



**The Power Quality
Controller – fit for the future**

PQC Power Quality Controller

The new universal control characteristic curve makes the FRAKO PQC even more flexible in use. It can be relied upon to optimize the power factor not only in classical correction systems but also in state-of-the-art decentralized power generation networks. In addition, the universal control curve ensures extremely efficient operation of the power factor correction system with minimized component wear. Continuous monitoring of system variables and control parameters means that critical situations are detected in good time. By means of selective switching, the PQC protects the installation against overloading, thus guaranteeing safe and reliable operation of the correction system.

The PQC Power Quality Controller adds powerful new functionality to the well-known strengths of the FRAKO Reactive Power Control Relays to meet the challenges posed by state-of-the-art power quality systems. With its built-in microprocessor, the PQC handles tasks over and above classical power factor correction. In particular, new protective mechanisms have been incorporated to safeguard not only the network itself but also the system that corrects its power factor. The PQC thus monitors the relevant parameters that can cause disruptions in the network, and gives alarms if they go beyond the limits set to ensure compliance with technical standards. In addition, the PQC also protects the power factor correction system responsible for the network, shutting it down if it becomes overloaded. This significantly reduces the risk of upsets occurring within that system. Defective or partially defective capacitor stages are identified and withdrawn from the power factor correction process. An extremely flexible alarm management function ensures that alarm messages are sent to where they are needed, as appropriate to the event concerned. The possibility of parameterizing each individual controller enables the PQC to be used anywhere, making it the best possible instrument for controlling power quality in contemporary industrial supply networks. The PQC is characterized by user-friendly features such as simple installation, intuitive operation and the auto-

matic start-up already known from FRAKO Reactive Power Control Relays. Its integrated self-monitoring function improves long-term operational reliability, thus helping to reduce costs and minimize the risk of network disruptions.

Key features

- 1- or 3-phase measurement
- 4-quadrant control
- 6 or 12 switching outputs + 1 alarm contact
- 5 parameterizable control curves
- Graphical user interface with plain text menu in choice of languages
- Integrated monitoring of system parameters with alarm management function
- Now also available with inductive and mixed inductive/capacitive control

Recommended applications

The PQC is suitable for 4-quadrant power factor correction in:

- Consumer networks
- Power generation networks
- Low and medium voltage networks
- Power factor correction systems with or without detuning

Components

Power Quality Controller

1

Instrument versions

The PQC is designed primarily for mounting in a 138 x 138 mm cutout in the front of a control panel. Different versions of the instrument can be selected to suit the required application. These differ essentially according to:

- Instrument power supply
- Number of measurement inputs
- Number and rating of switching outputs

Combinations of these parameters mean that 6 different basic types are available:

Instruments with 100–240 V, 50/60 Hz power supplies

Type	Measurement inputs	Switching outputs
PQC 1202401-0	1 V/I	12 x 250 V / 3 A
PQC 1202403-0	3 V/I	12 x 250 V / 3 A
PQC 0602401-0	1 V/I	6 x 250 V / 3 A

Instruments with 100–480 V, 50/60 Hz power supplies

Type	Measurement inputs	Switching outputs
PQC 1204801-0	1 V/I	12 x 250 V / 3 A
PQC 1204803-0	3 V/I	12 x 250 V / 3 A
PQC 0614801-0	1 V/I	6 x 440 V / 3 A

The inputs for the measured voltage are designed for 100–690 V networks, 50/60 Hz; those for the measured current are designed for use with x/1A or x/5A current transformers.

Operating the PQC

The PQC has a backlit monochrome LC display with 128 x 64 pixels, plus 5 keys for navigating the plain language (German, English, French, Spanish, Chinese) menu.



Overview screen

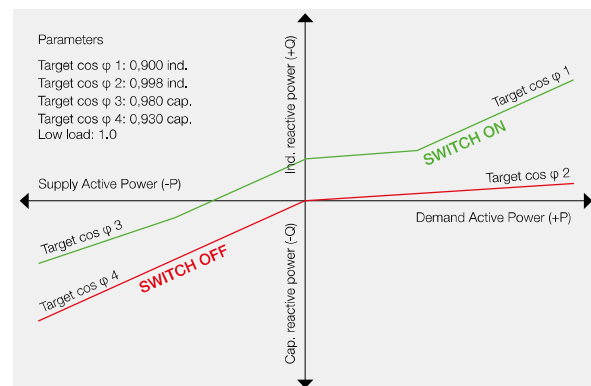


Stage Editor

The menu is structured in an intuitive way that makes it easy to parameterize the instrument. An overview of the controller in the display shows the key information for the individual phases together with the status of the switching outputs. The operator is thus given all relevant information on the state of the power factor correction system at a glance. An intelligent alarm management function alerts the operator to critical conditions, either by messages in the display, via the alarm contact, or both, as desired.

Consistently better

The new control characteristic curve with its increased control range has been shown to significantly reduce the number of switching cycles compared to earlier curves. This new universal curve gives the system flexibility in responding to the reactive power demands in both consumer and generator installations. Configuration of the upper and lower $\cos \varphi$ values enables the control characteristic to adapt to exactly comply with utility company specifications. Different control curves can be set for power draw and power feed-in conditions.



Precise, flexible and universal – Frako PQC

Profile switching for even more flexibility

The new universal characteristic curve boosts the versatility of the instrument, enabling it to meet additional challenges, particularly those posed by power factor correction in plants that generate electricity. An automatic switchover function – between up to 5 control profiles – is already integrated in the FRAKO PQC. Switching is prompted either by the active power or the measured voltage. If a Temp. I/O module is fitted, the profiles can also be switched by the digital input signals.

Commissioning the PQC

When first started up, the PQC automatically determines the system configuration to which it is connected plus the switching outputs in use with their respective capacitance ratings (in kvar). The operator selects the appropriate control profile for the application or parameterizes the PQC to meet the required specifications. Five control profiles—specially developed for the most frequently encountered applications—are saved in the instrument before it leaves the factory. On completion of the start-up procedure, the PQC switches the connected capacitor stages in or out according to the selected control curve.

Components

Power Quality Controller

1

Ready for the digital transformation

With the FRAKO PQC, you are prepared for the Internet of Things (IoT). Through the Ethernet interface, the PQC provides all measurement values and information from the compensation system. Standardized fieldbuses such as Modbus TCP and REST interface enable easy retrieval of information. But even in stand-alone operation, all measurement values and information can be accessed through the integrated web server. The visually integrated control diagram shows the user how the PQC has been configured and where the current operating point is located.

Features / Technical Data

Category	1-phase 12 stages	3-phase 12 stages	1-phase 6 stages	1-phase 12 stages	3-phase 12 stages	1-phase 6 stages
Type	PQC 1202401-0	PQC 1202403-0	PQC 0602401-0	PQC 1204801-0	PQC 1204803-0	PQC 0614801-0
Plain language selection	DE/EN/FR/ES/CN/IT					
Extended function option	• (**)					
Article No.	38-00400	38-00401	38-00402	38-00406	38-00407	38-00410
Voltage measurement	L-N / L-L					
Measured voltage [V]	100 - 690			100 - 690 ****		
Operating voltage [V]	100 - 240			100 - 480		
Network frequency [Hz]	50 / 60					
Currents measured	1	3	1	1	3	1
Min. response current [mA], manual programming	20					
Current transformer x/...A	1 - 5					
Connection type	Man/Auto	Man	Man/Auto	Man/Auto	Man	Man/Auto
Target cos φ (ind./cap.)	0.5 (ind.) - 0.5 (cap.)					
Resolution (target cos φ)	0.01					
Control characteristic curve setting	Variable					
Number of control curves	5					
Control selectable from Lx/Ly/Lz	• / - / -	• / • / •	• / - / -	• / - / -	• / • / •	• / - / -
Switching sequence	Man/Auto					
Determining number of active switching outputs	Man/Auto					
Number of fixed stages programmable	freely selectable (6/12)					
Relay switching contacts	12	12	6	12	12	6
Relay switching contact load rating	250 V / 750 VA					440 V / 1320 VA UL/CSA 3 A - 250 VAC / 30 VDC
Relay contact switching delay	Adjustable 5 - 500 s					
Effective relay contact switching delay	Optimized to match load changes					
Relay contact switched-off time (discharge time)	Adjustable 5 - 900 s					

Components

Power Quality Controller

1

Category	1-phase 12 stages	3-phase 12 stages	1-phase 6 stages	1-phase 12 stages	3-phase 12 stages	1-phase 6 stages
Type	PQC 1202401-0	PQC 1202403-0	PQC 0602401-0	PQC 1204801-0	PQC 1204803-0	PQC 0614801-0
Alarm function	Display / message / 1 volt-free NO contact					
Alarm switching contact load rating	250 V / 3 A					
Self-diagnosis	•					
Category	1-phase 12 stages	3-phase 12 stages	1-phase 6 stages	1-phase 12 stages	3-phase 12 stages	1-phase 6 stages
Type	PQC 1202401-0	PQC 1202403-0	PQC 0602401-0	PQC 1204801-0	PQC 1204803-0	PQC 0614801-0
Dimensions W x H x D [mm]	144 x 144 x 70					
Panel cutout dimensions [mm]	138 x 138					
Ingress protection, front	IP50 (IP54***)					
Ingress protection, rear	IP20					
Net weight [kg]	0.77					
Ambient Temperature	-25 °C to + 65 °C, No Condensation					
Maximum Installation Heigh	Maximum geographical installation height 2,000 m above sea level					
Display	Monochrome backlit display, 128 x 64 pixels					
Start-up Wizard	(stage editor)					
Measurement (frequency [kHz] / continuous)	12.5 / •					
Momentary cos φ	•					
Target cos φ	•					
Apparent current	•					
Capacitor current (overcurrent)	•					
Active [kW] / Reactive [kvar] / Apparent [kVA] power	• / • / •					
Corrective power still lacking (kvar)	•					
Capacitor power per stage	•					
Number of capacitor stages switched in	•					
Network voltage L-L [V]	•					
Harmonic voltage [%]	1 st –19 th 1 x manual spectrum analysis 0...2.5 kHz (°, °)					
Harmonic current [%]	1 st –19 th 1 x manual spectrum analysis 0...2.5 kHz (°, °)					
Switching cycles per stage	•					
Corrective power lacking (cos φ alarm)	Alarm (can be disabled)					
Defective capacitor stages	•					
Maximum number of switching cycles	Alarm					
Undervoltage	Alarm Shutdown					

Components

Power Quality Controller

1

Category	1-phase 12 stages	3-phase 12 stages	1-phase 6 stages	1-phase 12 stages	3-phase 12 stages	1-phase 6 stages
Type	PQC 1202401-0	PQC 1202403-0	PQC 0602401-0	PQC 1204801-0	PQC 1204803-0	PQC 0614801-0
Overcurrent	Alarm Shutdown (can be disabled)					
Undercurrent	Message Shutdown					
Harmonic voltage limits	Alarm Shutdown					
Thermal trip	• **					
Power failure detection	adjustable from 1/2 cycle to full cycle; de-energizes all active capacitor stages, automatically restarts when power resumes					
Stage monitoring	Monitoring of kvar loss per stage, adjustable 0...95 %					
Diagrammatic spectrum visualization	•					
Diagrammatic switching cycle visualization	•					
Diagrammatic stage power visualization	•					
Firmware function update	• *					

* possible with USB cable, ** see different PQC types, *** IP54 upgrade kit, **** UL 600 V AC

vi Advance indication for harmonics analysis, v 2,5 kHz ~ 50th harmonic (50 Hz) ~ 40th harmonic (60 Hz)

Different types:

Category	1-phase 12 stages	3-phase 12 stages	1-phase 6 stages	1-phase 12 stages (UL)	3-phase 12 stages (UL)	1-phase 6 stages (UL)
----------	----------------------	----------------------	---------------------	---------------------------	---------------------------	--------------------------

Modbus RTU (RS-485) interface:

Type	PQC 1202401-20	PQC 1202403-20	PQC 0602401-20	PQC 1204801-20	PQC 1204803-20	PQC 0614801-20
Article-No.	38-00404	38-00412	38-00417	38-00422	38-00427	38-00432

Temperature and I/O*

Type	PQC 1202401-01	PQC 1202403-01	PQC 0602401-01	PQC 1204801-01	PQC 1204803-01	PQC 0614801-01
Article-No.	38-00403	38-00411	38-00416	38-00421	38-00426	38-00431

Modbus TCP (IoT) interface*

Type	PQC 1202401-30	PQC 1202403-30	PQC 0602401-30
Article-No.	38-00408	38-00414	38-00419

Modbus RTU (RS-485) interface + temperature and I/O

Type	PQC 1202401-21	PQC 1202403-21	PQC 0602401-21
Article-No.	38-00405	38-00413	38-00418

Modbus TCP (IoT) interface + temperature and I/O

Type	PQC 1202401-31	PQC 1202403-31	PQC 0602401-31
Article-No.	38-00409	38-00415	38-00420

*Advanced temperature and I/O extension:

This option consists of 3 temperature measurement inputs, which can be wired with a PT100 or PT1000 and 2 NTC's. For each of the 3 temperature sensors connected, an individual threshold value can be set. 5 digital in- and outputs (I/O) are additionally available, which are individually configurable. The digital in- and outputs need an external supply voltage of 5 ... 24 V DC and can be loaded with 100 mA per output.

Application example:

- Fan control (temperature detection)
- Temperature monitoring
- Automatic switching of relay profiles 1 and 2 (only I/O 1)
- Individually configurable outputs (e.g. to a process control system (PLC)) for status indication and selected alarms