

PFC power factor controllers

Automatic power factor correction controller series PFC 6, 8, 12 RS

DESCRIPTION

An essential way of electrical energy cost reduction is the compensation of the reactive power caused by various type of loads. The main part of central and group power factor correction in systems with a variable load is the power factor controller. A proper power factor controller and the correct design of PFC (Power factor correction) system are the key to the reduction of reactive energy costs. Nowadays, when four-quadrant energy meters are used, the right power factor controller is essential to achieve the highest efficiency of PFC system. Reliable, smart and advanced ETI controllers assure effective reduction of reactive energy and long working life of PFC systems.

MAIN ADVANTAGES

- Circular usage of steps: The controller switches all steps that have the same power circularly in order to use them equally and prolong their working life time.
- Fast action: Optimal regulation is achieved in one regulation cycle with a minimum number of switched stages. Since the controller knows the needed compensation power, it can connect or disconnect several steps in one cycle.

REGULATION METHODS:

The power factor controller digitalizes measured phase voltage and phase current in one or three phases. From these values the controller then calculates power factor, effective values of voltage, current and powers. On the basis of allowed reactive power, which is set as a requested power factor value, the controller calculates the requested compensation power. In accordance with its size and direction, the controller connects or disconnects the appropriate capacitor steps.

- APFR (average power factor regulation): The controller quantifies an average power factor from active and apparent power over a defined period. This method assures that the controller reacts smartly to load changes taking into account the size of load and $\cos \varphi$. Thanks to the APFR system, the power factor controller reduces the number of switching operations together with a precisely kept requested power factor result.
- SHTD: This method uses the deceleration of time to reaction according to the size of the difference between the target power factor and instantaneous value. For every second of difference the time to the reaction is reduced by the square of difference until 0 (the moment of reaction).
- Instantaneous power factor: This method reacts to every change of the instantaneous power factor by the connection or disconnection of the exact size of reactive power step. This method is mainly used for the dynamic power factor correction system based on thyristor switching modules.

Advantages:

- monitoring of U, I, P, Q, S, $\cos \varphi$, THDU, THDI, odd harmonics up to the 19th order, temperature
- three regulation methods (APFR default)
- small design 97 x 97 mm for pannel mounting, PFC 6 RS and PFC 8 RS
- automatic or manual configuration of measuring circuit connection (load must not vary during the auto-detection process).
- automatic or manual detection of connected capacitor steps
- universal current transformer input $\dots/1A$ and $\dots/5A$
- internal temperature sensor
- temperature levels for ventilator control and steps disconnection
- ready for applications with de-compensation reactor steps
- monitoring of switching operations and operation time
- setting of discharging and min. operation time for each step
- memory for min. and max. values
- discharging time and min. operation time setting for each step
- last step output programmable for alarm purposes
- second tariff activation by external input, PFC 12 RS only
- programmable alarms and independent alarm output at PFC 12 RS only

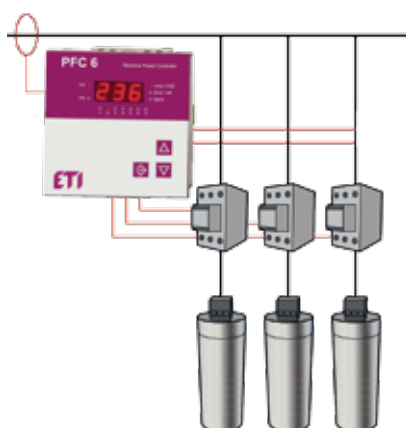
Controllers for compensation of 3 phase balanced loads (single phase current measurement)



Power factor controllers PFC 6 (6 outputs), PFC 8 (8 outputs) and PFC 12 (12 outputs) are designed for usage in standard LV and MV power factor correction applications operated by mechanical contactors. Despite the small size of power factor controllers, they offer four quadrant measurement and regulation, automatic detection of measuring circuits and capacitor steps, high sensitivity, reliability and design for the hardest conditions.

Technical data

| | |
|--|--|
| Supply and measuring voltage | 400 VAC (+10%, -15%) |
| System frequency | 50 Hz / 60 Hz |
| Power consumption | <3,2 VA |
| Current range | 5mA - 6A |
| Current input accuracy | ± 0,2% |
| Voltage input accuracy | ± 0,5% |
| THD _U and THD _I accuracy | (U>10%UN) ±5% / (I>10%IN) ±5% |
| Phase error for I>3%I _N | ± 3° (otherwise ±1°) |
| Switching power of relay output | 250 V AC / 5 A |
| Range of requested power factor | 0.8 inductive ÷ 0.8 capacitive |
| Step reconnection delay | 5 ÷ 900 s |
| Step disconnection delay | 5 ÷ 900 s |
| Step power setting | 999 kVAr inductive ÷ 999 kVAr capacitive |
| System connection detection | manual / automatic |
| Communication interface | RS485 (Modbus RTU) |
| Working temperature | -40°C ÷ +70°C |
| IP rating | IP20 rear, IP54 front panel |
| Site depth | 55mm |
| Related norms | EN 61010-1, EN50081-1, EN50082-1 |



| Type | Code No. | Rated voltage Un | Description | Communication module | Weight (kg) | Packaging (pcs) |
|-----------|-----------|--------------------------|-------------------------------------|----------------------|-------------|-----------------|
| PFC 6 RS | 004656905 | 400 V AC (+10%, -15%) | Single phase current measurement | RS485 | 0,65 | 1 |
| PFC 8 RS | 004656906 | | | | 0,65 | 1 |
| PFC 12 RS | 004656907 | | | | 1,2 | 1 |

Technical data

| Type | Number of steps | Measuring and supply voltage | LED segment display | Tariff input | Alarm output | Last step alarm output | 3-ph current measurement | RS 485 communication module | Front panel dimension | Panel cutout |
|-----------|-----------------|------------------------------|---------------------|--------------|--------------|------------------------|--------------------------|-----------------------------|-----------------------|--------------|
| PFC 6 RS | 6 | 400V AC | ✓ | | | • | | • | 97x97mm | 91x91mm |
| PFC 8 RS | 8 | | | | | • | | • | 97x97mm | 91x91mm |
| PFC 12 RS | 12 | | | • | • | | | • | 144x144mm | 138x138mm |

Over temperature control

The controller offers the possibility of the temperature alarm working in two levels. The first level starts the ventilation of the cabinet. The second level disconnects all steps and gives an alarm notification on the display.

Symbol menu

Every parameter in the monitoring and service menu is represented by a three or four character symbol. Symbols are logical and assure user friendly experience and an easy understanding of all parameters and measured values shown on the segment display.

Dichromatic LED indication

Each step of the controller has an operation status indicated by a dichromatic LED. Different colours and logical signalization identify the operation status and settings of each step.

Last step alarm output PFC 6 RS, PFC 8 RS

The last step normally functions as a standard compensation step. Nevertheless it can be removed from the regulation algorithm and enabled for alarm purposes. The configuration of the last step operated as an alarm output is easily done in the setup menu.

RS485 interface

The power factor controllers are equipped with the RS485 communication interface with communication protocol Modbus RTU.

Harmonics measurement

The controllers offer a wide range of monitoring features which are enlarged by THDU, THDI and also the particular odd harmonics of U and I up to the 19th order.

De-compensation

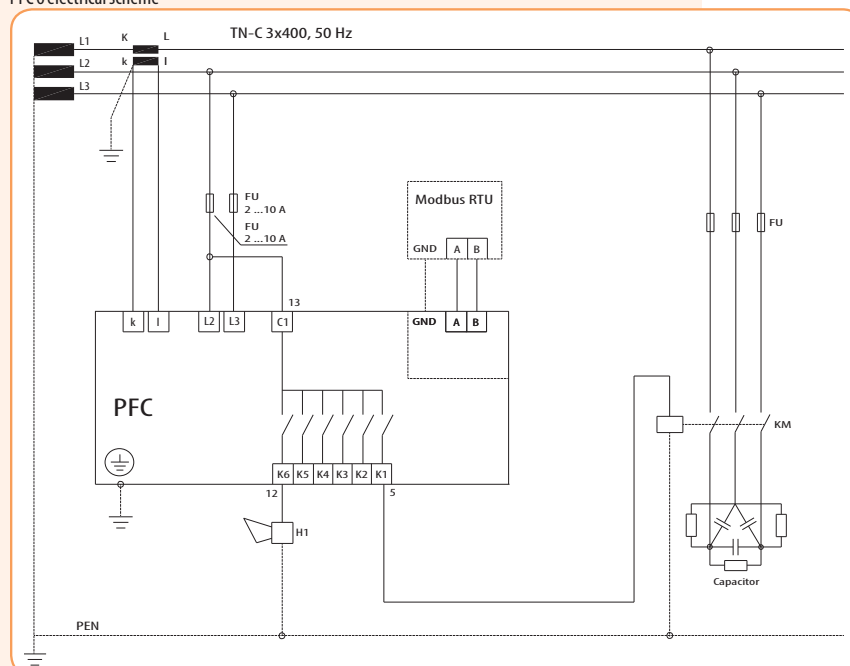
The controllers have features for smart decompensation with several reactor steps operated in a similar way as capacitor steps or only one reactor that is tuned by capacitor steps.

Tariff input, PFC 12 RS

The power factor controller has an input for the second tariff of $\cos \varphi$. The value of the second tariff $\cos \varphi$ can be defined in the controller's service menu. Applying the signal to input activates the second tariff of $\cos \varphi$.

Wiring diagrams of automatic PFC system

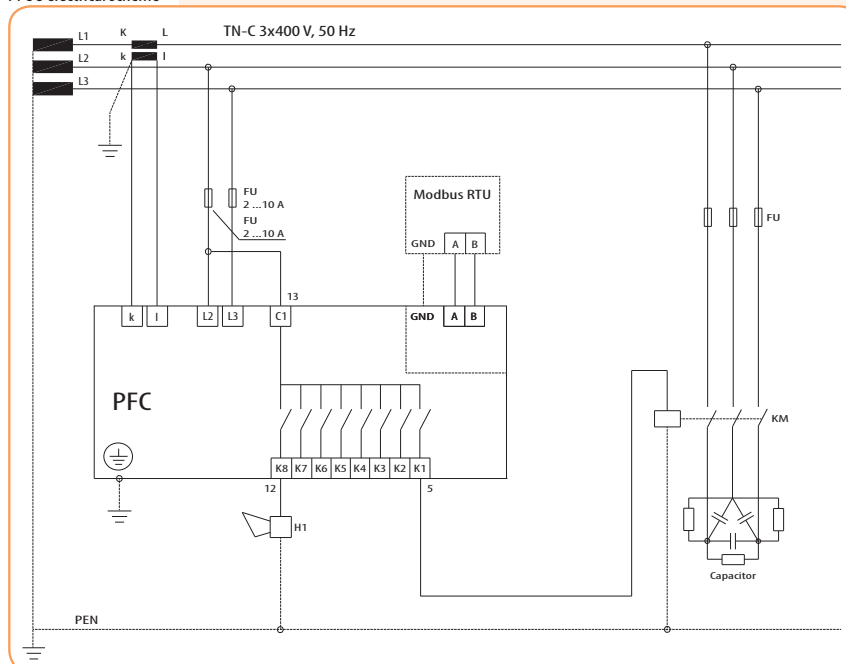
PFC6 electrical scheme



*Capacitor steps with the same power have to be connected next to each other (no different values between).

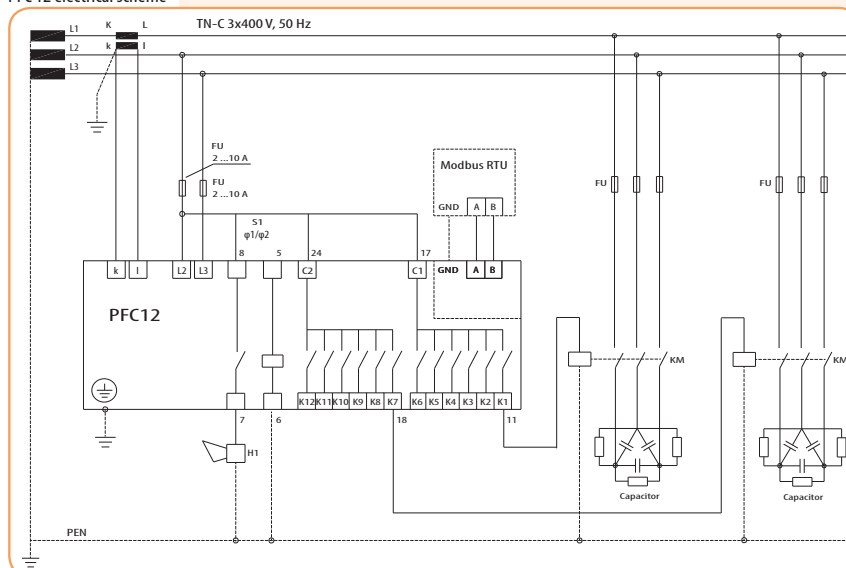
**Before current circuit disconnection make short-out of CT.

PFC 8 electrical scheme



*Capacitor steps with the same power have to be connected next to each other (no different values between).
 **Before current circuit disconnection make short-out of CT.

PFC 12 electrical scheme



*Capacitor steps with the same power have to be connected next to each other (no different values between).
 **Before current circuit disconnection make short-out of CT.

Position of controller

