



PQC

Power Quality Controller

The reactive power control relay for maximum operational reliability with power quality monitoring

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 Defective or partially defective capacitor stages are identified and withdrawn from the power factor correction process.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 automatic 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

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

For further Power Factor Control Relays please see page 35

Components

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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, 50/60 Hz; those for the measured current are designed for use with x/1A or x/5A current transformers.

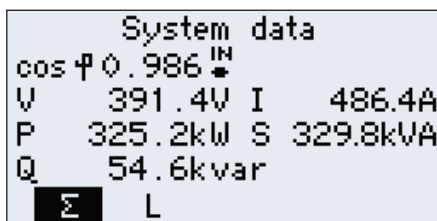
Operating the PQC

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

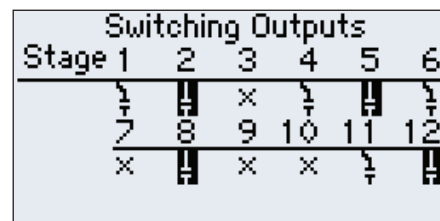
The menu is structured in an intuitive way that makes it easy to program the instrument. An overview of the controller in the display shows the key information for the individual phases together with the status of the switching outputs. The operator is thus given all relevant information on the state 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.

Commissioning the PQC

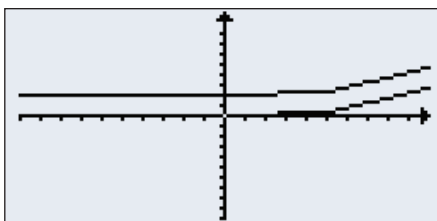
When first started up, the PQC automatically determines the system configuration to which it is connected plus the switching outputs in use with their respective capacitance ratings (in kvar). The operator selects the appropriate control profile for the application or parameterizes the PQC to meet the 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.



Network variables



Status switching outputs



Control diagram with real time control characteristic

Components

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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 (German/English/French) | • / • / • | | | | | |
| 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 | | | | | |
| Min. response current [mA], automatic identification | 20 | | | | | |
| Current transformer x/...A | 1 - 5 | | | | | |
| Connection type | Man/Auto | Man | Man/Auto | Man/Auto | Man | Man/Auto |
| Target cos phi (ind./cap.) | 0.800 (ind.) - 0.900 (cap.) | | | | | |
| Resolution (target cos phi) | 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 | 3 | | | | | |
| 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 | | | | | |
| Alarm function | Display / message / 1 volt-free NO contact | | | | | |
| Alarm switching contact load rating | 250 V / 3 A | | | | | |
| Self-diagnosis | • | | | | | |

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| 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 | | | | | |
| Display | Monochrome backlit display, 128 x 64 pixels | | | | | |
| Start-up Wizard | • | | | | | |
| Measurement (frequency [kHz] / continuous) | 12.5 / • | | | | | |
| Momentary cos phi | • | | | | | |
| Target cos phi | • | | | | | |
| 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 (v, v) | | | | | |
| Harmonic current [%] | 1 st –19 th 1 x manual spectrum analysis 0...2.5 kHz (v, v) | | | | | |
| Switching cycles per stage | • | | | | | |
| Corrective power lacking (cos phi alarm) | Alarm (can be disabled) | | | | | |
| Defective capacitor stages | • | | | | | |
| Maximum number of switching cycles | Alarm | | | | | |
| Undervoltage | Alarm Shutdown | | | | | |
| 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 | • | | | | | |

Components

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| 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 |
| Diagrammatic stage power visualization | • | | | | | |
| Control characteristic curve 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

*IoT (Internet of Things):

With this option, systems can be networked via the REST interface or the Modbus TCP/IP Ethernet protocol (RJ-45 connector). A web server with system parameters is also available.

Accessories:

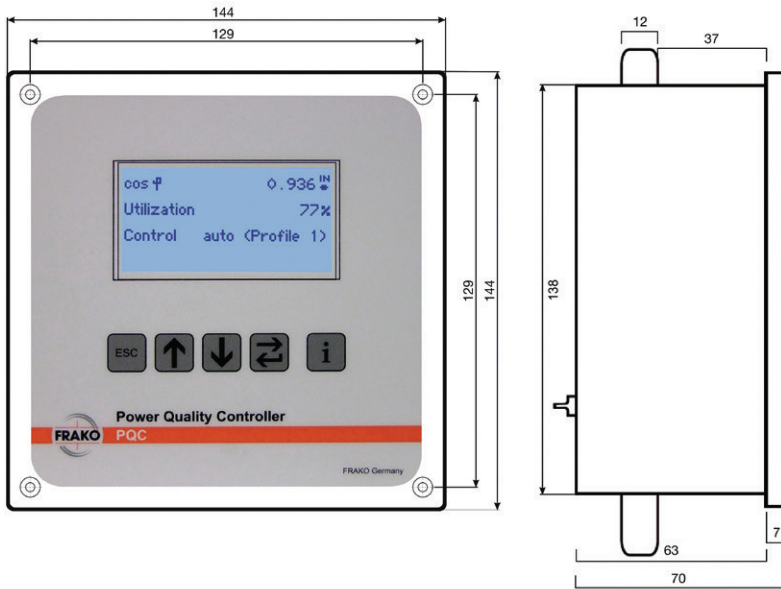
| | | |
|-------------|----------|-----------------------|
| Article-No. | 20-50015 | IP54 seal set for PQC |
|-------------|----------|-----------------------|

Components

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Dimensions

Dimensional drawing PQC



All dimensions in mm