# TECHNICAL MANUAL OF INSTALLATION

## EPFC-96 EPFC-144



## INDEX





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## *1 - BUTTONS AND INDICATION LED's:*

### 1.1 Indication Leds

IND - Inductive load.

CAP - Capacitive load.

TEMP - Temperature surround the controller (internal temperature sensor).

MAN - Manual operation mode selected of the outputs relays.

AUT - Automatic operation mode selected of the outputs relays.

VOLTAGE - Mains Input voltage of phase.

CURRENT - Load current of phase.

ΔKvar - kvar missing to achieve the Cosφ adjustament for the installation.

COSφ - Cosφ setting for the installation.

THD% - Total harmonic distortion of current in %.

SENS. - On delay timer to switch the capacitors bank.

### 1.2 Buttons :

MAN/AUT - Button selection for the operation mode , Manual or Automatic operation.

MODE - Button to advance on the Measurements menu or to enter the Menu.

<- - Button to decrease the value.

-> - Button operation to increase the set value

## *2 - DESCRIPTION:*

Control and digital Cosφ regulation device with accurate and reliable Cosφ readings, except possible errors deriving from aging of electronic components.
Thanks to particular devices and algorithms, the instrument, controls even electric lines with an high harmonic content.
Calculating reactive power, It allows to intervene in an aimed and timely way to connect the capacitor banks, which permits the best utilization of them both in the number of operations and in the equal rating of the capacitor banks.

## *3 - OPERATION:*

**> Device model:**
At the switching on, for one second, it's displayed the type of device in the following way.

| BOX | Model Type | Display Led | Steps |
|---|---|---|---|
| 96x96 | EPFC-96 | 00.4 | 04 |
| 96x96 | EPFC-96 | 00.6 | 06 |
| 144x144 | EPFC-144 | 00.4 | 04 |
| 144x144 | EPFC-144 | 00.6 | 06 |
| 144x144 | EPFC-144 | 00.8 | 08 |
| 144x144 | EPFC-144 | 0. 12 | 12 |

**> Output steps switching on test:**
The parameters P.01 to P.05 must be programmed first (5.1 - Basic Set-up Menu).



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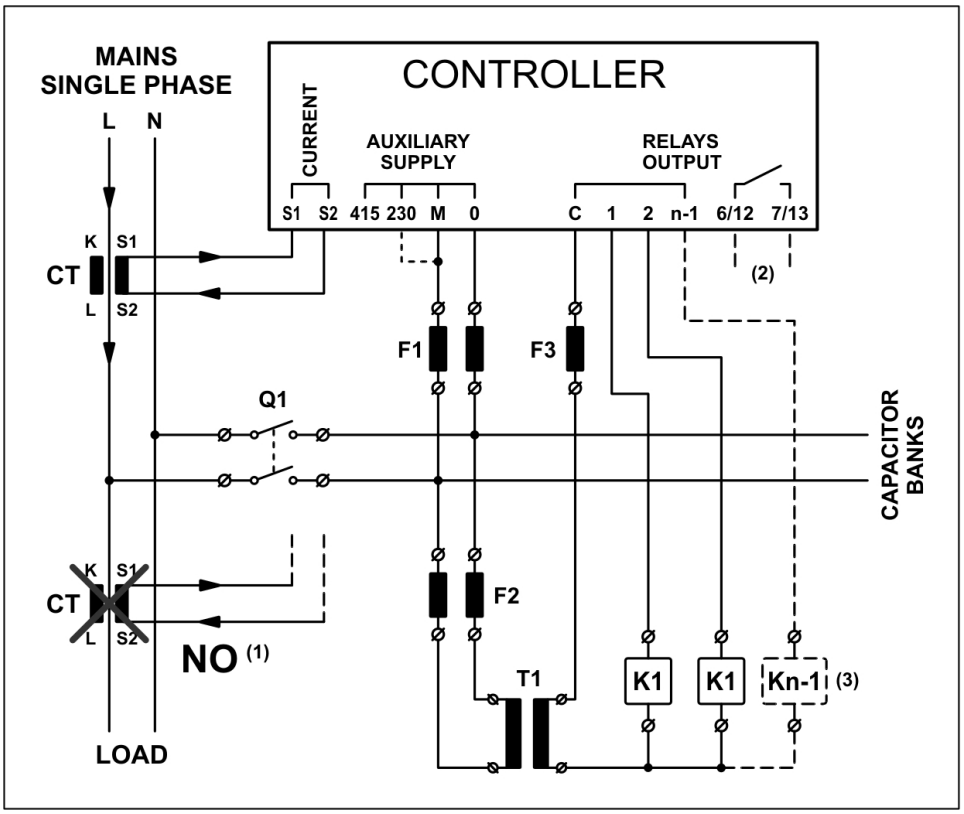
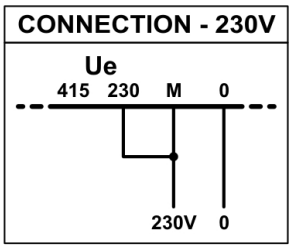
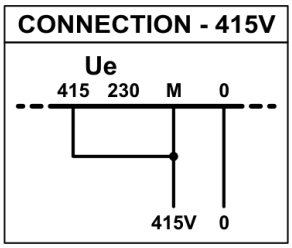
Pressing button  or  the respective outputs and the LED will be activated, letting you test the connections.

## *4 - ELECTRICAL DIAGRAM FOR INSTALLATION:*

**Mono-Phase Wiring Diagram:**




**Three-Phase Wiring Diagram:**



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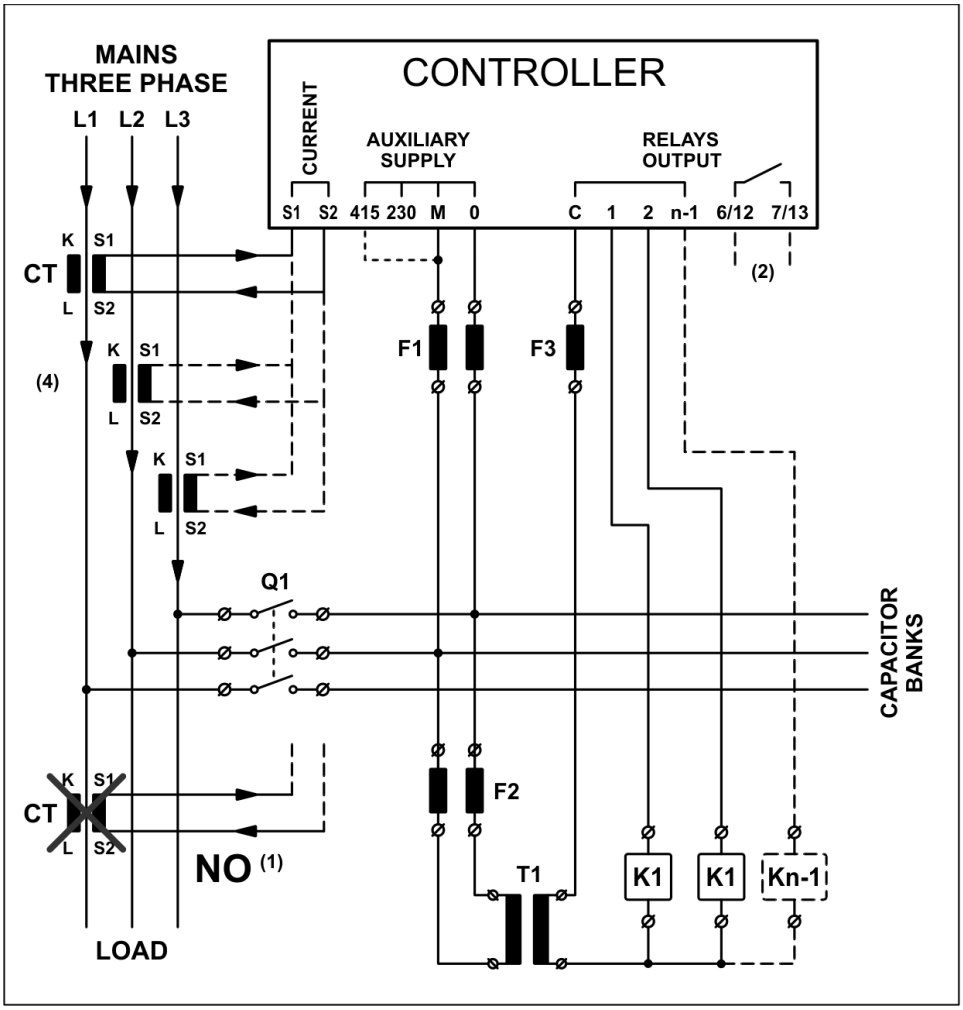


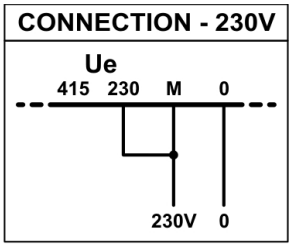


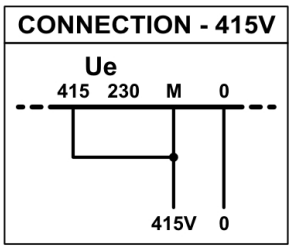


**NOTE:**

**The auxiliary transformer T1 is used for:**
- Isolated the auxiliary circuit for the controller from the mains circuit.
- Coil voltage of the contactors are different from the mains voltage network.

**(1)** On the wrong connection, the Cosφ measured remain constant when we switch on the capacitors.
It is necessary to change the connection of CT before the connection of voltage signal and on one phase.

**(2)** Last step contact (not present for EPFC-96 model).

**(3)** See Basic Set-up Menu P.05 notes (5.1).

**(4)** Setting sense of CT current in Advance Set-up Menu (5.2):

| Parameter | CT | Phase Displacement VI with Cosφ = 1 | CT - Phase Connection |
|---|---|---|---|
| A.02 = 1 | Direct | 90° | Current L1 – Power Supply L3-L2<br>*The Current phase is different to power supply phases* |
| A.02 = 2 | Inverse | 270° | |
| A.02 = 3 | Direct | 30° | Current L2 – Power Supply L3-L2<br>*The Current phase is coincident to an power supply phase* |
| A.02 = 4 | Inverse | 210° | |
| A.02 = 5 | Direct | 150° | Current L3 – Power Supply L3-L2<br>*The Current phase is coincident to an power supply phase* |
| A.02 = 6 | Inverse | 330° | |



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## 5 - SET-UP MENU:

### 5.1 TO ENTER THE BASIC SET-UP MENU:

a) The controller must be set on MANUAL operation and all capacitors must be OFF.

b) Press the button MODE for 5 seconds.

c) The display will show SEt

d) The Led MAN and AUT will flash with intermittent of 500ms.

e) Press the button MODE to show the parameters value P.01

f) Press the button → to increase or the button ← to decrease the value set.

g) Press the button MODE to advance to the next parameter programmed, press again to show the parameter value.

h) Press the button MAN/AUT to return on the parameter programmed.

i) Proceed and program all parameters until the last P.05

l) Press the button MODE to save all data, on display will shows SAU and exit the Basic set-up Menu.
All Led´s will light for a few seconds.

j) If the display shows Err, it means that an error has happened and was not possible to save the data.
Therefore it will be necessary to program again all the parameters on the Basic set-up menu.

**Basic Set-up Menu:**

| PARAMETER | DESCRIPTION | RANGE | DEFAULT |
|---|---|---|---|
| P.01 | Primary current transformer.<br>**The first dot on the display flashes to indicate the thousands of Ampere.** | 5 … 10000 | 5 |
| P.02 | Rated power (nameplate) in kvar of the smallest capacitor bank. | 0.10 … 300 | 1.00 |
| P.03 | Rated capacitor voltage (nameplate) in volts. | 80 … 750 | 400 |
| P.04 | Reconnection time of the same step in seconds. (Capacitor discharge time) | 1 … 600 | 30 |
| P.05 (LED 1) | Step 1 VAR | 0 … 300000 | 0 |
| P.05 (LED 2) | Step 2 VAR | 0 … 300000 | 0 |
| P.05 (LED X) | Follow the same programming as above, except for the last TWO steps. | 0 … 300000 | 0 |
| P.05 (LED N-1) | Programming of the last before last step. VAR or external fan **(a)** | 0 ... 300000<br>FAn | 0 |
| P.05 (LED N)<br>**(b)** | Programming of the last step. VAR or alarm output **(c)** | 0 ... 300000<br>noA - ncA | 0 |

**(a) External fan:** press the button ← until the display shows FAn
The temperature operation control should be set on the Advance Menu A.11 and A.12

**(b) Last step:** it can be 04/06/08/12 depending on the version (not present for EPFC04A model).

**(c) Alarm output:** when the display shows 000, pressing the ← key appears the lettering ncA (normal close alarm) which means the alarm relay normally energized that is closed contact in the absence of alarm.
Pressing again, the function is inverted and display show noA



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**5.2 TO ENTER THE ADVANCE MENU:**

a) The controller must be set on MANUAL operation and all capacitors must be OFF.

b) Press the button MODE for 5 seconds.

c) The display will show SEt

d) The Led MAN and AUT will flash with Intermittent of 500 ms.

e) Press both buttons together ← and → for 2 seconds until the display shows A.01

f) Press the button MODE to show the parameters value A.01

g) Press the button → to increase or the button ← to decrease the value set.

h) Press the button MODE to advance to the next parameter programmed, press again to show the parameter value.

i) Press the button MAN/AUT to return on the parameter programmed.

j) Proceed and program all parameters until the last A. 16

k) After last parameter value press the button MODE to save the data, display will shows SAU and exit the Advance Menu. All Led´s will light for a few seconds.

l) If the display shows Err, it means that an error has happened and was not possible to save the data. Therefore it will be necessary to program again all the parameters on the Advance Menu.

**Advance Set-up Menu:**

| PARAMETER | DESCRIPTION | | | RANGE | DEFAULT |
|---|---|---|---|---|---|
| A.01 | Mains Connection | 0 = Three-Phase | 1 = Single-Phase | 0 … 1 | 0 |
| A.02 | Sense of CT current | 1 = CT on L1 Direct | 2 = CT on L1 Inverse | 1 … 6 | 1 |
| | | 3 = CT on L2 Direct | 4 = CT on L2 Inverse | | |
| | | 5 = CT on L3 Direct | 6 = CT on L3 Inverse | | |
| A.03 | Frequency | 1 = 50 HZ | 2 = 60 HZ | 1 … 2 | 1 |
| A.04 | Serial interface TTL | 0 = Disable | 1-99 = Enable | 0 … 99 | 1* |
| A.05 | Temperature Alarm | 0 = Disable | 1 = Enable | 0 … 1 | 1 |
| A.06 | Temperature scale | 0 = °C | 1 = °F | 0 … 1 | 0 |
| A.07 | Alarm THD (%) I | | | 110 … 130 | 120 |
| A.08 | THD(%) Delay on (seconds) | | | 1 … 240 | 5 |
| A.09 | Alarm relay (see Table pag.10) | 0 = None;<br>1 = All<br>2 = A.HU<br>3 = A.LU<br>4 = A.HI | 5 = A.LI<br>6 = A.HC<br>7 = A.LC<br>8 = A.tH | 0 … 8 | 1 |
| A. 10 | Time to switch off all the capacitors because of low current (seconds). | | | 1 … 240 | 120 |
| A. 11 | Min Temp. to switch off the fan relay output. (if selected °F set the right value) | | | 1 … 240 | 30 |
| A. 12 | Max Temp. to switch on the fan relay output. (if selected °F set the right value) | | | 1 … 240 | 50 |
| A. 13 | Mains Three Phase Voltage. | | | 220 / 380<br>400 / 440 | 400 |



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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A. 14 | Fixed step selection (0=none) | | | | | | 0 … 12 | 0 |
| A. 15 | 0 = kvar with subtraction fixed step | | 1 = Real kvar | | | | 0 … 1 | 0 |
| A. 16 | Serial Protocol Type | 0 | Proprietary | 9600 Bauds | EVEN | 1 Bit | 0 … 15 | 0 |
| | | 1 | Modbus | 19200 Bauds | EVEN | 1 Bit | | |
| | | 2 | Modbus | 9600 Bauds | EVEN | 1 Bit | | |
| | | 3 | Modbus | 4800 Bauds | EVEN | 1 Bit | | |
| | | 4 | Modbus | 2400 Bauds | EVEN | 1 Bit | | |
| | | 5 | Modbus | 1200 Bauds | EVEN | 1 Bit | | |
| | | 6 | Modbus | 19200 Bauds | ODD | 1 Bit | | |
| | | 7 | Modbus | 9600 Bauds | ODD | 1 Bit | | |
| | | 8 | Modbus | 4800 Bauds | ODD | 1 Bit | | |
| | | 9 | Modbus | 2400 Bauds | ODD | 1 Bit | | |
| | | 10 | Modbus | 1200 Bauds | ODD | 1 Bit | | |
| | | 11 | Modbus | 19200 Bauds | NONE | 1 Bit | | |
| | | 12 | Modbus | 9600 Bauds | NONE | 1 Bit | | |
| | | 13 | Modbus | 4800 Bauds | NONE | 1 Bit | | |
| | | 14 | Modbus | 2400 Bauds | NONE | 1 Bit | | |
| | | 15 | Modbus | 1200 Bauds | NONE | 1 Bit | | |
| A. 17 | Anti-Hunting | 0 = Disable | | | 0.90 … 1.00 = Enable | | 0 / 0.90 … 1.00 | 0 |

*The values 1 to 99 indicate the device number when the units are connect on a serial interface, the values 100 to 199 are not used.

### 5.3 TO SET DEFAULT PARAMETERS:

- In A.0 1 parameter, press all buttons together MAN/AUT MODE <— +> for 5 seconds, on display will shows SAU
  Now the device will restart.

**ATTENTION:** All settings made on the device will be lost and all steps are will restored to default setting.

## *6 - SETTING PASSWORD:*

Default password is 000 and isn't active (unlocked).

a) The controller must be set on MANUAL operation and all capacitors must be OFF.

b) Press the button MODE for 5 seconds.

c) The display will show SEt

d) The Led MAN and AUT will flash with intermittent of 500ms.

e) Press the button MAN/AUT for 10seconds until display will show S.PS

f) To change password value press <— or +>.

g) To save new password press MODE for 5 seconds until display will show SAU

h) To exit without save password press MAN/AUT when password value is show.

i) Now you can view but not modify the parameters.

l) When you try to change the parameters the display show PAS, then pressing the keys <— or +> set the password and confirm by pressing MODE

m) If the password is correct you have access to edit parameters for 5 minutes after which everything will relock.

n) If the password is incorrect the display show Err.



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o) If when the instrument requires entering the password do not press any button for 30 seconds the system will exit the menu and resume normal operation.

p) To disable the password set the value 000, or in the most extreme case carry out reset (5.3 - Set Default Parameters).

## *7 - SETTING AUTORECOGNIZED CAPACITOR BANK:*

a) The controller must be set on MANUAL operation and all capacitors must be OFF.

b) Press the button MODE for 5 seconds.

c) The display will show SEt

d) The Led MAN and AUT will flash with intermittent of 500ms.

e) Press repeatedly the button MODE until the display show the parameters value P.05

f) Press the button MODE for 10 seconds until display will show Aut and start the automatic recognition of steps VAR.
This operation can take some minutes, at the end the display show P.05
Warning, the load must be stable during recognition, else wrong values of steps will be set.
However, when recognition is finish, you can see and eventually set the steps manually if values are wrong.

g) Press repeatedly the button MODE for scroll through the steps and see the banks acquired.

h) If the value is wrong press the button → to increase or the button ← to decrease the value set.

i) Now press the button MODE to save all data, on display will shows SAU and exit the Basic set-up Menu.
All Led´s will light for a few seconds.

**ATTENTION:** Capacity below 100VAR are recognized as 0.

## *8 - MEASUREMENTS FUNCTIONS:*

a) Standard the display shows the Cosφ of the installation, and if the load are inductive IND or capacitive CAP.
On Cosφ value indication, if the decimal point on first digit (from left) flashing is because the system working as Generator and the sense of current is inverted (verify correct CT connection or modify parameter A.02 ).

b) Press the button MODE to advance on measurements available and indicated by the related LED illuminated.

c) If a value is above 1000, the decimal point flashing. If the value is below 1000 the decimal point is light on fixed.

d) Select ΔKvar measure, the display will show the kvar missing to achieve the Cosφ adjustament for the installation.

Now if pressing the button ← the display will show the correct value measured by the controller of the minimum capacitor step set on P.02

Or if pressing the button →, the display will show the numbers of minimum step capacitor (programmed on P.02) that will be needed to reach the Cosφ set.

e) If the Δkvar led IND is ON, it means that the installation is inductive and needs to switch on the capacitor to reach the value of Cosφ programmed for the application.

f) If the Δkvar led CAP is ON, it means that the Cosφ of the installation is capacitive and needs to switch off the capacitor to reduce the Cosφ to the value programmed.

g) Press the button → to verify the equivalent number of steps that must be switch ON (load inductive) or OFF (load capacitive) to reach the Cosφ programmed for the installation.

h) If no button is pressed for 30 seconds, the display will returned to the Cosφ indication of the installation.

i) Select VOLTAGE measure, the display will show the Mains Input Voltage of phase.



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Now if hold press  , the display will show the total kVA of system.

Now if hold press  , the display will show the total kW of system.

l) Select CURRENT measure, the display will show the Load Current of phase.

Now if hold press  , the display will show the total kvar of system.

m) Select TEMP measure, the display will show the ambient temperature.

Now if hold press  , the display will show the total Hours of functioning.

## *9 - COSφ SET-UP AND SENSITIVITY SET-UP:*

### 9.1 Cosφ set-up:

Press the button MODE until the Led COSφ turns ON.

Press the button  to increase the value or the button  to decrease the value of Cosφ desired for the installation.

The Led IND ON indicates that the instantaneous Cosφ of the installation is inductive.

The Led CAP ON indicates that the instantaneous Cosφ of the installation is capacitive.

### 9.2 Sensitivity:

Is the time available for the unit to measure the average Cosφ of the installation and calculate the reactive power needed to reach the Cosφ programmed for the installation, switching ON or OFF the steps relays (therefore the capacitors).

The unit of sensitivity is: sec/kvar (The kvar of the lowest capacitor programmed on P.02 ).

> Press the button MODE until the SENS. Led lights ON.

> Press the button  or  to modify the value of sensitivity programmed and shown on display of the device.

> The time to turn ON the step relay depends on the time of Reconnection of the step. ( P.04 ).

### 9.3 Example:

If we need to switch ON 20 kvar. Parameters programmed on the device:

P.02 (lowest step): 10 kvar

Sensitivity programmed: 60 sec/kvar (lowest step on P.02 )

We will have: Reactive power needed of 20 kvar is equal to 2 x 10 kvar (lowest step on P.02 )

**Therefore, The device will switch On the step in: 60sec / 2x10kvar = 30sec**

## *10 - OPERATION MODE:*

***!!! ATTENTION !!!***

The operating mode can't be changed if **LED Δkvar, Set Cosφ** or **SENSITIVITY** is switched on.

1. Press the button MAN AUT for 1 second to select the mode of operation desired, Manual or Automatic.
2. The Led MAN or AUT ON indicates the operation mode selected.
3. The operating mode remains stored even in absence of supply voltage.

### 10.1 MANUAL OPERATION MODE:

During Manual operation mode , the status of step relays is stored even in the absence of supply voltage to the unit.
When the power returns back the unit will return to the stored status.

1. Press the button  or  to select the step relay to be activated, the correspondent Led will flash ON and OFF.



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2. Press the button MODE within 5 seconds of step selection, to modify the status of the output relay (turn On or turn OFF).
3. Repeat the above operation for the next steps to be examined.
4. If the last step is programmed as Alarm relay, then the relay can not be command manually.

Note: During Manual operation the device controls the reconnection time of the capacitors (same as discharged time of the capacitor on P.04), therefore to switch ON the same step it will be necessary to elapse the reconnection time programmed.

### 10.2 AUTOMATIC OPERATION MODE:

During automatic operation the PFC will consider the Cosφ of the installation and the Set Cosφ programmed.

1. If the AUT Led is flashing, it means that the controller is ready to switch On or Off the step.
2. If the time is too long is because the Cosφ controllers is waiting to elapse the reconnection time setted ( P.04 ).
3. The instrument utilizes the best choice combination of the following decreasing priorities listed bellow:
   a) Reactive power needed.
   b) Reconnection time for the step selected.
   c) Number of switching necessary to reach the Cosφ desired.
   d) Number of the effected insertions and connections.
   e) Total time need of the effected insertions/connections.
4. The software also includes the Anti-Hunting protection for the capacitors to prevent inconvenient switch on/off when trying to correct the Cosφ of installation if the capacitor is too large.
   The new Cosφ measure must be less than 1.00 with the capacitor is on.

## *11 - ALARMS TABLE:*

1. In manual mode the alarms are active only visual.
2. Pressing the MODE button the visual alarm can momentarily be cancelled, and the readings can be accessed to verify the causes of the alarms.
   If for 30 seconds no button is pressed the visual alarm returns until its removing.

| Code | Description | Delay | Intervention Parameter | Display LED |
|---|---|---|---|---|
| A.HU | Too high voltage | 15min | Voltage over +10% set value. | Display A.HU **VOLTAGE** LED blink |
| A.LU | Too low voltage | 5sec | Voltage under -15% set value | Display A.LU **VOLTAGE** LED blink |
| A.HI | Too high current | 2min | Current exceeds 110% of the rated value. | Display A.HI **CURRENT** LED blink |
| A.LI | Too low current | 5sec | Current is lower than 2.5% rated value. If the alarm condition persists for a time exceeding 2 minutes, then the outputs are disabled. | Display A.LI **CURRENT** LED blink |
| A.HC | Overcompensation | 2min | Capacitors are all disconnected and the Cosφ is higher than the preset value. | Display A.HC alternated with Cosφ value |
| A.LC | Under compensation | 15min | Capacitors are all connected and the Cosφ is lower than the preset value. | Display A.LC alternated with Cosφ value |
| A.Ot | Over temperature | 10sec | The temperature is to 60°C from at least 10 seconds. | Display A.Ot alternated with Cosφ value |
| A.tH | THD % I | 5 | When the THD is higher than the value set on par. A.07 | A.tH alternated with **THD %** |
| A.PS | Set-up parameters error | - | The set-up parameters read by the EEPROM are not correct. To restore is necessary the re-set up made by the user. | Display A.PS |
| A.PC | Adjustment/setting parameters error | - | The setting parameters read by the EEPROM arn't correct. The device operates with the default parameters. There could be error in the calculated measures. The user can't do the setting. It is necessary to return the unit to manufacturer. | Display A.PC |



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| | | | | |
|---|---|---|---|---|
| A.PU | Parameters error | - | The setting parameters read by the EEPROM are not correct (set Cosφ, sensitivity, operation mode).<br>To reset is necessary to contact the manufacturer. | Display A.PU |
| A.EE | Cancellation EPROM error | - | Only in the testing phase you can see if the EEPROM doesn't operates correctly.<br>Is necessary to contact the manufacturer. | Display A.EE |
| A.Fr | Frequency error | 0 | If frequency is out of +-5% of selected in A.03<br>Probably you must set parameter A.03 correctly.<br>The frequency is checked only at power on. | Display A.Fr |

De-activate the relay participation is possible by means of the parameter A.05

## *12 - TECHNICAL DATA:*

| Supply Circuit | EPFC-96 | EPFC-144 |
|---|---|---|
| Supply Voltage | 230 - 415 VAC | 230 - 415 VAC |
| Operating Limits | -15%…+10% UE | -15%…+10% UE |
| Rated Frequency | 50 or 60Hz | 50 or 60Hz |
| Power Consumption L/L - 400VAC | 5.8 VA | 6.1 VA |
| Immunity time for Microbreakings | <6ms | <6ms |

| Current Input | EPFC-96 | EPFC-144 |
|---|---|---|
| Rated Current | 5A | 5A |
| Operating Limits | 0.125…5.5A | 0.125…5.5A |
| Overload Capacity | 1.1Ie | 1.1Ie |
| Overload Peak | 10 Ie for 1sec | 10 Ie for 1sec |

| Reading and Control Range | EPFC-96 | EPFC-144 |
|---|---|---|
| Voltage Reading Limits | 195...460 VAC | 195...460 VAC |
| Current Reading Limits | 0.125…5.5A | 0.125…5.5A |
| Type of Current and Voltage Readings | TRMS | TRMS |
| Cosφ Adjustment | 0.85 inductive…0.95 capacitive | 0.85 inductive…0.95 capacitive |
| Tripping Sensitivity | 5…600 s/step | 5…600 s/step |
| Re-connection Time of the Same Step | 5…240 seconds | 5…240 seconds |
| FFT - Harmonic Spectrum | THD% - 64st | THD% - 64st |

| Relay Outputs | EPFC-96 | EPFC-144 |
|---|---|---|
| Number of Outputs | 04 - 06 | 04 - 06 - 08 - 12 |
| Contact Arrangement | 1NO | 1NO |
| Contacts Capacity | 8A – 250VAC (AC1) | 8A – 250VAC (AC1) |
| Maximum Capacity the Common Contacts | 10A | 10A |
| Insulating Category/Rated Voltage VDE0110 | C/250 - B/400 | C/250 - B/400 |
| Maximum Switching Voltage | 400VAC | 400VAC |
| Electrical Contact Life | 20 x $10^6$ ops | 20 x $100^6$ ops |
| Mechanical Contact Life | 100 x $10^3$ ops | 100 x $10^3$ ops |

| Enclosure and Connections | EPFC-96 | EPFC-144 |
|---|---|---|
| Type of Terminal | Pluggable | Pluggable |
| Enclosure Version | Flush mount 96x96 | Flush mount 144x144 |
| Temperature Work | -10 / +50 °C | -10 / +50 °C |
| Electrical Insulation – Mains/Contact | 4 kV | 4 kV |
| Protection Degree | IP41 Front - IP20 Terminals | IP41 Front - IP20 Terminals |
| Relative Humidity w/o Condensation | 95 RH% | 95 RH% |
| Conforming Norms | IEC 60255-5_IEC 60255-6<br>IEC 60068-2-61_IEC 60068-2-6<br>EN50081-1_EN50082-2 | IEC 60255-5_IEC 60255-6<br>IEC 60068-2-61_IEC 60068-2-6<br>EN50081-1_EN50082-2 |



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| | | |
|---|---|---|
| **Dimensions** | **96 x 96 x 74mm** | **149 x 149 x 60mm** |
| **Weight** | **350g - 370g** | **520g - 540g - 650g - 700g** |

| **Serial Interface** | **EPFC-96 (on option)** | **EPFC-144** |
|---|---|---|
| **TTL** | **Standard** | **Standard** |
| **Communication Protocol** | **Proprietary / MODBUS RTU** | **Proprietary / MODBUS RTU** |
| **Connector Type** | **RJ11** | **RJ11** |

| **Serial Adapter TTL / USB / 485** | **ALL EPFC MODELS** |
|---|---|
| **Connector RJ11 / USB / 485** | **Optional order code AD-USB/485** |

## *13* - REGISTERS:

### READ REGISTERS (INPUT REGISTERS)

| ADDRESS | FORMAT | MULTIPLIER | UNIT | PARAMETERS |
|---|---|---|---|---|
| 0000 | USHORT | 0,001 | - | Cosφ actual ( x1000 ) |
| 0001 | USHORT | 1 | V | RMS Voltage |
| 0002 | ULONG | 0,01 | A | RMS Current |
| 0004 | LONG | 1 | VAR | Actual Reactive Power ( Negative = Capacitive ) |
| 0006 | LONG | 1 | VAR | Reactive Power Demand |
| 0008 | ULONG | 1 | W | Actual Active Power |
| 000A | USHORT | 1 | % | Actual THD |
| 000B | USHORT | - | bits | General Alarms: ( 0 = Disabled, 1 = Enabled ) |
| | | | | bit0 = A.HU Voltage Too High |
| | | | | bit1 = A.LU Voltage Too Low |
| | | | | bit2 = A.HI Current Too High |
| | | | | bit3 = A.LI Current Too Low |
| | | | | bit4 = A.HC Over Compensation |
| | | | | bit5 = A.LC Under Compensation |
| | | | | bit6 = A.Ot Over Temperature |
| | | | | bit7 = A.th High THD |
| | | | | bit8 = A.Fr Wrong Frequency |
| 000C | USHORT | - | bits | Eeprom Alarms: ( 0 = Disabled, 1 = Enabled ) |
| | | | | bit0 = A.PS Error Parameters Setup |
| | | | | bit1 = A.PC Calibration Error Parameters |
| | | | | bit2 = A.PU Various Parameters Error |
| | | | | bit3 = A.EE Eeprom Error Cancellation |
| | | | | bit4 = A.SS Error Parameter Set |
| | | | | bit5 = A.SC Not Used |
| | | | | bit6 = A.SU Calibration Error Parameter Set |
| 000D | USHORT | - | bits | Steps Actual Output Status |
| 000E | ULONG | 1 | VAR | Real Reactive Power – Step 1 |
| 0010 | ULONG | 1 | VAR | Real Reactive Power – Step 2 |
| 0012 | ULONG | 1 | VAR | Real Reactive Power – Step 3 |
| 0014 | ULONG | 1 | VAR | Real Reactive Power – Step 4 |
| 0016 | ULONG | 1 | VAR | Real Reactive Power – Step 5 |
| 0018 | ULONG | 1 | VAR | Real Reactive Power – Step 6 |
| 001A | ULONG | 1 | VAR | Real Reactive Power – Step 7 |
| 001C | ULONG | 1 | VAR | Real Reactive Power – Step 8 |
| 001E | ULONG | 1 | VAR | Real Reactive Power – Step 9 |
| 0020 | ULONG | 1 | VAR | Real Reactive Power – Step 10 |
| 0022 | ULONG | 1 | VAR | Real Reactive Power – Step 11 |
| 0024 | ULONG | 1 | VAR | Real Reactive Power – Step 12 |
| 0026 | USHORT | 0.1 | °C | Temperature |
| 0027 | USHORT | 1 | - | Max Step Number ( 04-06-08-12 ) |
| 0028 | USHORT | - | - | Firmware Checksum |



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| | | | | |
|---|---|---|---|---|
| 0029 | USHORT | - | - | Actual Quadrant ( 1 = IND-CAR, 2 = IND-GEN, 3 = CAP-GEN, 4 = CAP- |
| 002A | USHORT | 1 | seconds | Seconds of Discharge – Step 1 |
| 002B | USHORT | 1 | seconds | Seconds of Discharge – Step 2 |
| 002C | USHORT | 1 | seconds | Seconds of Discharge – Step 3 |
| 002D | USHORT | 1 | seconds | Seconds of Discharge – Step 4 |
| 002E | USHORT | 1 | seconds | Seconds of Discharge – Step 5 |
| 002F | USHORT | 1 | seconds | Seconds of Discharge – Step 6 |
| 0030 | USHORT | 1 | seconds | Seconds of Discharge – Step 7 |
| 0031 | USHORT | 1 | seconds | Seconds of Discharge – Step 8 |
| 0032 | USHORT | 1 | seconds | Seconds of Discharge – Step 9 |
| 0033 | USHORT | 1 | seconds | Seconds of Discharge – Step 10 |
| 0034 | USHORT | 1 | seconds | Seconds of Discharge – Step 11 |
| 0035 | USHORT | 1 | seconds | Seconds of Discharge – Step 12 |
| 0036 | ULONG | 1 | hours | Total Hours of Operation |

**READ / WRITE REGISTERS (HOLDING REGISTERS)**

| ADDRESS | FORMA | MULTIPLIE | UNIT | RANGE | PARAMETERS |
|---|---|---|---|---|---|
| 0000 | USHOR | - | - | 0 … 1 | Mode ( 0 = Manual, 1 = Auto ) |
| 0001 | USHOR | - | - | 0 … 4095 | Manual Step Combination Set ( bit0 = Step 1, … , bit11 = Step 12 ) |
| 0002 | SHORT | 0,01 | - | -100 … 100 | Cosφ desired ( negative = capacitive ) |
| 0003 | USHOR | 1 | sec./ste | 5 … 600 | Sensitivity |
| 0004 | USHOR | 1 | A | 5 … 10000 | P.01 CT Current |
| 0005 | USHOR | 1 | VAR | 1 … 30000 | P.02 Minimum Step |
| 0006 | USHOR | 1 | V | 80 … 750 | P.03 Nominal Capacitor Voltage |
| 0007 | USHOR | 1 | seconds | 1 … 600 | P.04 Reconnection Time Step |
| 0008 | LONG | 1 | VAR | 0 … 300000 | P.05 Step 1 Value |
| 000A | LONG | 1 | VAR | 0 … 300000 | P.05 Step 2 Value |
| 000C | LONG | 1 | VAR | -1 … 300000 | P.05 Step 3 Value ( if 04 steps: -1 = FAN ) |
| 000E | LONG | 1 | VAR | -2 … 300000 | P.05 Step 4 Value ( if 04 steps: -1 = NCA, -2 = NOA ) |
| 0010 | LONG | 1 | VAR | -1 … 300000 | P.05 Step 5 Value ( if 06 steps: -1 = FAN ) |
| 0012 | LONG | 1 | VAR | -2 … 300000 | P.05 Step 6 Value ( if 06 steps: -1 = NCA, -2 = NOA ) |
| 0014 | LONG | 1 | VAR | -1 … 300000 | P.05 Step 7 Value ( if 08 steps: -1 = FAN ) |
| 0016 | LONG | 1 | VAR | -2 … 300000 | P.05 Step 8 Value ( if 08 steps: -1 = NCA, -2 = NOA ) |
| 0018 | LONG | 1 | VAR | 0 … 300000 | P.05 Step 9 Value |
| 001A | LONG | 1 | VAR | 0 … 300000 | P.05 Step 10 Value |
| 001C | LONG | 1 | VAR | -1 … 300000 | P.05 Step 11 Value ( if 12 steps: -1 = FAN ) |
| 001E | LONG | 1 | VAR | -2 … 300000 | P.05 Step 12 Value ( if 12 steps: -1 = NCA, -2 = NOA ) |
| 0020 | USHOR | - | - | 0 … 1 | A.01 Mains Connection ( 0 = Three-Phase, 1 = Single-Phase ) |
| 0021 | USHOR | - | - | 1 … 6 | A.02 Sense of CT current ( 1 = L1 Direct, 2 = L1 Inverse ) ( 3 = L2 Direct, 4 = L2 Inverse ) ( 5 = L3 Direct, 6 = L3 Inverse ) |
| 0022 | USHOR | - | - | 1 … 2 | A.03 Frequency ( 1 = 50Hz, 2 = 60Hz ) |
| 0023 | USHOR | - | - | 0 … 247 | A.04 Serial Address ( 0 = Off, 1…247 = On “address” ) |
| 0024 | USHOR | - | - | 0 … 1 | A.05 Enable Temperature Alarm Relay ( 0 = Disable, 1 = |
| 0025 | USHOR | - | - | 0 … 1 | A.06 Temperature Scale ( 0 = °C, 1 = °F ) |
| 0026 | USHOR | 1 | % | 110 … 130 | A.07 THD Alarm Threshold |
| 0027 | USHOR | - | bits | 0 … 255 | A.09 Relay Alarm ( 0 = Disable, 1 = Enabled ) ( bit0 = A.HU, bit1 = A.LU, bit2 = A.H 1, bit3 = A.L 1 ) ( bit4 = A.HC, bit5 = A.LC, bit7 = A.tH, bit8 = A.Fr ) |
| 0028 | USHOR | - | units | 1 … 240 | A. 10 Delay Step Disconnection Warning ( A.L 1 ) ( the unit of measure depends on parameter 0038 ) |
| 0029 | USHOR | 1 | °C | 1 … 240 | A. 11 Minimum Temperature Threshold for Disabling Fan Relay |
| 002A | USHOR | 1 | °C | 1 … 240 | A. 12 Maximum Temperature Threshold for Activating Fan Relay |
| 002B | USHOR | 1 | V | 200 … 500 | A. 13 Rated Voltage |
| 002C | USHOR | - | - | 0 … 12 | A. 14 Fixed Step Number |
| 002D | USHOR | - | - | 0 … 1 | A. 15 Fixed Step Type |
| 002E | USHOR | - | - | 0 … 15 | A. 16 Serial Protocol Type |
| 002F | USHOR | - | bits | 0 … 255 | Alarm Enable (0 = Disabled, 1 = Enabled) ( bit0 = A.HU, bit1 = A.LU, bit2 = A.H 1, bit3 = A.L 1 ) |



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| | | | | | |
|---|---|---|---|---|---|
| | | | | | ( bit4 = A.HC, bit5 = A.LC, bit7 = A.tH, bit8 = A.Fr ) |
| 0030 | USHOR | - | units | 1 … 240 | A.HU Time Delay Alarm |
| 0031 | USHOR | - | units | 1 … 240 | A.LU Time Delay Alarm |
| 0032 | USHOR | - | units | 1 … 240 | A.H I Time Delay Alarm |
| 0033 | USHOR | - | units | 1 … 240 | A.L I Time Delay Alarm |
| 0034 | USHOR | - | units | 1 … 240 | A.HC Time Delay Alarm |
| 0035 | USHOR | - | units | 1 … 240 | A.LC Time Delay Alarm |
| 0036 | USHOR | - | units | 1 … 240 | A.Ot Time Delay Alarm |
| 0037 | USHOR | - | units | 1 … 240 | A.tH Time Delay Alarm ( A.OB ) |
| 0038 | USHOR | - | bits | 0 … 255 | Alarm Scale ( 0 = Seconds, 1 = Minuts )<br>( bit0 = A.HU, bit1 = A.LU, bit2 = A.H I, bit3 = A.L I )<br>( bit4 = A.HC, bit5 = A.LC, bit7 = A.tH, bit8 = A.Fr ) |
| 0039 | USHOR | - | bits | 0 … 255 | Disconnection Steps on Alarm ( 0 = Disabled, 1 = Enabled )<br>( bit0 = A.HU, bit1 = A.LU, bit2 = A.H I, bit3 = A.L I )<br>( bit4 = A.HC, bit5 = A.LC, bit7 = A.tH, bit8 = A.Fr ) |
| 003A | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 1 |
| 003C | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 2 |
| 003E | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 3 |
| 0040 | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 4 |
| 0042 | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 5 |
| 0044 | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 6 |
| 0046 | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 7 |
| 0048 | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 8 |
| 004A | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 9 |
| 004C | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 10 |
| 004E | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 11 |
| 0050 | ULONG | 1 | - | 0 … 4294967295 | Number Insertions Step 12 |
| 0052 | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 1 |
| 0054 | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 2 |
| 0056 | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 3 |
| 0058 | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 4 |
| 005A | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 5 |
| 005C | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 6 |
| 005E | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 7 |
| 0060 | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 8 |
| 0062 | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 9 |
| 0064 | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 10 |
| 0066 | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 11 |
| 0068 | ULONG | 1 | seconds | 0 … 4294967295 | Time Insertion Step 12 |
| 006A | USHOR | 0,01 | - | 090 … 100 | A. I7 Anti-Hunting threshold |

**Avaible optional communication module PC-USB / RS485 / TTL**

**Order Code: AD-USB/485**

## *14 - FLOW CHARTS:*



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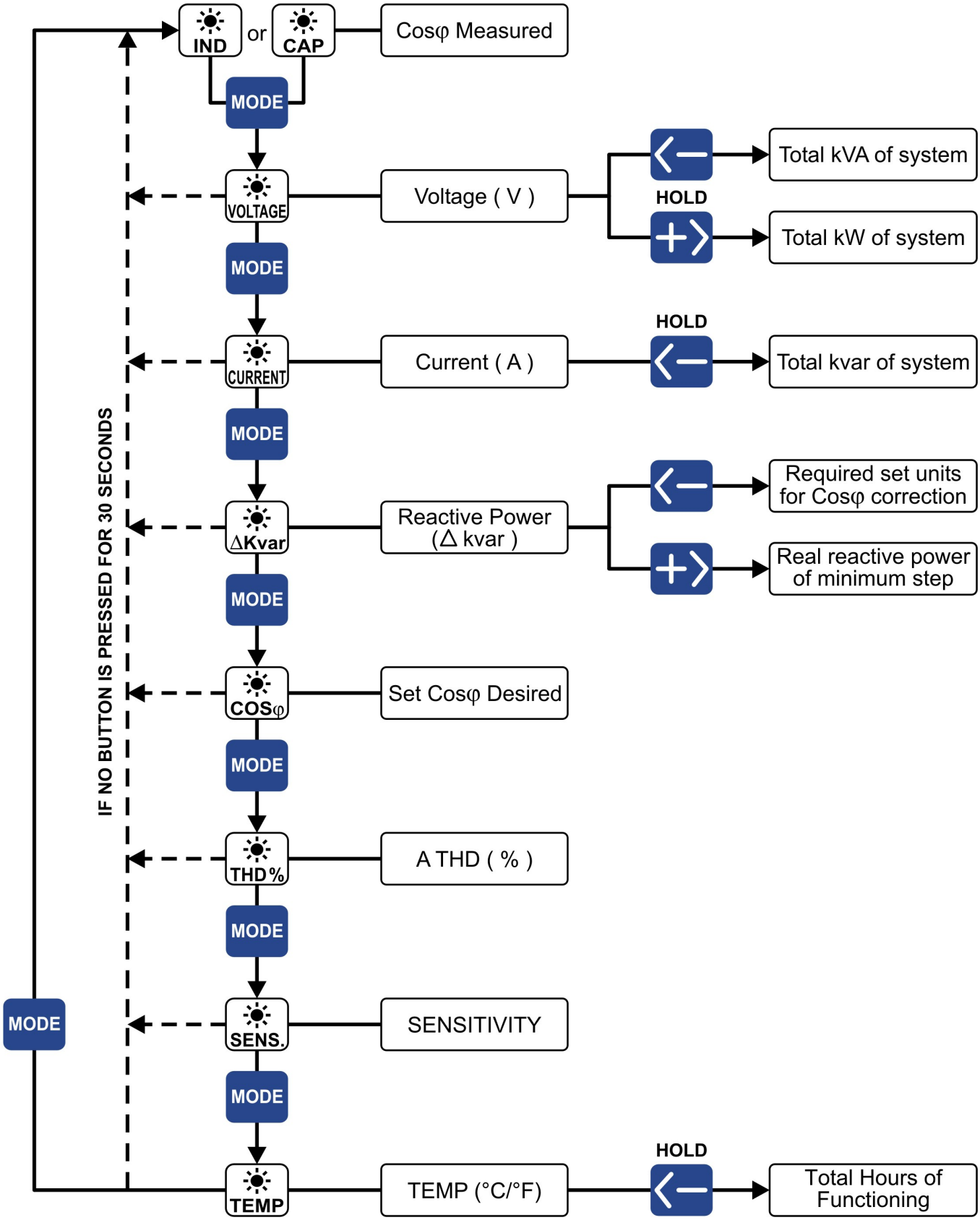
## READ MEASURES



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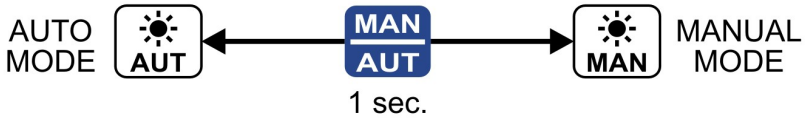
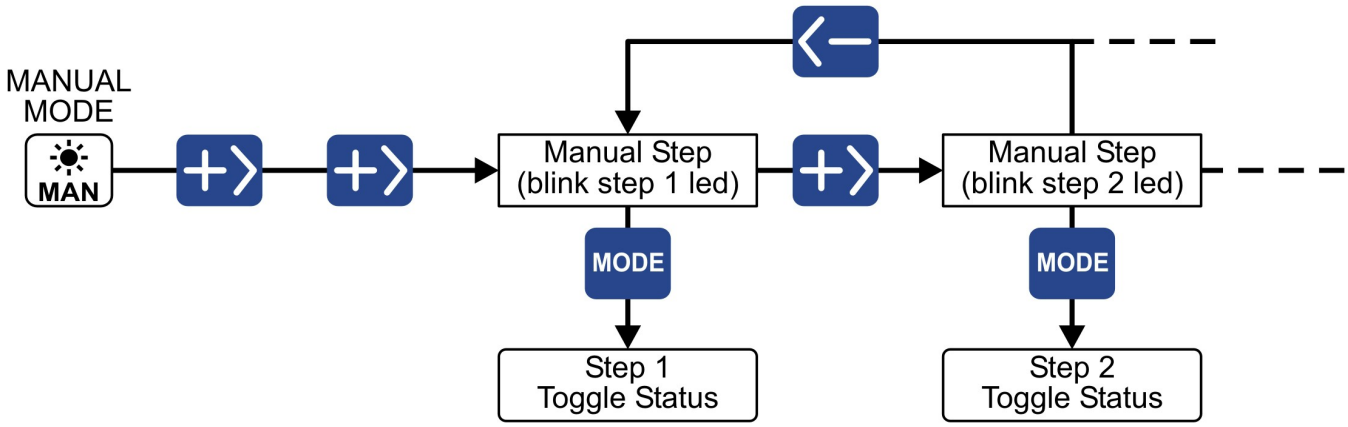
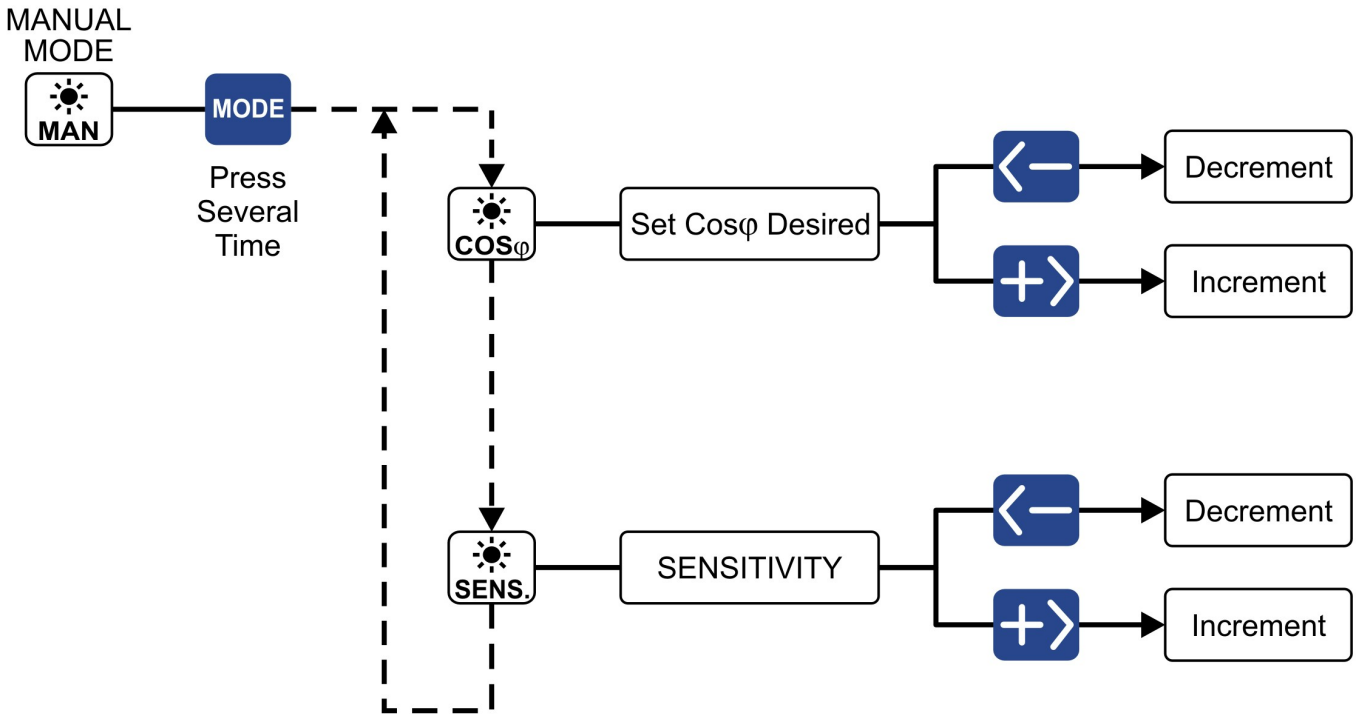
## CHANGE MODE




## SET MANUAL STEPS ( Cosφ Measured - V - A - THD% )




## SETTING VALUE ( Cosφ Desired - SENS )



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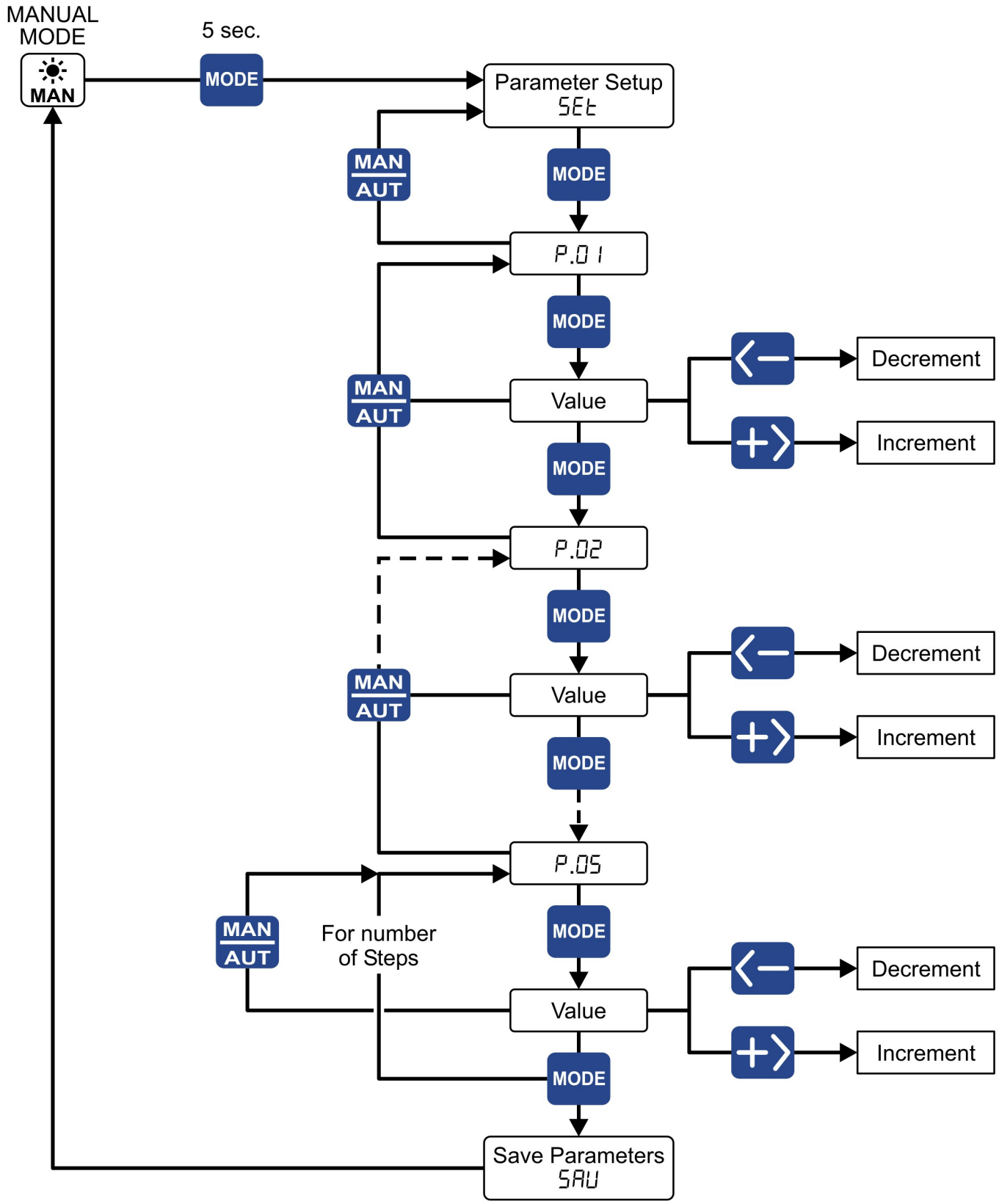
## BASIC PARAMETER SETUP (ONLY WITH CAPACITORS SWITCHED OFF)



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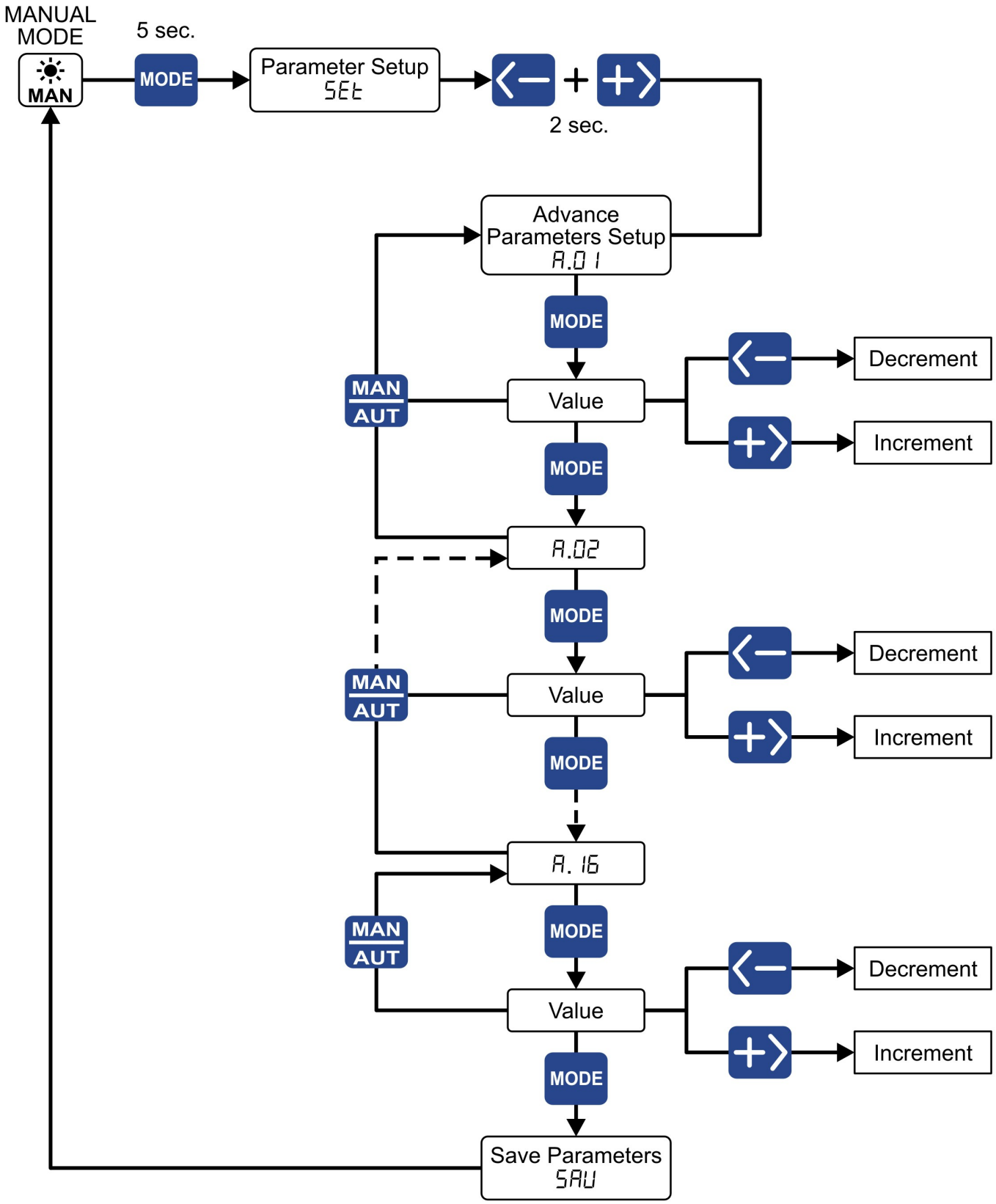
## ADVANCE PARAMETERS SETUP (ONLY WITH CAPACITORS SWITCHED OFF)



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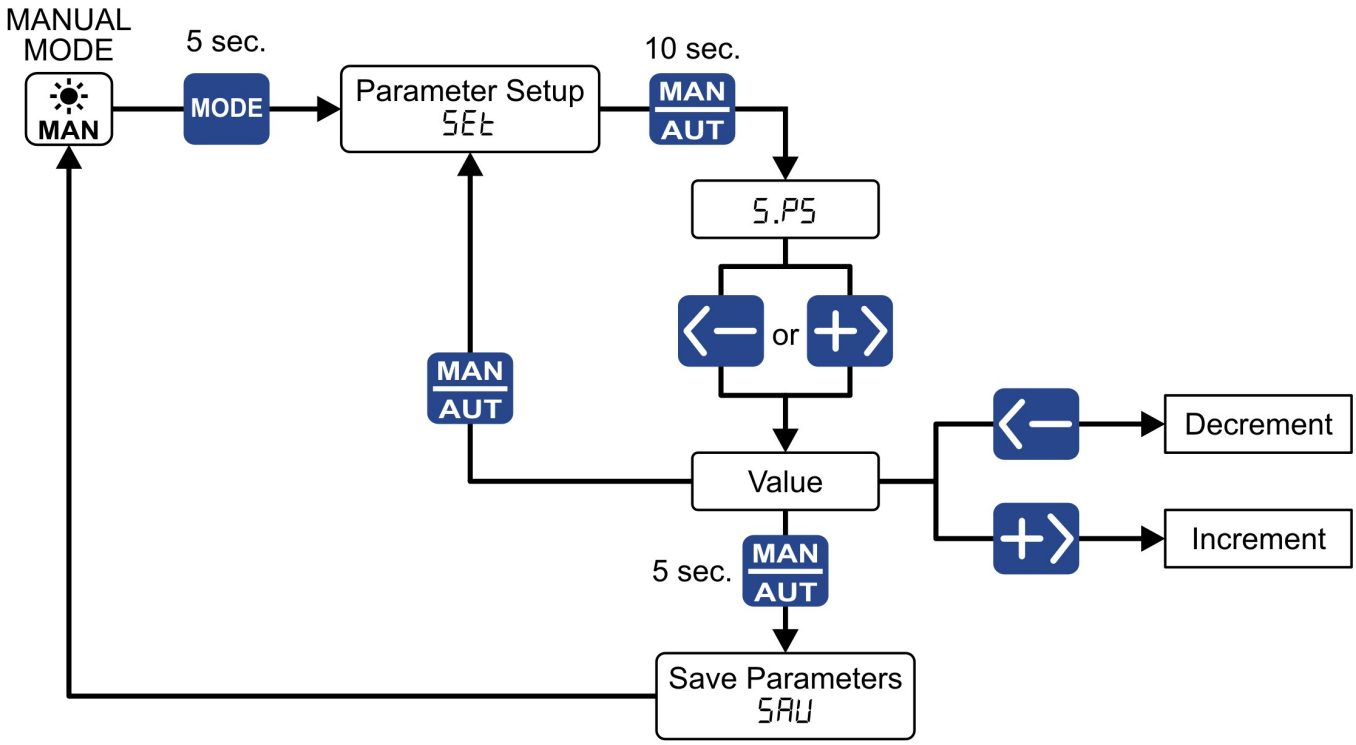
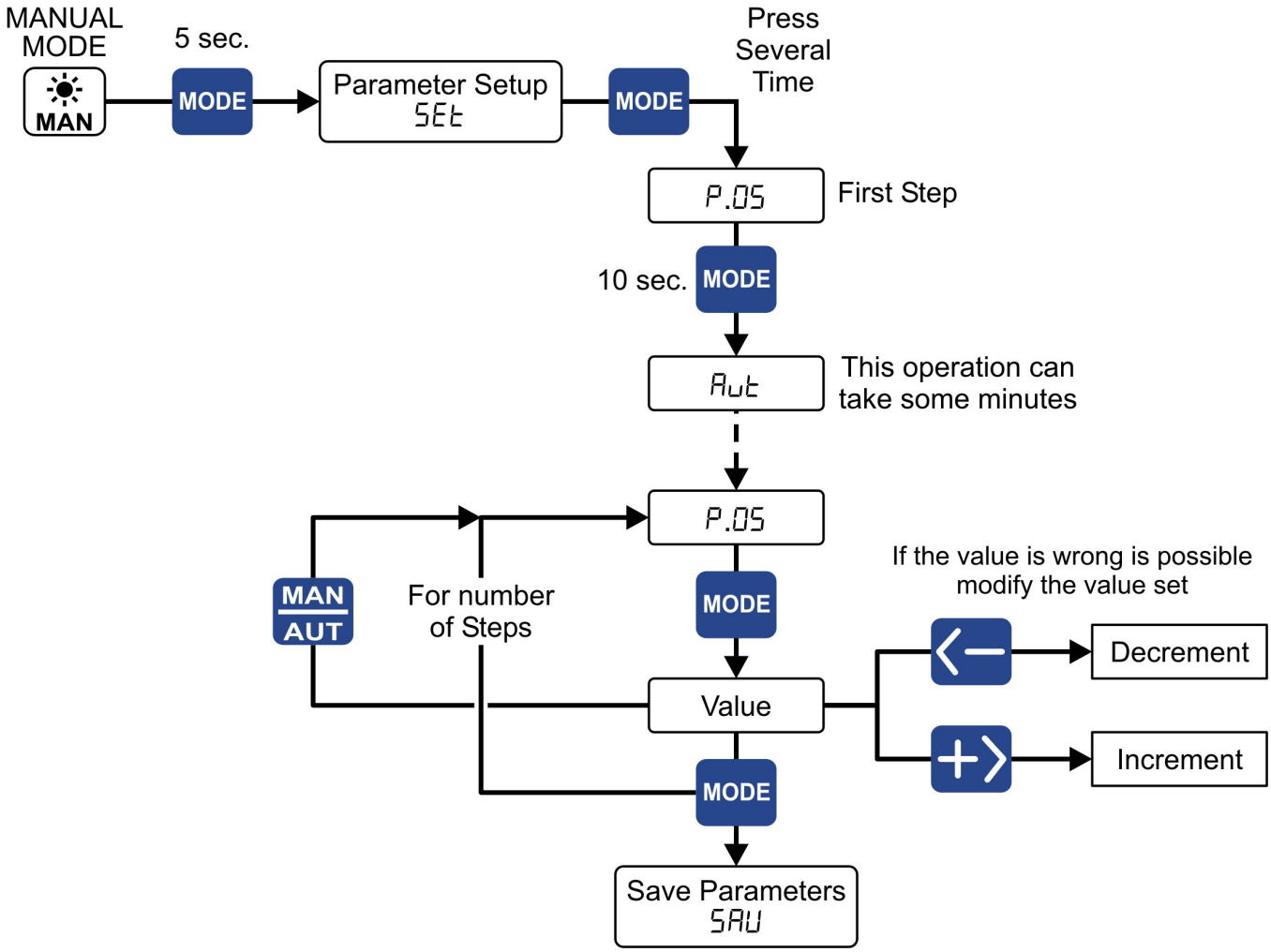
## SETTING PASSWORD (ONLY WITH CAPACITORS SWITCHED OFF)




## SETTING AUTORECONIZED CAPACITOR BANK (ONLY WITH CAPACITORS SWITCHED OFF)



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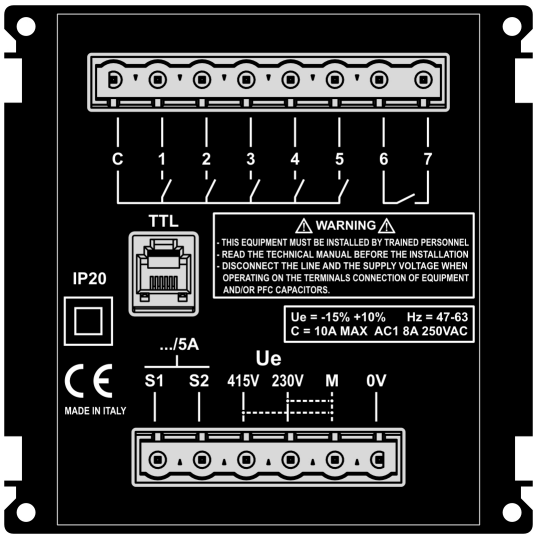
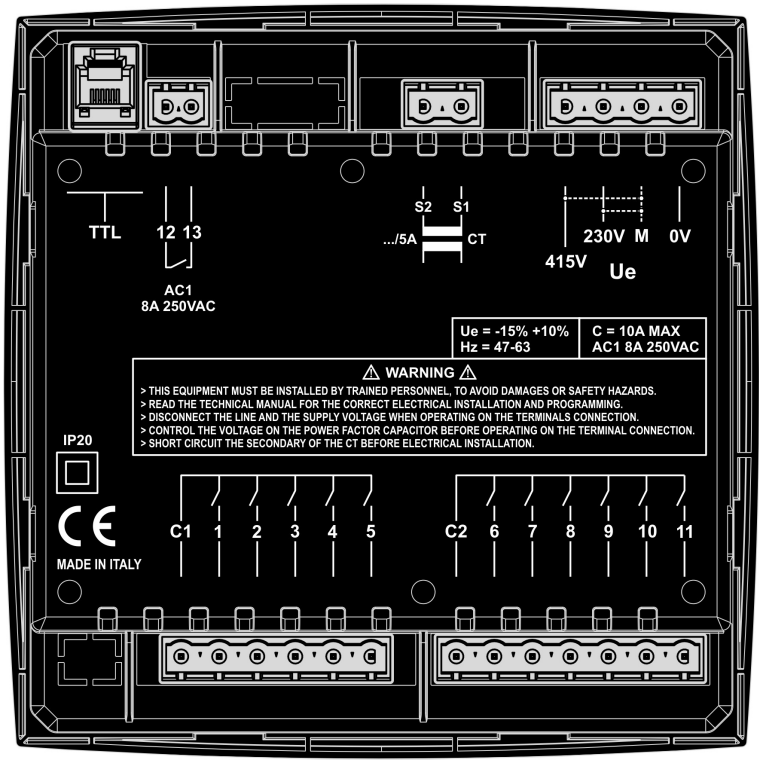
## 15 - TERMINAL CONNECTIONS:

### 96x96 EPFC-96



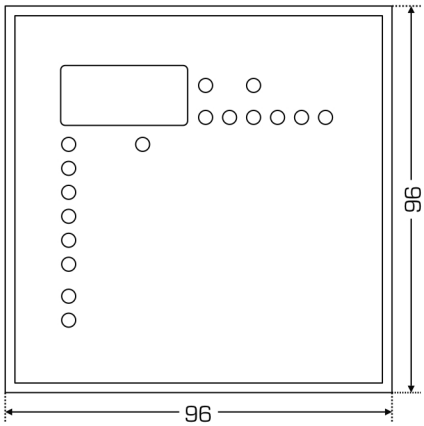

### 144x144 EPFC-144



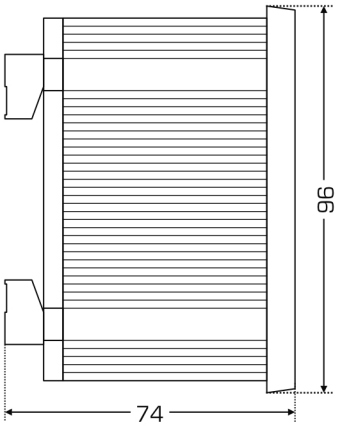

## 16 - DIMENSIONS

### 96x96 – EPFC-96

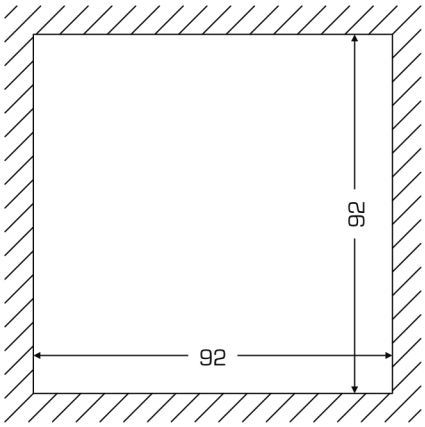
FRONT VIEW




SIDE VIEW

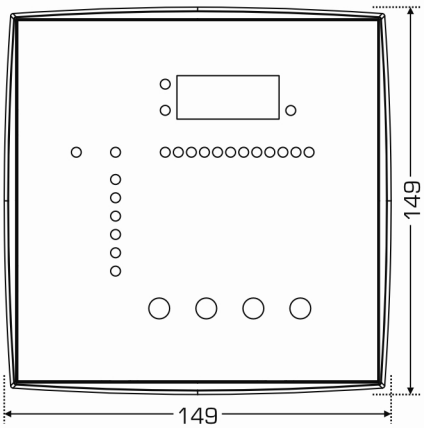



PANEL HOLE

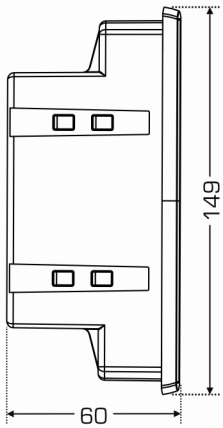



### 144x144 – EPFC-144

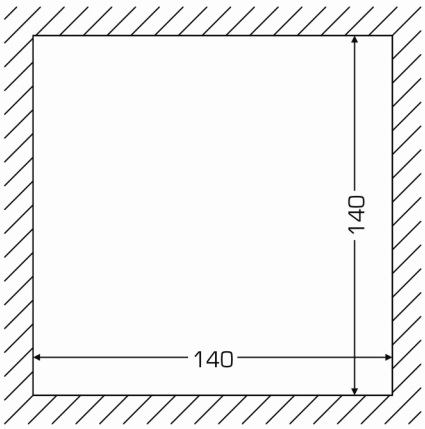
FRONT VIEW




SIDE VIEW




PANEL HOLE



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