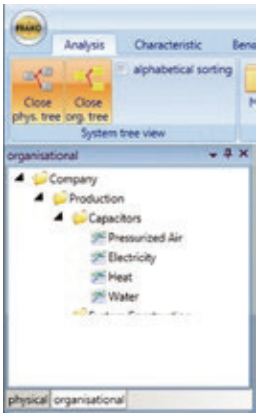


Continuous line graphic – shows the
frequency of the variables within a period
of time

PQ Analysis

Visualization Software

Standard evaluations for each energy management device are stored in the physical system tree, enabling the user to visualize the recorded and momentary measurement data without the need for individual configuration.



Within the organizational system tree business specific structures are deposited. The business specific structures are projected in form of individual evaluation in the organizational system tree by the customer.

Technical Data

PC requirements for small and medium systems	
Hardware	• Min. Intel Core I3-Processor • User memory: 4 GB RAM • 1 GB free hard disk space • Graphics adapter: min. DirectX 9.0c support and 512 MB video memory
Software	• Microsoft® Windows®* 7 • Microsoft® Windows®* 8 • Microsoft® Windows®* 10 • Microsoft® Windows®* Server 2008 R2 • Microsoft® Windows®* Server 2012 R2 • Microsoft® Windows®* Server 2016 • Microsoft® .NET Framework 3.5 • Microsoft® .NET Framework 4.5 • FRAKO-NET (min. V1.40.0056 or higher) • Firebird V2.5.0 (included in FRAKO-NET) * Registered trademark of Microsoft Corporation Please note: the server variant will only work with a 64-bit system
Article-No.	20-10649

EMVIS 3000 Extension packages

Article-No.	Type	Description
20-10650	EasyCustomizing-S	Individually designed views with up to 100 data points
20-10651	EasyCustomizing-M	Individually designed views with up to 200 data points
20-10652	EasyCustomizing-L	Individually designed views with up to 350 data points
20-10653	EasyCustomizing-XL	Individually designed views with up to 550 data points
20-10654	EasyCustomizing-XXL	Individually designed views with up to 1000 data points

EMVIS 3000 Software-Update

Article-No.	Type	Description
20-10555	EMVIS 3000 Software-Update	from version 3.0 to the latest version up to V3.XXX