

EPF8T – EPF12T

Automatic power factor regulator

DESCRIPTION

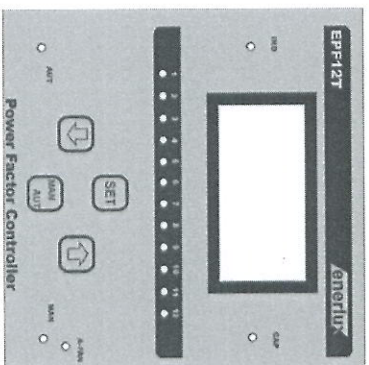
The power factor regulator has been designed with a signal processing technology assuring an accurate control of all the electrical parameters of the user's circuit as: voltage, current, cosφ, THD % in the current, ambient temperature at sound side, active- reactive and apparent power, max. values assumed by the measurements, and through a reliable calculation algorithm optimizes the use of capacitors and contactors considering also the harmonic distortion phenomena of industrial supply. Using also digital filtering of signals, the regulator is able to separate the current and voltage fundamental sinusoidal components from the others, on which phase displacement is measured.

The regulator is able to display in the mean time all the measurements of the channels set on the backlight LCD display to assure a simple data reading in every environmental condition.

Due to this feature to display clear alpha-numeric text concerning the electrical measurements and alarm messages, it permits a simple use for every user.

Four keys allow access to the regulation of the device, manual switching in of the various steps, reading measurements and alarms.

Further, in the series with the specific software, is possible to have also alarm personalization with setting of tripping thresholds and detailed operation information, such as number of switchings of each step, blocking of each step operation (used as fixed power factor correction), testing of the installation with printing report.



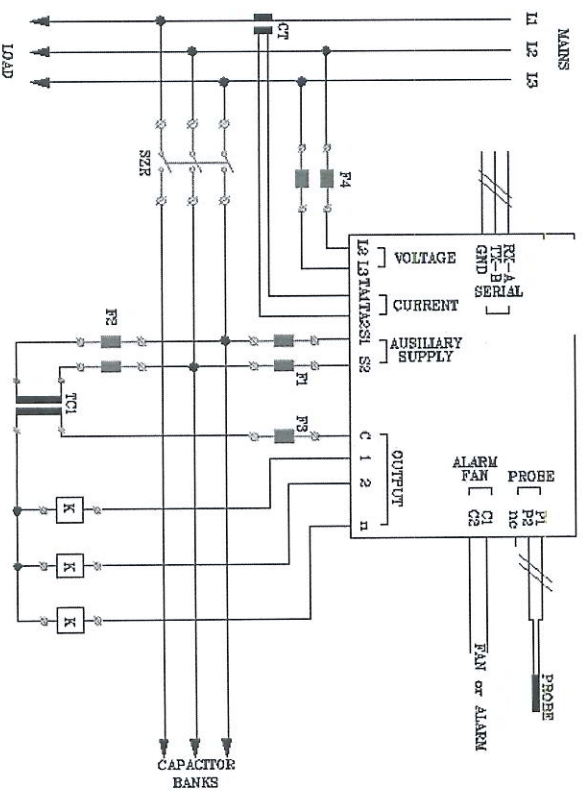
INSTALLATION

The power factor regulator must be installed on a three-phase or single-phase network with an insertion in quadrature and network frequency of 50-60 Hz through a CT for the line current (L1), supplied between the terminals L1 and L on the base of the rated values and through the remaining phases (L2-L3), given the voltmetering references.

The mains inputs must be protected by suitably designed fuses complying with the current standards and the foreseen absorptions. The control outputs must be suitably connected to their tripping devices that must be also protected as all the other power parts of the installation.

The control contacts for the steps are NO with the common C connected, while the alarm contact can be set as NO-NC-independent FAN.

Depending on the power factor regulator model, there are terminals for series connection and terminals for the temperature threshold.



SETTING THE PARAMETERS

The regulator has two types of menu: basic (PAR SET UP) and advanced (MAIN SETUP). To move among the setting parameters of the menus you should press the SET key and to change the values press the keys UP \uparrow or DOWN \downarrow .

*The first menu is easy accessible and permits setting the parameters strictly necessary to final installation at user's, that is to say, CT, SENS, OVER Temperature, THERM THD I%, OVER THD I%, SENS THD I, SENS DOWN. To access this menu keep pushed the SET key in manual operation and with all the steps switched off in the page of POWER FACTOR displaying, till the PAR SETUP is displayed.

The settings that must be made in this menu are:

- PAR TA=> Setting of the ratio of the amperometric transformer connected to the line.
- SENS=> Setting of tripping sensivity for each step on cos ϕ setting
- OVER TEMP=> Setting of operation max. temperature above which the alarm trips and the inserted steps are disconnected.
- THERM THD I%=> Setting of the thermal protection THD% current alarm above which, on the base of SENS THD% time, the inserted steps are sequentially disconnected.
- OVER THD I%=> Setting of the instantaneous TDH% current alarm tripping: in the moment we have this situation, resonance conditions, the inserted steps are disconnected.

SENS THD I%=> Setting of tripping time of THD% current alarm.

SENS DOWN=> Setting of the operation restoration after alarm stopping (if it is set as ON, when the alarm stops, it permits instantaneously steps switching in, while if it is set as OFF it reverses the SENS THD remaining time till the switch in of the steps could be made). To modify it, press and keep pushed SET and UP \uparrow or DOWN \downarrow keys.

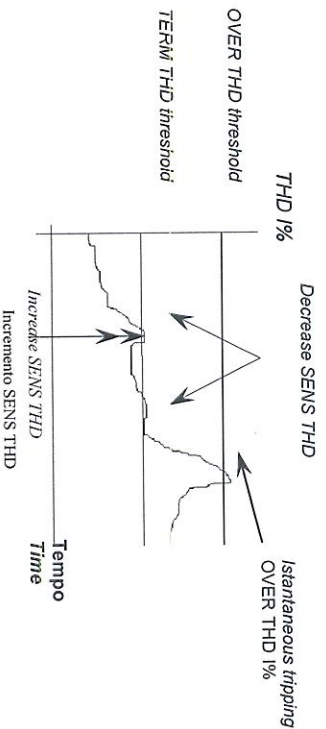
NOTE: The setting of tripping Sensivity (SENS) for each step is made by setting its tripping value, compatible with the re-connecting times (RC TIME); we can deduce that smaller is the set value quicker will be the setting of power factor.

The setting of THERM THD I% parameter is strictly connected to the technical characteristics of capacitor that is installed in the equipment; thus, verify the data given by the manufacturer for what concern capacitor withstand of harmonic current content (ie. 50% for 60 sec).

DETAILS ON THD PROTECTION OPERATION

The internal algorithm of the device reads constantly the harmonic current distortion flow at the point of amperometric transformer installation. If the instantaneous THD is higher than the set threshold TERM, the system progressively decrease the SENS value with pitch 1 following an integral logic till arriving to 0 value, at which the inserted steps are sequentially disconnected. The new switching in of the various steps could be made only if THD values are reach a value under the set THERM threshold. In case the instantaneous THD value is variable and close to the THERM threshold, the device makes a decrease during the time in which instantaneous THD is higher than the threshold, and an increase, till the max. setting of the initial SENS, in case the THD value returns under the control threshold. This algorithm permits to simulate a heating of the capacitor due to harmonics, and subsequently the disconnection of the steps if the situation continues to be the same, avoiding in this way dangerous hunting and protecting in this way the capacitors.

However, if you need a system that re-switches in immediately the various steps when instantaneous THD value is under the threshold you have to set the SENS DOWN parameter as ON.



* The second menu is used for configuring the parameters strictly connected to the PFC equipment i.e., type of steps, capacitor rated voltage, re-connecting time of steps, mains frequency, type of electric system (three-phase or single-phase) and configuration of the alarm relay (NO or NC).

To access the MAIN SETUP enter the base Setup keeping pushed the SET key in manual operation and with all the steps switched off in the page of POWER FACTOR displaying, until PAR SETUP is displayed, then push again SET key until the text MAIN SETUP appears.

The settings that must be made in this menu are:

POWER CAP n°=> setting of the step power rated value installed at the indicated position (indicated in kvar at the rated voltage)

CAP VOLTAGE=> setting of the rated value of the installed steps (supplied by the manufacturer)

CAP RC TIME=> minimum re-connection time of the same step on the base of the capacitor discharge devices

EXTERNAL TV=> setting of voltmetric input configuration with a voltage transformer on the external line: if it exists set the transformer primary and secondary values
LINE FREQ=> Line frequency (50 or 60 Hz)
LINE TYPE=> Insertion type (Single-phase or three-phase)
SYSTEM MODE=> setting of device installation on installations to measure 2 or 4 quadrants

OPERATION

Once the SETUP procedure is completed the display shows the current $\cos\phi$ value actually calculated in the plant, the mains voltage, current measured on the CT (true RMS), Δ kVAr deficit to reach the set $\cos\phi$ value (both capacitive or inductive).
Note: in case of visualization of an instable POWER FACTOR, the connections at the terminal KL of the amperometric input must be inverted.
Keeping pushed the SET key you could read and display the various pages at the following sequence:

MAIN-THD-FAN-SET $\cos\phi$ -POWER-MAX(line) -MAX (power)

MAIN=> Displaying of all installation values: $\cos\phi$ as phase-displacement angle between voltage and current on the fundamental, true RMS voltage, true RMS current, Delta Power intended as excessive or defective reactive power value compared with the set $\cos\phi$
THD=> Displaying of THD% current, fundamental current (fundamental assumed value) and harmonic current (harmonic residual), average weekly $\cos\phi$.
FAN=> Displaying of the temperature measured by the sound and setting of the threshold to start ventilation (if it is enabled)
SET $\cos\phi$ => Setting of $\cos\phi$ regulation value in automatic operation (this parameter is modifiable only if the system is in manual operation)
POWER=> Displaying of active, reactive apparent power
MAX(line) => max. values assumed by the sizes measured under control
MAX(power) => max. values assumed by the sizes measured under power

To reset the recordings of the maximum measured values press the UP \uparrow key and confirm resetting with DOWN \downarrow key.

After 30 sec of choosen parameter visualization, the display returns to the main page visualization.

To switch in or switch off the various steps you should firstly select MANUAL operation, then go to the main page; then push the UP \uparrow and DOWN \downarrow keys to select the step, then press SET to confirm selection. To verify that the selected step is the one that must be switched-in or switched-off the display shows its value expressed in kVAr set in the Setup.
In the subsequently displaying the total switchings in of each step are reported; in this way an evaluation of the state of wear of capacitors and contactors could be made (this is not a resettable value because it shows the wear state of the system).
The manual switching-in of the various steps stops the automatic regulation, but permits to display all measurements and alarms.
In case there would be an interruption of mains voltage interruption, the status of the various steps in manual operation is memorized in the internal memory not by the volatile one; this operation permits to the regulator to reconnect the same steps that had been manually connected ones mains is restored.

To switch from Manual to Automatic operation mode or reverts, press the MAN/AUT key for 5 sec. The corresponding LED consequently will light.

Enabling the mode EXTERNAL TV the device permits to set the parameters of voltage transformation values (primary and secondary values of the transformer). In this way is possible to set the rated values of the various steps keeping directly them to the line on which capacitors are installed and by which they are supplied.
The displaying of the voltage depends on the parameter setting, so if a different configuration is set, the voltage displaying will be proportional to the setting.

NOTE: as default the device is set as direct supply.

With automatic operations all the settings are in a complete tuning with the set parameters switching in and/or disconnecting off the various power factor correction steps to reach the set $\cos\phi$ value.
The software of the regulator permits to display and eventually communicate the alarms as:

HIGH VOLTAGE – Line voltage exceeding 110% the rated voltage for 15 min. long; tripping of alarm relay;

LOW VOLTAGE – Line voltage less than 85% the rated voltage for 5 sec. long; tripping of alarm relay;

HIGH CURRENT – Current exceeding 110% the rated value for 2 min. long;

LOW CURRENT – Current is lower than 8% of rated value for 5 sec. long (no switching in or switching off if the alarm persists for a time exceeding 2 minutes).

UNDER COMPENSATION – Under compensation $\cos\phi$ for 15 min. long; tripping of alarm relay;

OVER COMPENSATION – Over compensation $\cos\phi$ for 2 min. long (Switching off of the various steps to safeguard the integrity of the capacitors); tripping of alarm relay

HIGH THD% - Percentage of harmonic distortion higher than the set threshold limit; alarm relay tripping and sequently switching off of the switched in steps.

OVER THD% - Instantaneous max. percentage of harmonic distortion higher than the set threshold limit; alarm relay tripping and sequentially switching off of the switched in steps.

OVER TEMPERATURE – Sound side temperature higher than the maximum set value; tripping of alarm relay and sequentially switching off of the switched in steps.

MAIN FAILURE: No network voltage or voltage lower than the min. value of the system on the voltmetric input.

In case of an alarm its reference relay is activated (NO/NC): it has a re-entering logic when the alarm finishes

TECHNICAL FEATURES

Power supply: 380-415 V a.c. 220÷240 V ac and 415÷440 V ac on request

Network frequency: 50/60 Hz

Absorption: 5VA

Voltmetric input: 80 - 525 V

Amperometric input: 2.5 – 110% In

Operation: 2 or 4 quadrants could be set

Power factor regulation: 0.85 Ind a 0.95 Cap

Measurements: Voltage, Current, Cosφ, THD I%, Temperature

Display: 16 types with 4 backlight lines

Led: Output relay: MAN/OUT, Ind-Cap; FAN

Batteries relay output: 8(EPPF8T) - 12(EPPF12T)

Alarm relay output: 1

Max current on switching contacts 8A 250V (AC¹), max switching 440V

Terminal board: standard extractible

Operation temperature: -20° C + 60° C

Frontal degree of protection: IP41; IP54 on request

WARRANTY

The product is guaranteed for 24 months starting from the date of installation, with reference to the purchase document. The firm declines every responsibility on eventual damages that could directly or not directly derived to persons, things and animals consequently to an undue observation of all prescriptions indicated in the instruction manual.

REFERENCE STANDARDS

This regulator is in conformity with the following standards:

European Directives:

CEE 73/23 e 93/68 (Low voltage)

CEE 89/336 e 93/68 (EMC)

Reference standards:

EN 50081; EN 61000-6-2; EN 60240-1

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