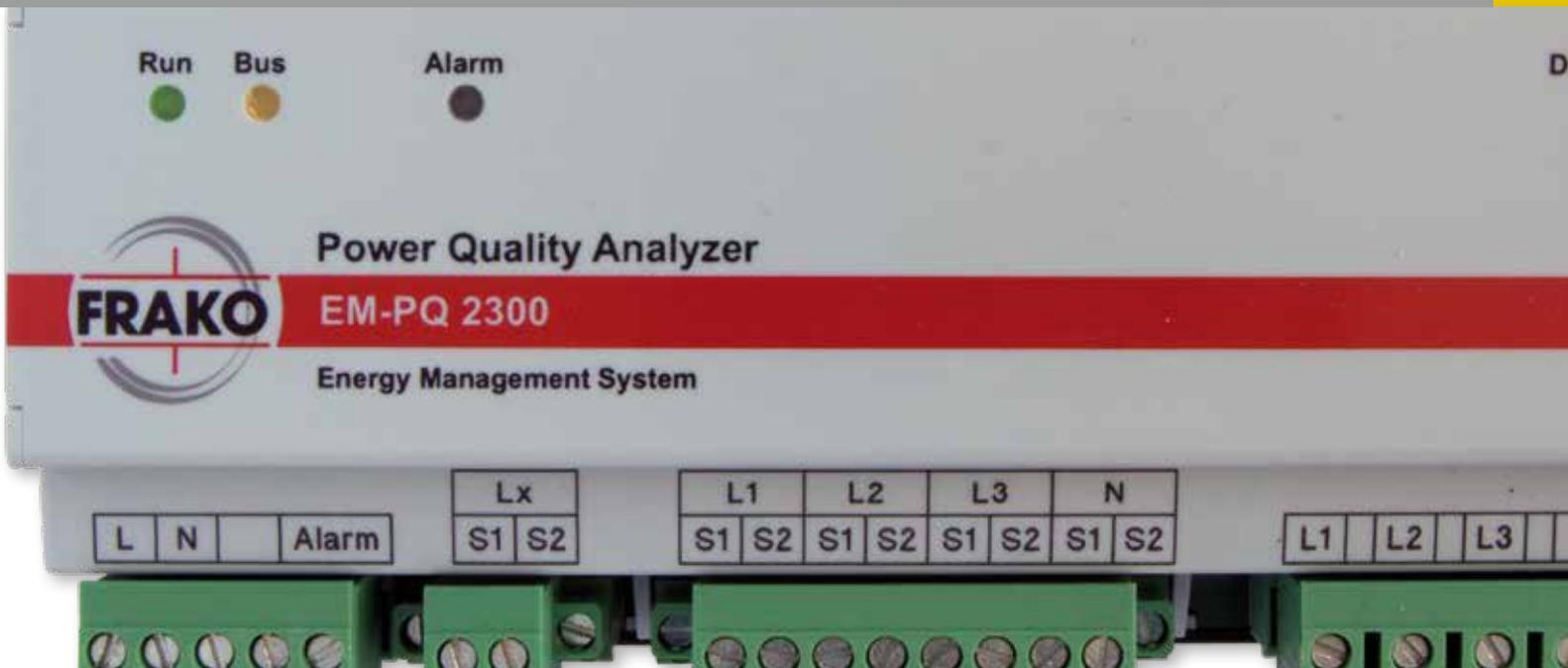


Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation



Mains Analysis Devices for DIN rail mounting or door installation

The power quality of the electrical supply networks plays an increasingly important role for the operational safety of electrical installations and equipment. Therefore it becomes more and more important to take appropriate measures to monitor the power quality. This thus provides a measurement of the residual current, i.e. the algebraic sum of the currents in L1, L2, L3 and N, as a key parameter in enabling an assessment of the condition of the electrical installation to be made.

In contrast to the past it is obvious that it is not sufficient to do a single measurement and then disregard the mains quality if the measurement showed unproblematic values.

Due to complex production processes, changing load conditions and a steady progress in the degree of automation it became important to permanently monitor the quality of electrical power supply.

Thus one can acquire energy know-how and define critical values for measurement variables such as voltage, current and harmonics.

Automatic alarms via different information channels such as e-mail, SMS, warning lights, etc. allow the control of compliance with the now specified critical values.

Of course, critical values predefined by standards and regulations can also be signalled via these channels.

FRAKO Mains Monitoring devices can handle all these operations.

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.

Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation

	EM-PQ 2300	EM-PQ 1500 M	EMA 1101
			
Voltage	90-267 V AC or 100-360 V DC	withdrawn from mains voltage	85-267 V AC or 100-377 V DC
Frequency	45-65 Hz	50 Hz	45-65 Hz
Power consumption	Max. 8 W	Max. 7 VA	Max. 7 VA
Contact termination 3/4/5-wire	• / • / •	• / • / -	• / • / -
Current measurements	5 x X/5A	3 x X/5A (error current > 6 mA), galvanically isolated	3 x X/5A (Transformer current > 15 mA), electrically isolated
Voltage measurements	400/600 V AC (L-N/L-L) 3-phases 5-wire system 5 x 80 V AC - 690 V AC (external/external conductor)	3 x 57-230 V AC (external/neutral conductor) 3 x 100-400 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	1-51	-	1-19
Short term interruptions	•	-	•
Active energy class	1	1	1
Analogue In-/Outputs	- / 2 (0-10 V or 0-20 mA or 4-20 mA)	- / 1 (max. 30 V DC, 100 mA), (4-20 mA DC passive)	2 temperature / -
Digital In-/Outputs	4 / 2	- / 1 (max. 48 V DC, 100 mA); 1 (max. 30 V DC, 100 mA)	Tariff input for selection of 2 profiles / 1 alarm signalling contact 250 V AC, max. 3 A
Memory Min./Max. values	•	•	•
Memory size	256 MB	-	-
Interfaces			
Ethernet	•	-	-
FRAKO Energy Management System	• via FRAKO Starkstrombus Intranet (Ethernet) Modbus/TCP	• via FRAKO Starkstrombus	• via FRAKO Starkstrombus
RS-232 / RS-485	- / •	• / -	- / •
Profibus DP	-	-	-
Webserver / E-Mail / SNMP	• / • / •	- / -	- / -
Recommended applications	Transformer monitoring with residual current measurement and PE-monitoring	Machine disposals	Transformer / NA
Catalogue Page	Page 195 ff.	Page 201 ff.	Page 205 ff.

Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation



EM-PQ 2300 Power Quality Analyzer

The power quality of electrical supply networks is of ever increasing importance for the operational reliability of electrical installations and appliances. It is therefore becoming increasingly essential to take appropriate measures to monitor supply network power quality.

The approach used in the past, i.e. simply taking some measurements and then disregarding the power quality issue if these did not appear unusual, is no longer sufficient.

Highly complex manufacturing processes and new power demand profiles, together with ever more sophisticated automation systems, make it today more important than ever to monitor the quality of the power supply on a continuous basis.

This allows the user to accumulate 'energy expertise' and specify sensible alarm settings for parameters such as voltage, current and harmonics.

An automatic alarm function using various means of communication, such as e-mails or alarm annunciators, makes it easier to keep these parameters under control within their specified limits.

The limiting values called for by electrical standards and regulations can, of course, also be monitored in this way.

FRAKO power quality analysis instruments can do all of these things. Depending on instrument type and specifications, these

functions can be performed by a single device alone or in combination with a FRAKO Energy Management System.

Whether the duty is to manage a transformer, take measurements at a low voltage main or secondary distribution board, or monitor individual electrical machines or loads, FRAKO has the right instrument for every application.

Description

Power supply monitoring instrument for the acquisition, monitoring and analysis of electrical data in networks up to 690 V (phase-phase, optional with article No. 20-30243, measurement range extension), with 5 current transformer inputs and 4 voltage inputs, including residual current measurement (the algebraic sum of the currents in L1, L2, L3 and N, being equal to zero in the ideal case) and PE monitoring.

Permanent and simultaneous monitoring of up to 250 measurement points. The instrument offers more than 600 measurement points to be selected from. Its power failure detection function enables a supply failure of up to one second to be buffered, so that those short dips of particular interest can also be recorded by the EM-PQ 2300 even if the instrument's own power supply is disrupted by this event.

Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation

Integrated firewall-friendly web interface. The monitoring function enables an entire building, for example, to be continuously checked for the presence of earth fault currents automatically. This means that incipient insulation faults can be detected at a very early stage and reported to the office responsible for electrical safety.

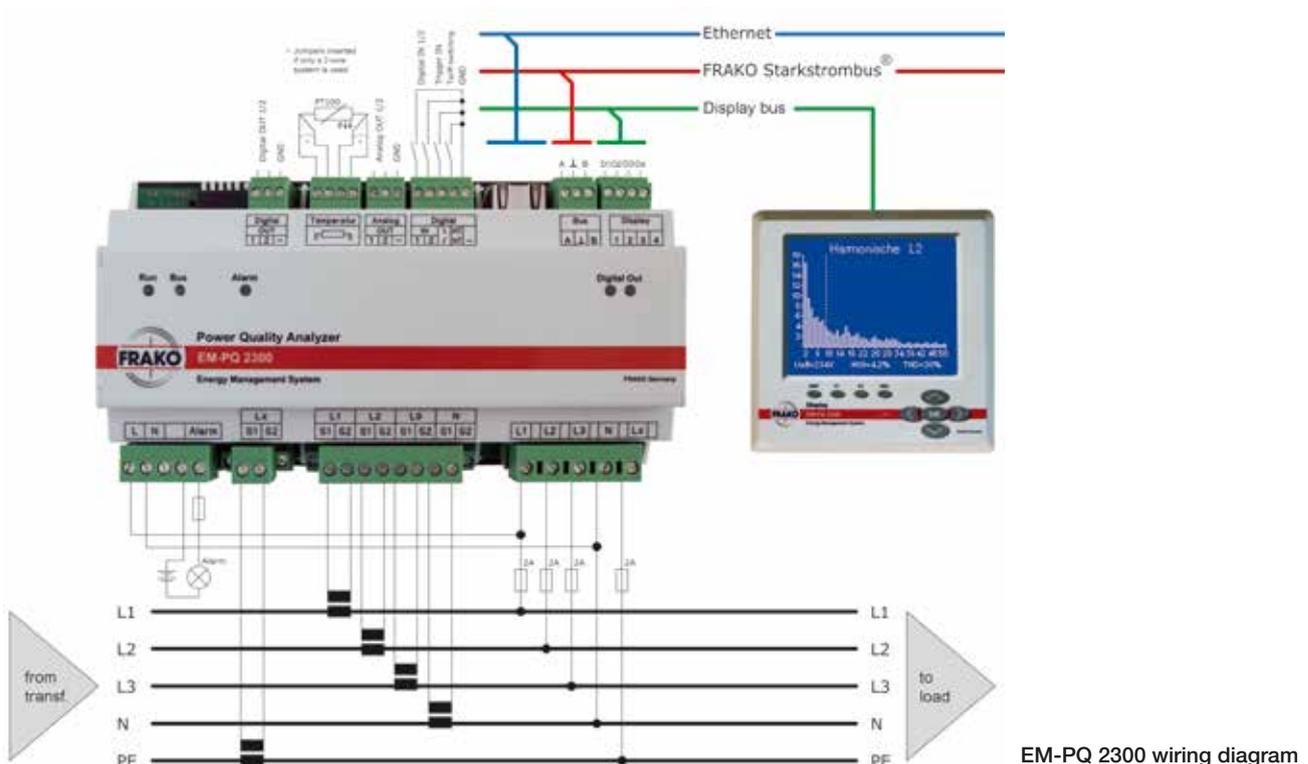
In many companies, manufacturing automation and IT are still two different worlds. The EM-PQ 2300 solves this problem with the Simple Network Management Protocol (SNMP), an integrated communications interface that enables measurement data from the automation area to be automatically transferred to the IT area.

- Long-term network analysis to EN 50160 or EN 61000-2-4
- Monitoring of supply voltage dips
- Harmonics analysis, current and voltage up to 50th harmonics
- Monitoring of earth conductor current and residual current detection
- User-selectable data recording, e.g. analysis of power demand curve profile
- Display of measurement readings and curves at the optional EM-FD 2500 display, connected to the EM-PQ 2300 Power Quality Analyzer by a 4-core cable. One display can indicate the data from up to 7 EM-PQ 2300 instruments.
- Inputs:
 - 5 current transformer inputs for L1 to L3/N/(PE)
 - 4 voltage inputs for L1 to L3/N and Lx/N up to 690 V (extension option)
 - 3 freely assignable S0 pulse inputs for status signals, energy metering and power calculation, or to synchronize metering with the power supplier

- 1 S0 pulse input for tariff switching
- 1 Pt100/1000 4-wire resistance temperature detector input, automatic probe type identification
- Outputs:
 - 1 alarm contact rated at up to 250 V AC
 - 2 digital outputs for alarm purposes. The outputs are electrically isolated and are rated up to 30 V DC
 - 2 analogue outputs for any 2 desired measurement readings, as 0–20 mA, 4–20 mA or 0-10 V signal, internal instrument voltage source, automatic voltage/current identification
- Interfaces:
 - RS-485 bus, for connection to FRAKO Energy Management System
 - Ethernet (RJ45 jack) for connection to FRAKO Energy Management System
 - Modbus (TCP) slave, SNMP agent: the internal alarm system can transmit e-mails via Ethernet
- Software (Device Manager) included for configuration and display of the stored measurement readings via Ethernet
- IoT compatible, REST interface ('machine to machine')

Data acquisition and recording:

- Acquisition and recording of the minimum, maximum and average values of the measurement readings and acquisition intervals defined by the user over parameterized periods of time
- Detection of under- and overvoltages V_{rms}
- Detection of voltage failures V_{rms}
- Detection of inrush currents (10 ms)
- Energy meter (active and reactive power, consumed and fed into network)
- Internal data storage: 256 MB flash memory



EM-PQ 2300 wiring diagram

Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation

Easy installation with the DIN rail-mounted enclosure

The EM-PQ 2300 is housed in an enclosure with a pin strip underneath it.

This system, consisting of pin and socket strips and DIN rail bus connectors, enables the individual modules to be easily fitted and connected to one another.

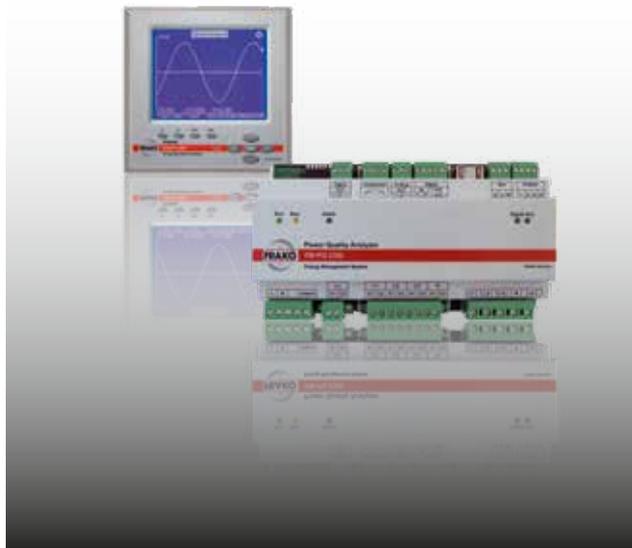
All connections are also available at external terminals for conventional wiring. Use of the 16-pin DIN rail bus connector provides automatic contact from instrument to instrument.

The bus connector enables the FRAKO Starkstrombus, extension bus and display bus to be connected. The pin and socket strips on the DIN rail ensure quick and easy installation of the instruments in parallel.

It is possible to plug individual instruments in or remove them without dismantling the modular assembly.



4



Data display on the EM-FD 2500

The EM-FD 2500 has been developed as a physically separate LCD display and operator panel to work with all FRAKO Energy Management devices of the new generation that require this, such as the EM-PQ 2300 and EM-MC 2200 instruments.

The Display is connected to the EM instrument via 4 terminals: two wires for the instrument power supply and two for data transfer. A maximum of 8 instruments can be connected to a common display bus, with a bus length of up to 40 m to the Display.

The Display is mounted on the control cabinet door or wall through a \varnothing 22.5 mm hole, thus greatly simplifying installation. Its orientation is fixed by a screw through the wall into a threaded bush.

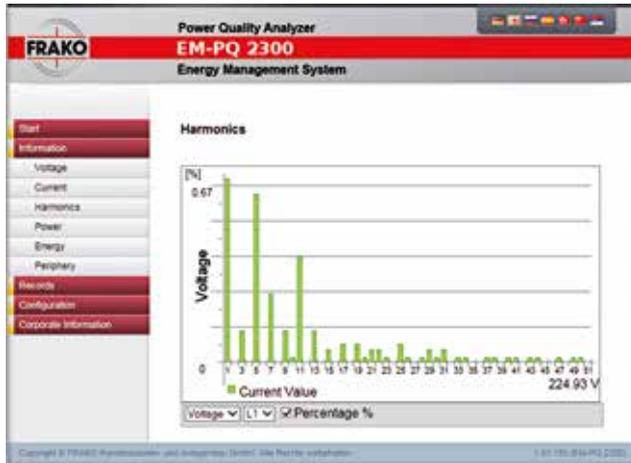
Alternatively, the Display can also be mounted in any available 144 x 144 mm cut-out.

Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation

Web interface to display the momentary measurement readings and the event list

- Web server for the configuration and online display of all measurement readings
- Every user at any PC can view the most important measurement data via the intranet



4

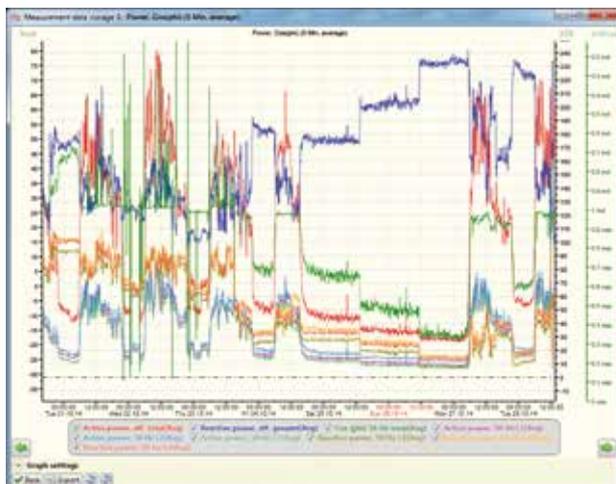
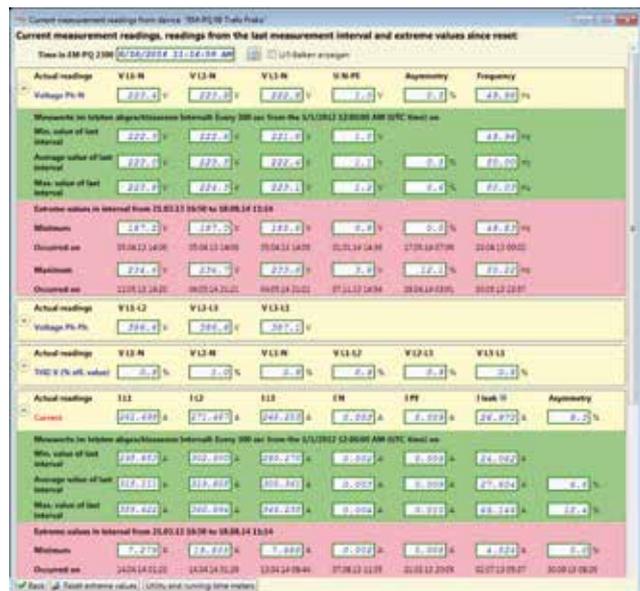
Device Manager – Clear overview and straightforward programming

Momentary measurement readings

All key measurement data from the EM-PQ 2300 are displayed in a clear overview.

With most measurement points, each individual section can be expanded to display the extreme values in the last interval and the extreme values since the last reset.

The V/I bar graph indicator, which ranges from 0 to full scale value, offers a quick check on the extent to which the current and voltage measurement ranges are being used. This shows immediately whether the current transformers are correctly dimensioned.



Continuous data recording

The continuous data recording function of the EM-PQ 2300 can be configured as desired.

Up to 250 data points can be recorded, the time interval and the type of reading (minimum, average or maximum value) being specified for each data point.

In addition, the option of defining charts and assigning data points to them is also given, so that when the EM-PQ 2300 is accessed, regardless of the PC on which the device manager is installed on, the same charts will always be available.

Mains Monitoring

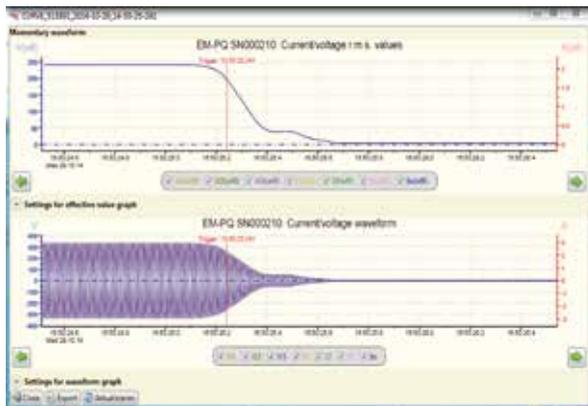
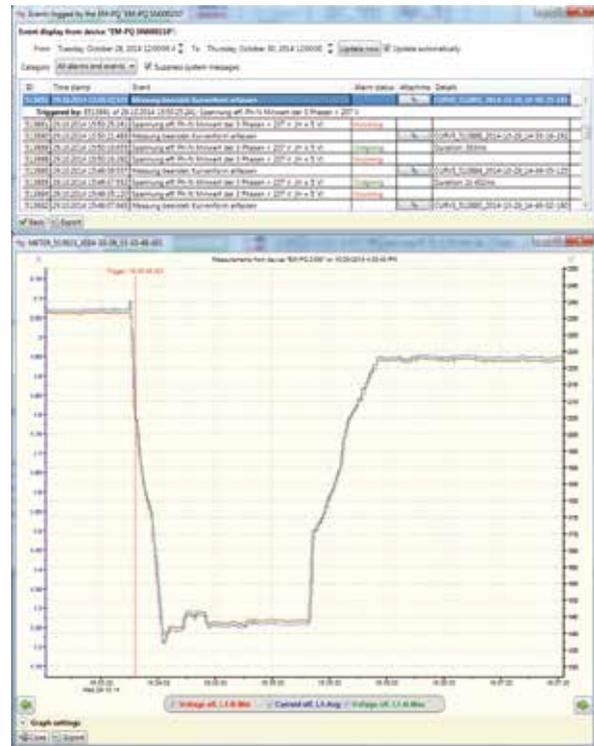
Mains Analysis Devices for DIN rail mounting or door installation

- **Event-driven data recording including the period prior to the triggering event**

Various events can trigger the recording of data for a limited time independently of the continuous recording function. The user is free to define which measurements are recorded and for how long.

This 'pretrigger' function also enables the measurements from the time leading up to the triggering event to be recorded. If this is set at 25 %, and the duration of the recording period at one hour, the EM-PQ 2300 will record the measurements made over the 15 minutes before the triggering event and the 45 minutes after it. The EM-PQ 2300 does this by continuously recording the measurements in a small circular buffer. When the recording period is over, the data from before and after the event are saved in a file, and the message 'Measurement completed' appears as a new entry in the event report.

Clicking the button in the 'Att.' (Attachment) column will display the measurement.



Analysis to EN 50160 or IEC 61000-2-4

The EM-PQ 2300 can be configured so that it carries out an analysis every week, saving this as a results file, which can then be loaded via the event report.



Apart from the user-defined measurements, predefined short-term measurements covering periods of 2 or 6 seconds can also be triggered, the current and voltage measurements being saved both as root-mean-square values over 10 ms intervals and as waveform curves.

An additional feature is that an e-mail can be sent after a measurement is completed. Clicking the e-mail attachment on any PC on which Device Manager or FRAKO-NET is installed will display the measurement.

- **Energy meter for each phase**

The EM-PQ 2300 meters the energy of each phase in addition to the total energy. Two resettable energy meters and one non-resettable meter are available for each phase. Resetting can be performed manually or automatically at any desired interval.

- **User-friendly evaluation in the chart with cursor values and display of min. and max. readings**

By activating the cursor lines, the readings can be displayed in a table and time differences can be measured.

The min./max. display enables the user to find minimum and maximum values over long periods and to display them on an enlarged scale.

The min./max. display can also be used with an energy meter to determine the energy consumption over a set period. This is displayed directly in the 'Max - Min' column.

Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation

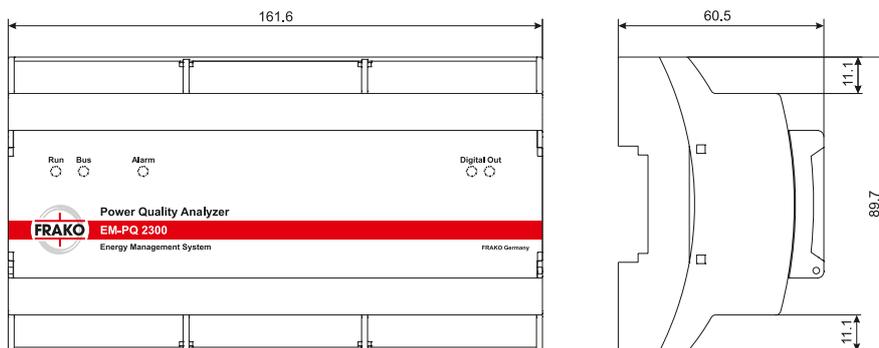
Technical Data

Power supply	
Voltage	90-267 V AC or 100-360 V DC
Frequency	45...65 Hz
Power consumption	Max. 8 W
Measurement inputs	
Connection w.	•/•/•
Cat. 3/4/5 cable	
Current measurement inputs	5 x X/5A
Voltage measurement inputs	4 x 400/600 V AC (L-N/L-L); 3-phase 5-wire system
Inputs and outputs	
Analogue inputs and outputs	- / 2 (0-10 V or 0-20 mA or 4-20 mA)
Digital inputs and outputs	4/2
Temperature	PT100/1000 4-wire system
Interfaces	
Ethernet	•
FRAKO Energy Management System	FRAKO Starkstrombus Intranet (Ethernet), Modbus (TCP), SNMP (agent)
RS-232 / RS-485	- / •
Profibus DP	-
Web server / e-mail	• / •
	IoT compatible, REST interface (‘machine to machine’)

Display and operation

	Operation via EM-FD 2500 Display / 5 LEDs on EM-PQ 2300
Article-No.	20-30240
Connections	
	Pin and socket strips
Mechanical construction	
Dimensions (W x H x D)	161.6 x 89.7 x 60.5 mm
Ingress protection	Enclosure /terminals: IP 30 / IP 20 according to EN 60529
Protection class	Class 1 according to EN 61140
Enclosure	Flame retardant V0 to UL94
Mounting	On standard 35 mm DIN rail to EN 50022
Weight	Approx. 0.5 kg
Operating conditions	
Ambient temperature	-20 °C...+60 °C
Article-No.	20-30241

Dimensions



Dimensional drawing EM-PQ 2300

All dimensions in mm

Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation



Discontinued model – only a limited number of items available. We would be very pleased to recommend an alternative.

EM-PQ 1500 M Power Quality Analyzer

Power Quality measurement system to detect, analyze and monitor electrical measurement variables in 400 V low voltage mains and medium voltage mains (100 V secondary).

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
- Different measurements over 10 periods (200 ms, see EN 61000-4-7), measuring range up to the 40th harmonic (distortion factor current/voltage, absolute value of harmonic current)
- 4 voltage and 3 current measurement inputs
- Bimetallic function
- Integrated alarm management with different output configurations: 2x contact outputs, display, LED
- Easily extendable to include up to 15 measurement units via 2 link connections (max. 40 m) for displaying all relevant data via the display EM-FD 1500
- 2 outputs: adjustable digital/analogue (digital, 4-20 mA/ alarm individually programmable)
- Connection to the FRAKO Energy Management System via FRAKO Starkstrombus (RS 485)
- Top hat rail mounting

Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation

Technical Data

Measurement inputs	
Voltage path	(Phase-Zero) 3 x 57 - 230 V AC +/- 10 % (Phase-Phase) 3 x 100 - 400 V AC +/- 10 %
Frequency	50 Hz
Power consumption	Max. 7 VA
Fuse protection	Max. 2 A external protection required
Current path	3x X/5A (transformer current >6 mA)
Power consumption	Max. 1.8 VA each transformer connection
Inputs	
Display IN	24 V DC, voltage input for display units with a 24 V control unit
Outputs	
Digital OUT	Max. 48 V DC, max 100 mA DC
Digital/Analogue OUT	Max. 30 V DC, max. 100 mA (DC 4-20 mA passive)
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
2 Link Connections	Connection to further EM-PQ 1500 (max. 15) to display on display unit EM-FD 1500 Type/ Protocol: CAN / FRAKO internal
Display	Connection to display unit EM-FD 1500
Mechanical construction	
Dimensions	160 x 102 x 67 mm (W x H x D)
Ingress protection	Housing / terminals IP 40 / IP 20
Version	According to DIN EN 61010-1, DIN EN 61000-6-2 and DIN EN 61000-6-3
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	0 °C up to +55 °C
Article-No.	20-30212

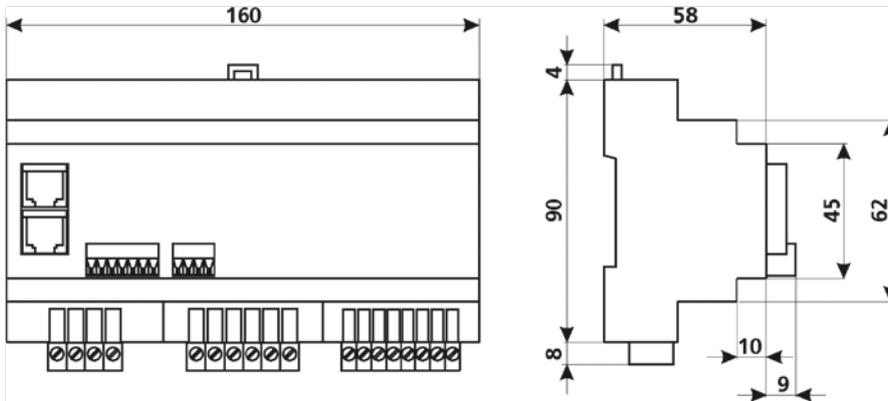
Optional Accessories

Article-No.	Type	Description
20-30233	Interface adapter EM-PQ-RS 232	RS-232 Adapter for PC direct access to the data of EM-PQ 1500, including display and configuration software EM-PQ-SW; Cable length: 3 m
20-10700	Mains adapter for Analogue Module EM-AM 24 V DC (can be used as well for EM-PQ 1500)	Switching power supply for DIN rail mounting 24 V DC / 0.35 A and 12 V DC / 20 mA; Mains power supply: 85 to 264 V AC
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, EMP 1100, EMT 1101 and EM-PQ-RS 232 adapter. Note: included with FRAKO-NET when supplied on CD-ROM

Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation

Dimensions



Dimensional drawing EM-PQ 1500 M

All dimensions in mm

Mains Monitoring

Mains Analysis Devices for DIN rail mounting or door installation



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
- $\cos \varphi$, active 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
- Overcurrent
- Voltage harmonics
- Current harmonics
- Temperatures PT1 and PT2
- 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

Mains Monitoring

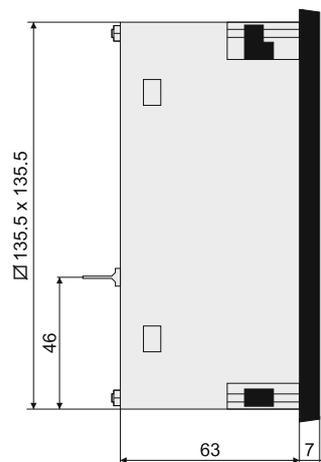
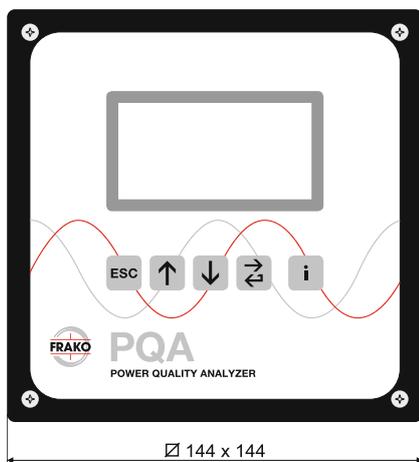
Mains Analysis Devices for DIN rail mounting or door installation

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)	
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

Dimensions



Dimensional Drawing PQA 1101

all dimensions in mm