

POWER FACTOR CONTROLLERS

The quality of power supply is an important criterion for safe operation of modern technical equipment. In this context, the functionality of installations for power factor correction and their control and safety features gain a special bearing. Power factor correction banks have the ability to improve power quality, but they can also cause substantial problems.

Modern power factor controllers are self-optimizing and determine the correct power of the capacitor steps within a few trial switchings. If the $\cos\varphi$ deviates from the programmed limits, the necessary capacitor power for compensation is calculated and a suitable output or a combination of outputs are switched, considering the situation of supply system and power factor correction equipment.

A state-of-the-art power factor controller must also be in a position to monitor all relevant data of equipment and supply system, to alarm in case of overload and, if required, to switch off the whole equipment or capacitor steps temporarily or permanently.

PFR
PFR-M



POWER FACTOR CONTROLLERS



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PFR-X⁺ **R / PFR-M **T

for latest edition and updates
check www.powercapacitors.info

BECAUSE EXCELLENT CAPACITORS ARE NOT ENOUGH

The plug'n'play power factor controllers of our PFR-series calculate the active and reactive power in the mains from the measured current and voltage. Their intelligent control algorithm optimizes the switching sequences and guarantees for short regulation times with a minimum number of switching cycles. At the same time, equal distribution of switchings for capacitors of equal size extends the lifetime of the capacitors. The integrated connection control immediately detects in which phases voltage and current are measured, and adapts the entire system automatically. The very low current threshold of 15 mA (PFR-M**T) / 5mA (PFR-X⁺ **R) allows for very reliable and exact PF control. 1A as well as 5A current transformers can be used without additional manual adjustments. The power supply of PFR-X⁺ covers a voltage range of 90...550V, the PFR-M supply is rated for a voltage range of 207-253V or 100-132V.

The rated mains voltage is the only value to be entered before commencing operation. The controller blocks operation to protect the capacitors if the tolerance of this voltage setting is exceeded during operation. All other relevant parameters have been preset by the manufacturer for immediate start of operation in nearly any common configuration. Individual adjustment and optimization of the control parameters is possible at any time, even during operation of the equipment.

Once connected, the size of capacitors or reactors is detected automatically. The lifecycles of the capacitors are determined by the degradation of capacitance, and a pre-failure alarm can be provided.

The controllers will operate correctly even if the value of the current transformer ratio has not been entered. Please note that in case of the PFR-X⁺, all display functions related to current measurements will be disabled.

Our controllers can monitor the temperature inside the capacitor cabinet with an integrated sensor. The temperature control can activate a fan connected to the related output relay (PFR-X⁺)/the digital output (PFR-M), or switch off the capacitors if necessary. External thermostats may be connected in parallel to the integrated temperature sensor (PFR-X⁺)/to the digital input (PFR-M) to monitor the temperature in other related cabinets.

For maintenance purposes, all capacitor outputs can be switched manually.

Display

The backlit LC-Display delivers information about the equipment and the mains conditions. Additionally, it facilitates the input of changes during commissioning and operation.

Reported mains conditions

PFR-X⁺: Voltage, current, active power, reactive power, apparent power, frequency, $\cos\phi$, ΔQ (power to be compensated), THD U, THD I, detailed voltage and current harmonics 3...19

PFR-M: Voltage, current, active power, reactive power, apparent power, frequency, $\cos\phi$, ΔQ (power to be compensated), counters, THD U, THD I, detailed voltage and current harmonics 3...19

Reported information on the equipment

Passed operation time (hours), number of switching cycles per capacitor output, max temperature in the equipment, average power factor, actual power per branch, actual percentage of originally installed reactive power. Moreover, the $\cos\phi$ and the status of the capacitor outputs are displayed permanently.



CE Conformity

The controller is declared to conform to the following European Directives:

2014/35/EU Low-Voltage Directive

2004/108/EG EMC directive

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Monitoring

The monitoring functions ensure long and reliable operation of the capacitor equipment:

- zero-voltage tripping to avoid contactor fibrillation
- overvoltage protection
- over-temperature protection
- harmonic monitoring of voltage and current
- detection of defect capacitors (with adjustable threshold value)
- alarm at under-compensation
- maintenance reminder
- fan control output (can also be used as additional capacitor output)
- overcurrent
- no current

PFR-M only:

- cosφ alarm
- frequency alarm
- overload Q
- overload P
- P export

Malfunctions and status signals of the equipment are indicated in the LC-Display. Malfunctions can also be transmitted through the isolated alarm relay (PFR-X⁺: N-O contact, PFR-M: S-P-D-T contact) or to the digital output (PFR-M only).

Special Features of PFR-M

- Transistor outputs for the operation with thyristor switches (dynamic compensation)
- Optionally available with relay outputs or as hybrid version (PFR-M 12RT) with 6 relay outputs for static loads and 6 transistor outputs for dynamic loads
- fast algorithm for dynamic thyristor operation (switching time ~20ms)
- Available with optional modbus communication
- Optional 3 Phase current measurement

Special Features of PFR-X⁺

- Guided setup through commissioning process of the controller
- Fan relay can be used as 7th or 13th step
- Step balancing (equal distribution of switching cycles) available based either on operation hours per step or on number of switching cycles.
- optional modbus communication
- Storage of the last 10 alarms
- Suppression of "I lo" alarms possible via digital input.

Modbus Option

The MODBUS extension offers the possibility to read values from the device and modify various settings.

The MODBUS-protocol doesn't restrict the user to one single physical transmission system. With the bus-capable RS485 interface, it is possible to connect more than one controller to a single pair of wires and access the units by use of an ID number.

Many commercial devices and PLCs are able to use the MODBUS protocol either as bus master or slave. Various SCADA solutions are also available from a variety of vendors. For this reason, the integration in a new or existing bus-system is only a minor issue.

Type	outputs	measurement	Order code
PFR-X ⁺ 06R	6 relays	1ph	11091.100-06.R
PFR-X ⁺ 12R	12 relays	1ph	11091.100-12.R
PFR-M 06T	6 transistors	1ph	11050.100-06.T
PFR-M 12T	12 transistors	1ph	11050.100-12.T
PFR-M 12RT	6 relays + 6 transistors	1ph	11050.100-12.H

Type Range

DATA CHART

General Technical Data

Feature	PFR-X ⁺	PFR-M
Operation voltage	90-550V rms, 45...65Hz, 5VA, 1ph	230V (optional 115V) rms, 45...65Hz
Measuring voltage	90-550V rms	50-530V rms
No of output relays	6, 12	6, 12
Output rating	250V AC / 5A 400V AC / 1A	8...32V DC Hybrid option also: 250V AC / 5A
Control algorithms	LIFO, FIFO, automatic (best fit), progressive	LIFO, automatic (best fit), combi-filter, progressive, fast
Digital input	90 ... 250V AC	90 ... 250V AC
Switching delay	adjustable 1s ... 6500s	≤ 20 ms
Display	LCD	graphic LCD
Operating elements	rubber buttons	foil keyboard
Measuring current	5mA ... 6A	15mA...6A
Adjustable transformer ratio	1...9600	1...6500
External Alarm contact	isolated relay, NC 48V DC / 1A 250V AC / 5A 400V AC / 1A	isolated relay, changeover contact
Terminals	multiple contact plug (2.5 mm ²)	multiple contact plug (2.5 mm ²)
Fuses	must be installed externally (see manual)	must installed externally (see manual)
Fan control	isolated relay, NC 48V DC / 1A 250V AC / 5A 400V AC / 1A	digital output (DO)
Interface	MODBUS RS485 (optional)	
Data Storage	Latest 10 alarms	-
Ambient temperature	-20°C ... 70°C	0°C ... 70°C
Storage temperature	-40°C...+85°C	-20°C ... +85°C
Humidity	0% ... 95% (no condensation)	
Temperature measurement	NTC	
Protection class	Front Back	IP50 (IP54 with special gasket) IP20
Pollution degree	3 (DIN VDE 0110, Pt 1 / IEC60664-1)	
Max. altitude	2000 m	
Mounting position	no restrictions	
Case	Front Back	plastic (UL94: V0), IP41 Metal, IP20
Dimensions H × W × D	144 × 144 × 58mm (window size 138 × 138mm)	
Weight	ca. 0.6 kg	
Standards	IEC/DIN EN 61010-1, 61000-6-2/-4 (level B) IEC/DIN EN 61326 UL 61010	
Approval marks	UL, c-UL	

ANNEX

