

# POWER FACTOR CONTROLLERS

## PFR-X \*\*R / PFR-M \*\*T



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### 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 switchings. 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 allows for very reliable and exact PF control. 1 A as well as 5 A current transformers can be used without additional manual adjustments. The power supply of PFR-X covers a voltage range of 90...550 V, the PFR-M supply is rated for a voltage range of 207-253 V; it can easily be modified to 100-132 V by a jumper setting.

The rated mains voltage is the only value to be entered before commencing operation. The controller blocks operation to protect the capacitors if the tolerances of this voltage setting are 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 life cycle of capacitors is monitored via 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.

PFR-M can monitor the temperature inside the capacitor cabinet by means of an integrated sensor. For PFR-X, the sensor comes as an optional part which can simply be plugged onto the back of the case. It can activate a fan connected to one of the output relays (PFR-X)/the digital output (PFR-M), or switch off the capacitors if required. External thermostats may be connected in parallel to the integrated temperature sensor (PFR-X)/to the digital input (PFR-M) for monitoring of the temperature in other related cabinets.

For maintenance purposes, all branches can be switched manually.

#### Display

The backlit LC-Display delivers information about the equipment itself and about the mains conditions. It is also necessary for the controller setup.

#### Reported mains conditions

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

**PFR-M:** Voltage, THD U, current, THD I, active power, reactive power, apparent power, frequency,  $\Delta Q$  (power to be compensated), detailed voltage and current harmonics 3...30,  $\cos\phi$ , counters

# POWER FACTOR CONTROLLERS

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### Reported information on the equipment

Passed operation time (hours), number of switchings per branch, max temperature in the equipment, average power factor, actual power per branch, actual percentage of originally installed branch power.  
The  $\cos\phi$  and status of branches are displayed permanently.

### 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 (PFR-M: voltage and current)
- detection of defect branches (with adjustable threshold value)
- alarm at under-compensation
- maintenance reminder
- fan control (using one of the branch outputs)
- overcurrent
- no current

PFR-M only:

- $\cos\phi$  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 compensations)
- 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 ~20 ms).
- Available with optional modbus communication
- Optional 3 phase current measurement

### Modbus Option

The MODBUS extension of the PFR-M offers the possibility to read values from, and modify the settings of, the device. The PFR-M can transmit up to 30 values. The MODBUS-protocol doesn't restrict the user to one single physical transmission system. With the bus-capable RS485 interface of the PFR-M, 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. So, the integration of the PFR-M in a new or existing bus-system is only a minor issue.

Type	outputs	measurement	Order code
PFR-X 06R	6 relays	1ph	11090.100-06.R
PFR-X 12R	12 relays	1ph	11090.100-12.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	90-550 V rms, 45...65 Hz, 5 VA, 1 ph	230 V (optional 115 V) rms, 45...65 Hz
Measuring voltage	90-550 V rms	50-530V rms
No of output relays	6, 12	6, 12
Output rating	250 V / 5 A	8 ... 32 V DC hybrid option: also 250 V / 5 A
Switching delay	1 s ... 6500 s	20 ms
Display	LCD	graphic LCD
Operating elements	rubber buttons	foil keyboard
Measuring current	15 mA ... 6 A	15 mA ... 6 A
Adjustable transformer ratio	1 ... 9600	1 ... 6500
External Alarm contact	isolated relay, closed contact	isolated relay, changeover contact
Terminals	multiple contact plug (2.5 mm <sup>2</sup> )	multiple contact plug (2.5 mm <sup>2</sup> )
Fuses	to be installed externally (see manual)	to be installed externally (see manual)
Fan control	through branch output	digital output (DO)
Interface	TTL (back)	MODBUS RS485 (optional)
Ambient temperature	-20°C ... 70°C	0°C ... 70°C
Storage temperature	-20°C ... +85°C	-20°C ... +85°C
Humidity	0 % ... 95 % (no condensation)	
Temperature measurement	NTC	
Protection class	IP50 (IP54 with special gasket)	
Front	IP20	
Back		
Pollution degree	3 (DIN VDE 0110, Pt 1 / IEC60664-1)	
Mounting position	no restrictions	
Case	plastic (UL94: V0)	
Front		
Back	metal	
Dimensions H × W × D	144 × 144 × 58 mm (window size 138 × 138 mm)	
Weight	ca. 0.6 kg	
Standards	DIN VDE 0110 1 (IEC 60664-1:1992) VDE 0411 1 (IEC/DIN EN 61010-1:2001) VDE 0843 20 (IEC/DIN EN 61326: 1997 + A1:1998 +A2: 2000) GOST 15150-69 UL 508 – Industrial Control Equipment CSA C22.2 No. 14-M95 - Industrial Control Equipment	
Approval marks	UL, Rostest, c-UL	



### 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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