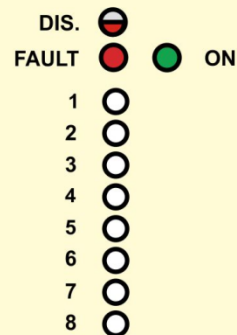
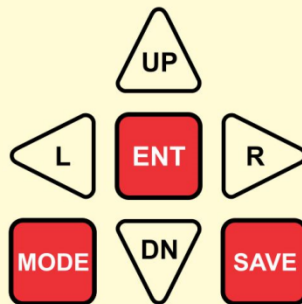




## Automatic Power Factor Controller



RS 232



**HTPF-03**

# Operational Manual for **HTPF-03/08 (for 8 banks)** & **HTPF-03/16 (for 16 banks)**

For High-Tension Line Application  
(refer appropriately)

Version 1.1

## **NOTE**

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchasers purposes, the matter should be referred to our TAS PowerTek Pvt. Ltd. offices.

The contents of this instruction Manual shall not become part of or modify any prior or existing agreement or relationship. The sales contract contains the entire obligations of TAS PowerTek Pvt. Ltd. The warranty contained in the contract between the parties is the sole warranty of TAS PowerTek Pvt. Ltd. Any statements contained herein do not create new warranties or modify the existing warranty.

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### **CAUTIONS:**

1. High Voltage!
2. HTPF-03/08 and HTPF-03/16 may only be used indoor!
3. Make sure that the discharge time set in the controller matches the capacitor discharge time!
4. **This User Manual is applicable to HTPF-03/08 (for 8 Banks) and HTPF-03/16 (for 16 Banks) HT APFC Unit with Firmware Version 2.0.9 dated on 25<sup>th</sup> September, 2013.**

Because of continuous improvements efforts by TAS PowerTek in their Product's Features and Specifications, the Product as well as the Content of the User Manual is likely to get updated.

Therefore, please always refer to the User Manual supplied to the customer along with the Product, at the time of product dispatch.

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# Index

❖ Index page	-- 1
❖ Features	-- 2
❖ Specifications	-- 3
❖ Mechanical dimensions	-- 3
❖ Front fascia	-- 4
❖ Back side terminals	-- 5
❖ Functional block diagram	-- 6
❖ PF correction technique	-- 7 & 8
❖ Typical wiring scheme	-- 9
❖ Rear side terminals	-- 10
❖ Bottom side terminals	-- 11
❖ Communication port connection	-- 11
❖ Terminals available on sides	-- 12
❖ Front fascia & RS232 Communication port	-- 13 & 14
❖ Keyboard details	-- 15
❖ Display of various parameters	-- 16
❖ Sub menu for display of parameters	-- 17 to 20
❖ Method of Keyboard / Display usage	-- 21 to 23
❖ Keyboard / Display operations	-- 24 & 25
❖ CT-PT Ratio Table for 50 MVA System	-- 25
❖ Edit Parameters	-- 26
General & IO	-- 27
System	-- 27 & 28
Fault	-- 28 to 30
Steps	-- 31 & 32
Communication	-- 33
Step utilization	-- 34
❖ Do's and Dont's for HT PF Controller	-- 35 & 36
❖ Commissioning Instructions	-- 37 & 38
❖ Manual Synchronization Method	-- 39 & 40
❖ Fault finding Guidelines	-- 41 & 42
❖ Factory Default Settings	-- 43 to 49

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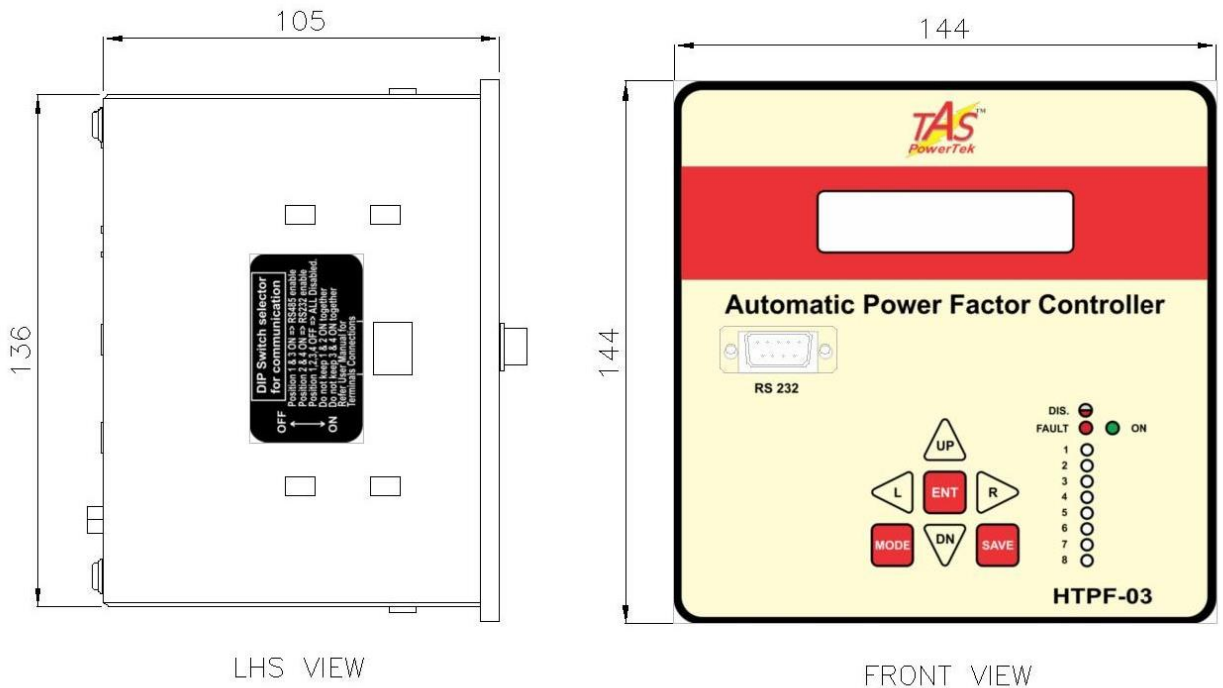
## Features

- Totally Micro-controller controlled Digital Signal processing logic for measurements, monitoring, controls and logging etc.
- Voltage & Current measurements with Class-2 accuracy.
- Load V, I, and Cap. current THD measurement with odd harmonic coefficients up to 15<sup>th</sup> harmonic. Neutral current analysis too.
- Various modes for switching, viz:
  - Binary
  - Un-equal (user defined)
  - C-Series (preset series)
  - E-Series (user defined)
- Output banks control for 16 banks and 8 banks.
- Capable of doing kVAr measurements every cycle of the mains waveform.
- Optional GSM connectivity via rear-side RS-232 Port.
- DIN Standard 144 x 144 mm cabinet for panel-door flush mounting.
- Serial communication through dedicated protocol.
- Selectable rear serial com. port – MOD-BUS RS-485 or RS-232.
- A RS-232 comm. port with Dedicated protocol, on front fascia.
- Logging of 2 months data in the form of *Hourly Records*, *Fault Records* & *Daily Records* – recording all electrical parameter values.
- Protections provided:
  - Over/Under Voltage
  - Cap. Over/Under Current / THD.
  - Over/Under Frequency
  - Over / Under Load.
  - Load Unbalance.
  - Panel Over Temperature & APFC Internal Over Temperature.
  - Out of steps (Insufficient Total Cap. kVAr, only for indication.
  - Non-Volatile, Battery-backed Memory, Battery-down.All these are user settable.

## Specifications:

- Feed-back Voltage: 3-Ph, 3-W, Nom. 110 V (+20% to -30%).
- Current input: Selectable 1A or 5A for both load & capacitor.
- Measurement Accuracy: 2% (Dynamic range 10).
- Auxiliary Supply: Nominal 415 V ac (+15% to -15%).
- Correction time:  
Selectable in Seconds from 2 Minutes to 180 Minutes.
- Bank Switching O/P commands: 16 (HTPF-03/16) or 8 (HTPF-03/08). ('N.O.' Relay Contacts of Inductive rating 0.5 Amp ac / 250 V ac).
- RS-232 baud rate selectable up to 57.6 kbps.
- Dedicated R-S232 port on front fascia for Logged-Data off-loading
- Selectable RS-485 (Multi-Drop) or RS-232 port on rear.
- Connection provided for Panel Temperature Probe (PT-100).
- Operating Temperature: 0 to +55°C.
- Storage temperature: -5 to +60°C.
- Relative Humidity: 10 to 90% (Non-Condensing)
- AC Mains Supply frequency: Nominal 50 Hz, Range: 47 Hz to 53 Hz.

**Mechanical dimensions:** All Dimensions given are in mm.

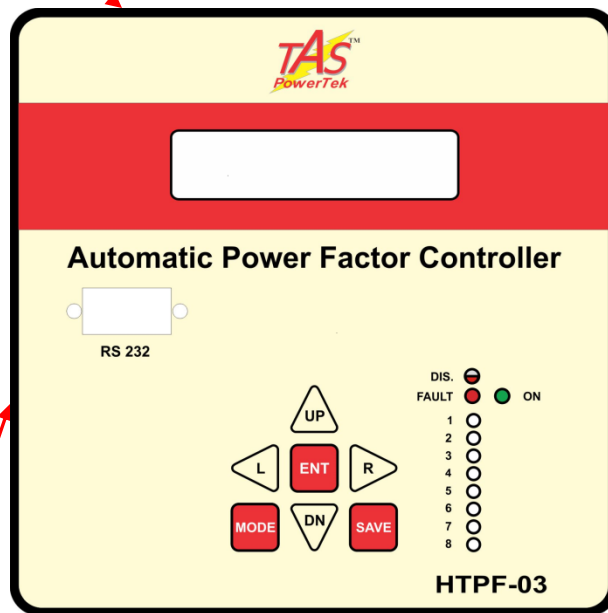


Recommended size for cut-out on panel door is 138 x 138 mm.  
Maximum weight: (with clamps and terminals) = 2.5 kg.

# Front fascia

Keyboard, LCD display, LED indications and communication port

LCD Display

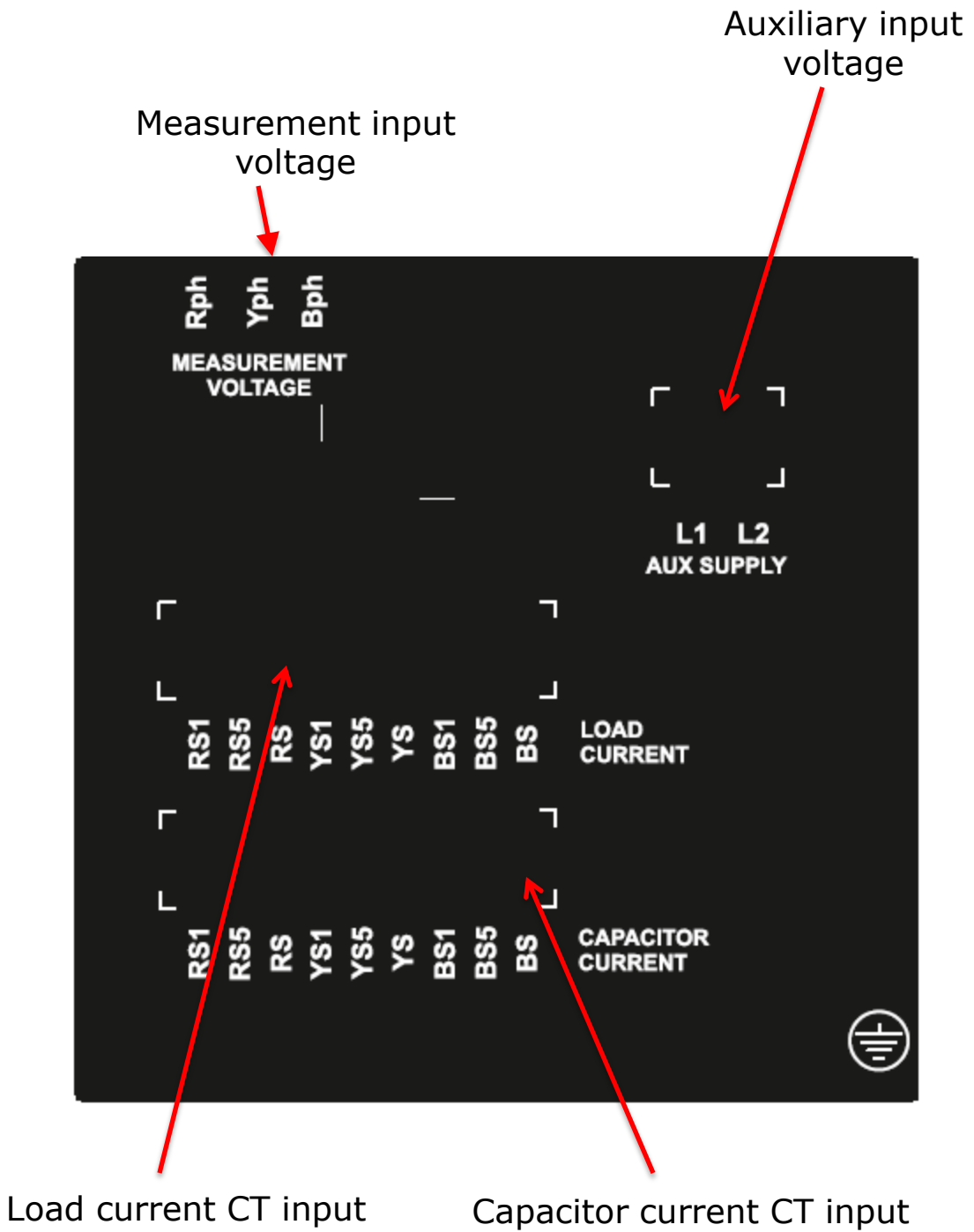


RS-232 port with dedicated protocol.

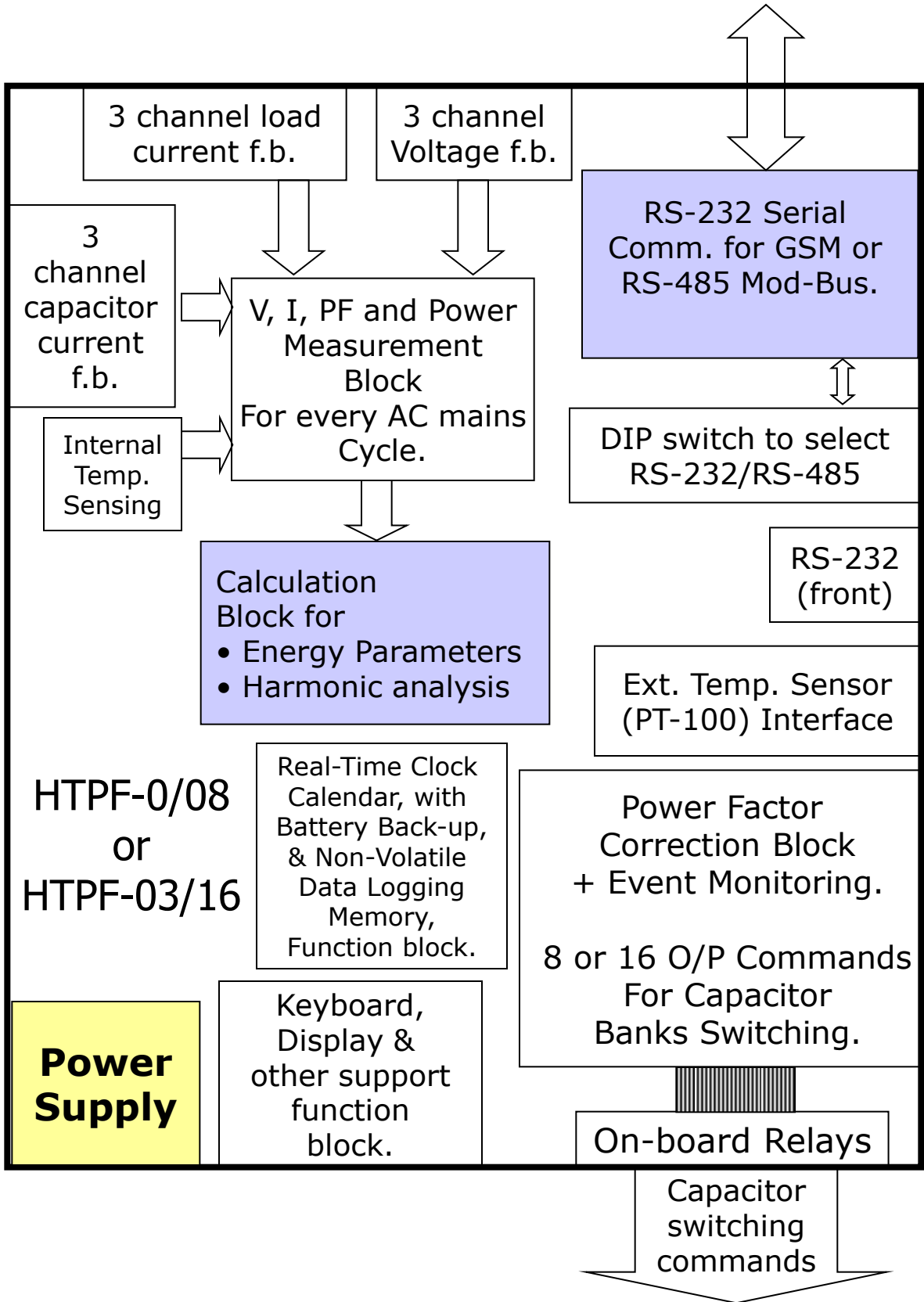
7-Keys Key-pad

LED indications:  
Step ON/OFF,  
Fault, Capacitor  
Bank Discharging

# Back side terminals



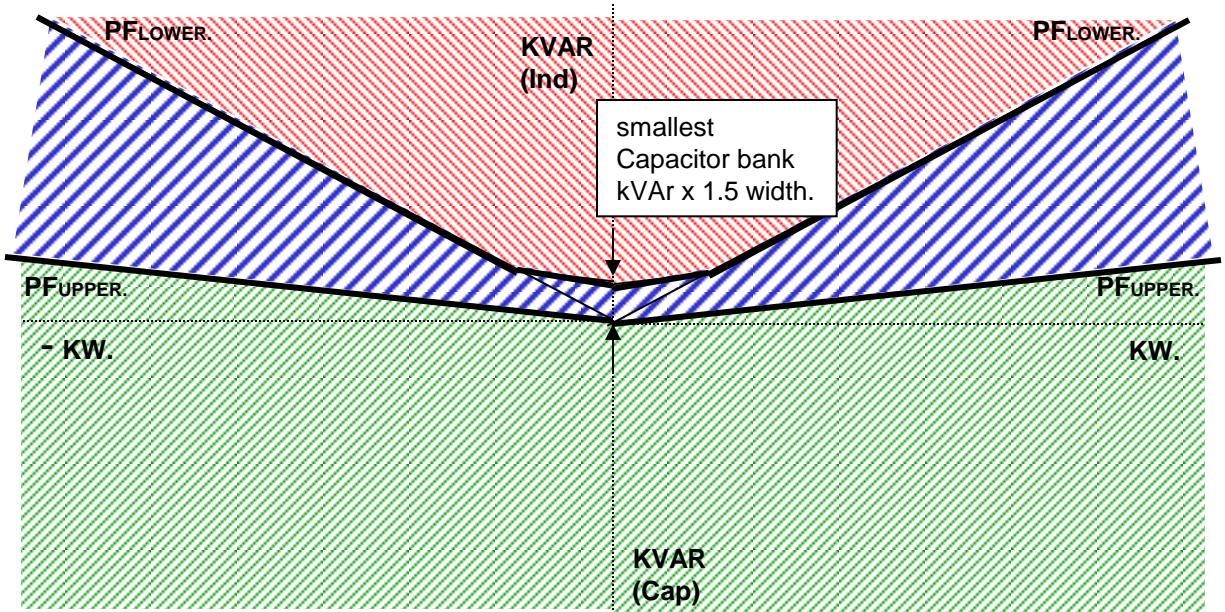
# Functional Block Diagram



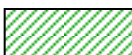




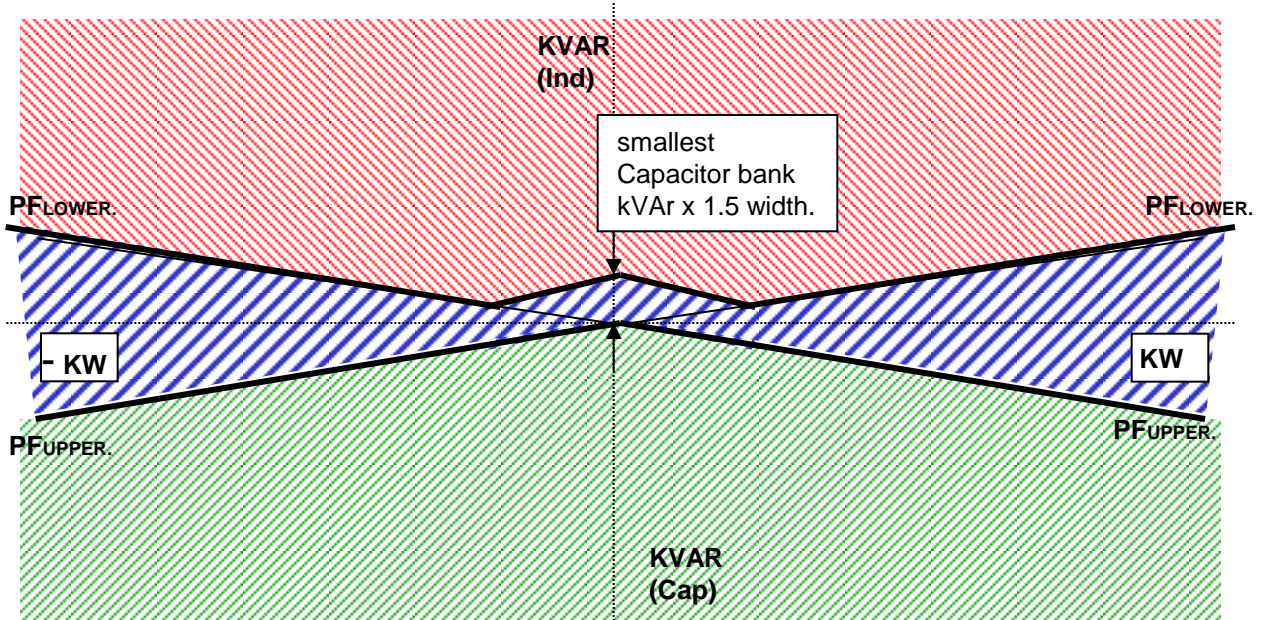
# PF correction technique

Case-1: PF-UPPER & PF-LOWER both set as inductive:

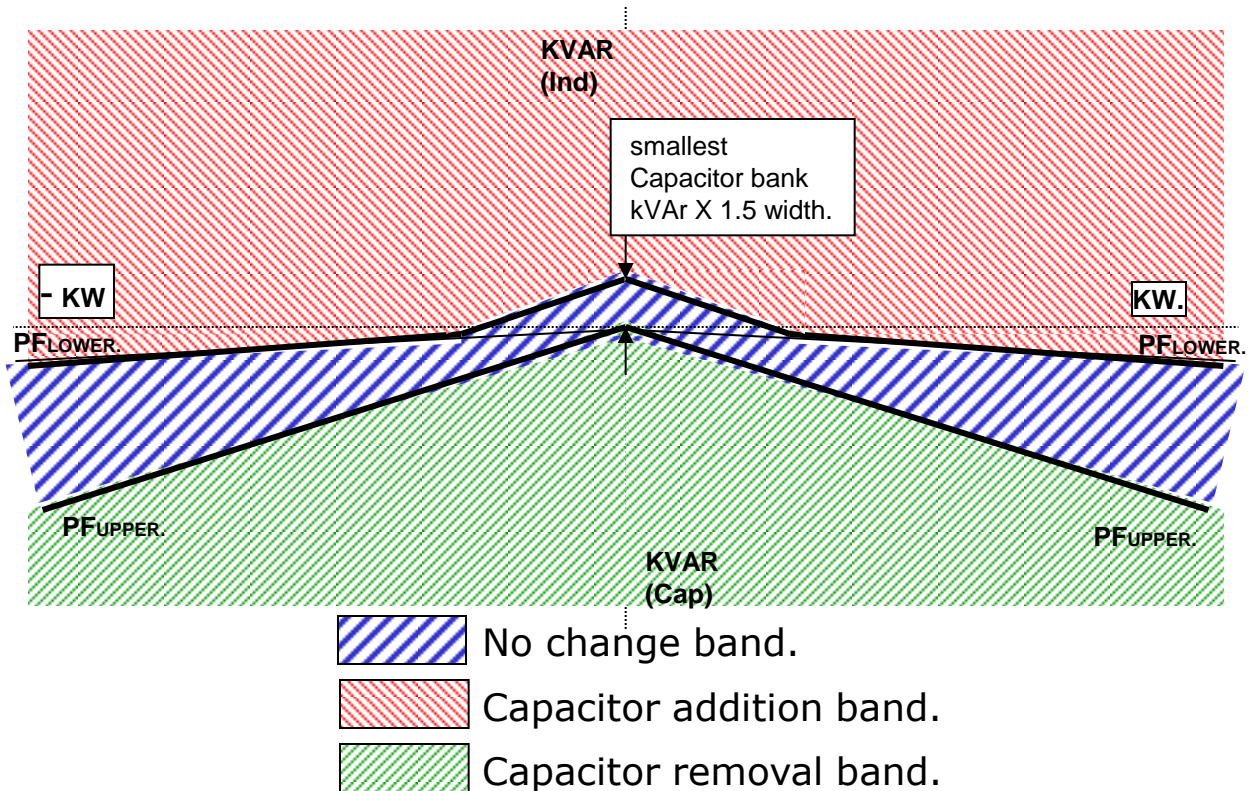


-  No change band.
-  Capacitor addition band.
-  Capacitor removal band.

Case-2: PF-UPPER as Capacitive & PF-LOWER set as Inductive:



### Case-3: PF-UPPER & PF-LOWER both set as Capacitive:



There are two PF set points to be set in HTPF-03/16 or HTPF-03/08. The UPPER limit and the LOWER limit. HTPF-03/16 or HTPF-03/08 ensures that PF-UPPER is never exceeded.

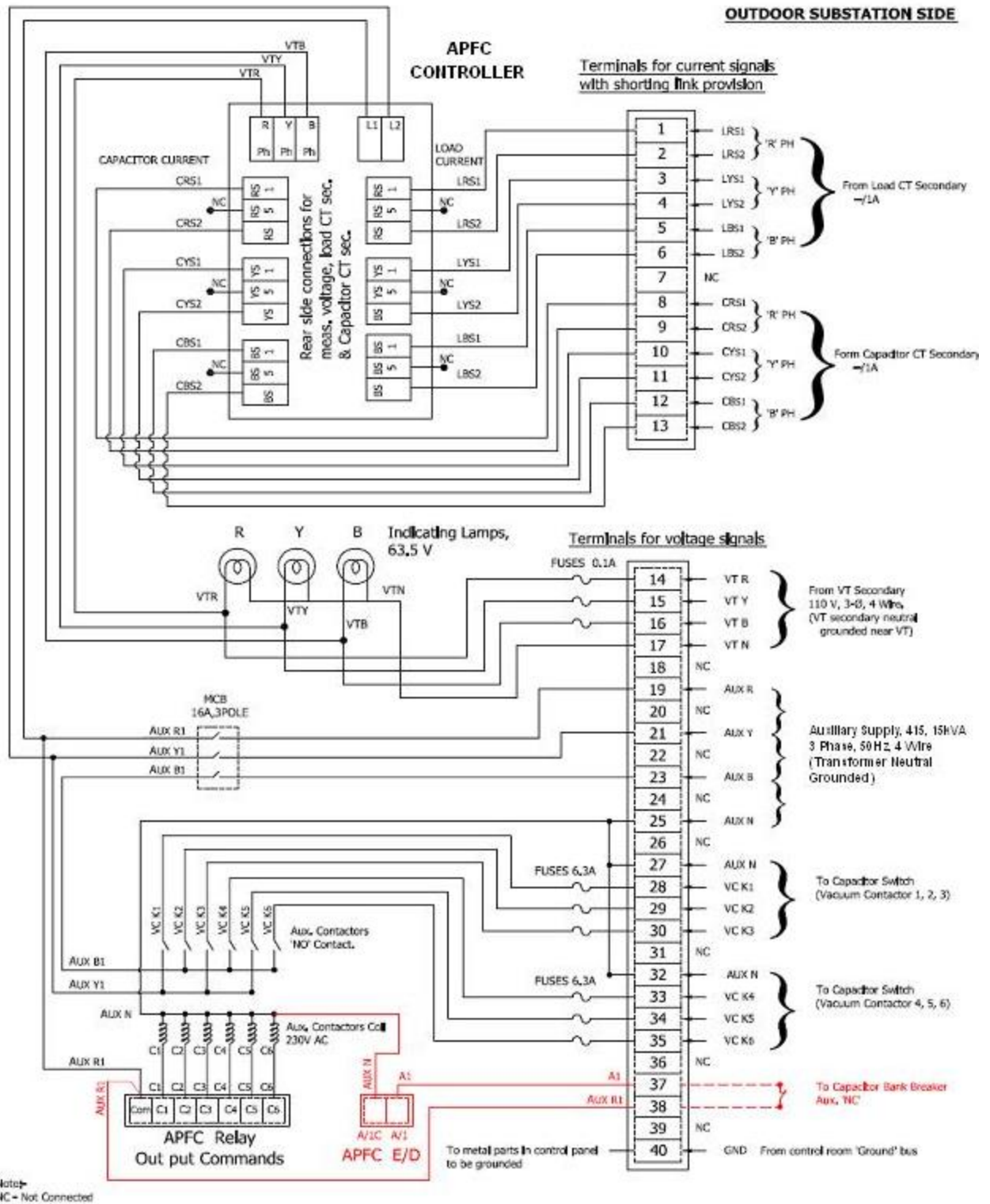
Additionally, "No change band" to minimum kVAR band size equal to smallest bank kVAR x 1.5 ensures no hunting during the low kW loading.

HTPF-03/16 or HTPF-03/08 is normally set for PF settings as per first two diagrams shown where PF<sub>LOWER</sub> is inductive. This philosophy helps to optimize the system maximum kVAR to be used as well as reduces the number of switching operations during higher loading conditions. This ensures better life expectancies of the switched capacitors as well as the switching devices such as Internal Relays or External Contactors.

This methodology of kVAR compensation reduces the complex settings that are used by conventional PF Relays. The settings like C/K ratio and kVAR offsets/shifts are eliminated which makes HTPF-03/16 and HTPF-03/08 user friendly, and thus easy to commission.

Typical example of 4-quadrant operation is "Co-Generation Plants" and "Wind-Power Generation".

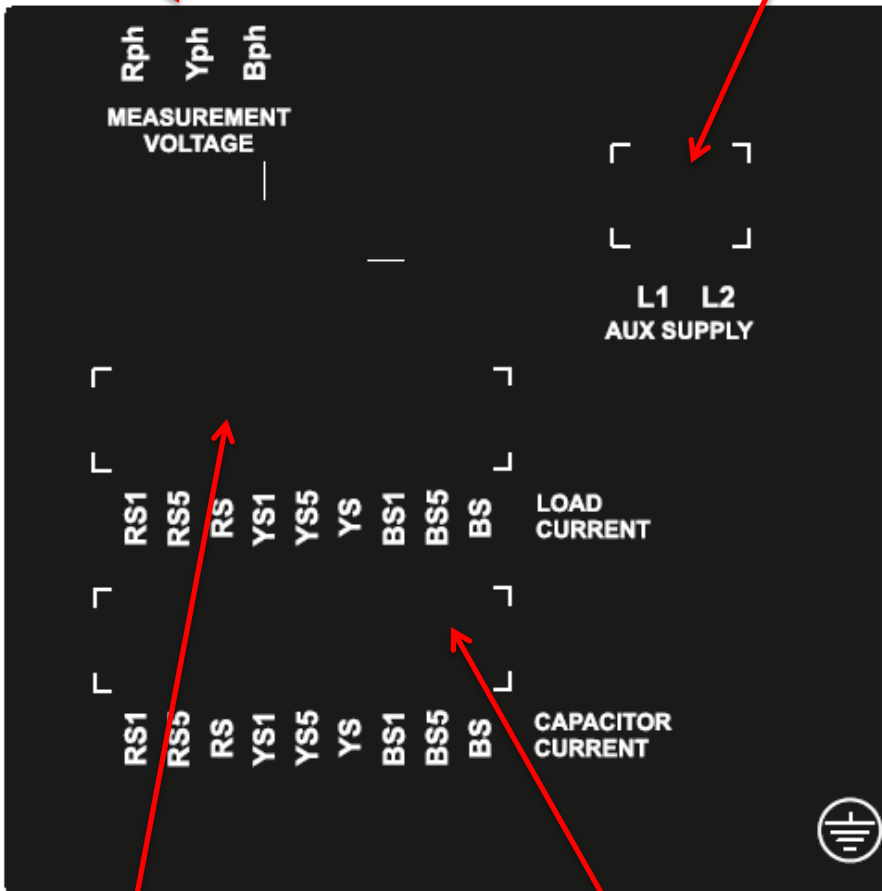
# Typical wiring diagram for PF correction



# Rear side terminals – measurement voltages, measurement currents, capacitor current, auxiliary operating supply voltage

Voltage feedback input connections  
**110V (L-L), 3-Phase, 3-Wire**

Auxiliary supply voltage i/p connections  
**415 Vac (nominal)**



Load current CT i/p connections  
**Selectable 1A or 5A**  
 Example: For R-phase CT, Select either RS1 (1A) or RS5 (5A) along with RS (common). Similarly for Y-phase and B-phase.

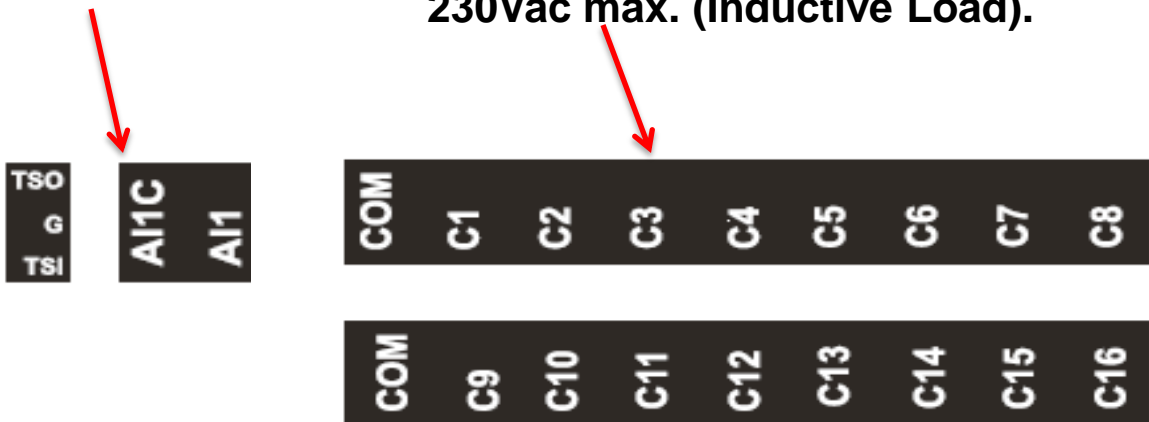
Capacitor current CT i/p connections  
**Selectable 1A or 5A**  
 Example: For R-phase CT, Select either RS1 (1A) or RS5 (5A) along with RS (common). Similarly for Y-phase and B-phase.

## Bottom side terminals – output commands, auxiliary digital input & outputs and serial data communication

Output commands to capacitor contactors. 16 outputs for HTPF-03/16 and 8 outputs HTPF-03/08.

**COM = common,**  
**C1...C16) = potential-free, N.O. Relay**  
**Contacts, Contact Rating: 0.5A,**  
**230Vac max. (Inductive Load).**

Auxiliary Digital input  
**AI1C = common,**  
**AI1 = 120 - 230Vac**



Data communication port. Two options are possible, depending on configuration of DIP switch

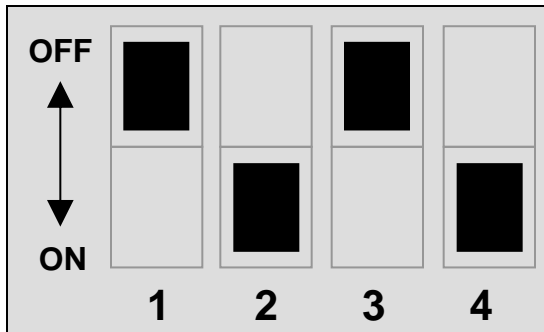
1. **RS-485 on [D+, D-, G] if DIP positions 1 & 3 only are ON.**
2. **RS-232 on [TX, RX, G] if DIP positions 2 & 4 only are ON.**
3. **Do not keep all 4 Switches in ON position simultaneously.**



Auxiliary Digital outputs – 2 Nos.  
 Potential-free, N.O. Contacts,  
 Contact Rating: 5A, 230 Vac  
**A01 = 230 V ac,**  
**A01C = common,**  
**A02 = 230 V ac,**  
**A02C = common**

# Terminals / Switches available on sides:

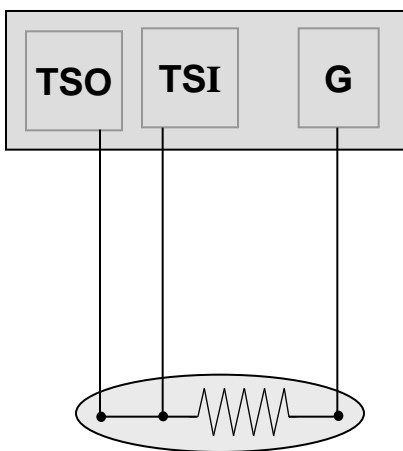
## DIP switch selector for communication, External Temperature Sensor Terminals



Terminals on left side of controller – DIP switch for selection of communication protocol through port available on bottom side.

- 1. Positions 1 & 3 only ON = RS-485 enabled.**
- 2. Positions 2 & 4 only ON = RS-232 enabled.**

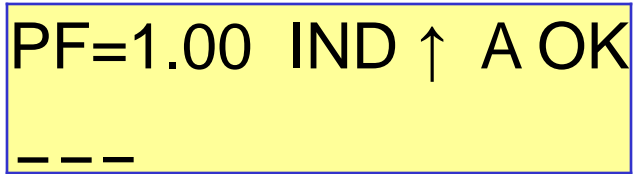
Do not use all 4 Switches in ON position. Select only one option at any time, RS-232 for GSM or RS-485 for MOD-Bus.



External RTD Temperature sensor input terminals provided on top side. Use only the RTD Sensor, PT100. The RTD is not provided with Controller. It is user installed. It is for monitoring Panel inside Temperature.

3-Wire PT100 RTD Temperature Sensor, user installed.

# Front fascia – LCD screen, LED indications



**First** line of display indicates the PF value, inductive / capacitive PF, mode of operation and fault / OK status:

"PF = 1.00" indicates the overall PF of the system.

"IND" or "CAP" indicates if this PF is inductive or capacitive respectively.

"A" or "M" indicates the Auto and Manual mode of operation respectively.

"OK" (blinking) indicates status of the system, healthy or faulty.

Last two characters represent one of the following status:

OK	Controller status is okay.
VA	Measurement voltage is absent
OD	Outputs are disabled
UC	Under capacitor current
OC	Over capacitor current
NV	NV RAM check sum error
BF	Battery fail
ET	Over external temperature

LU	Load unbalance
OB	Out of banks (Insufficient Cap. kVAR)
OH	Over capacitor current THD
UT	Over internal temperature
UF	Under Line-Frequency
OF	Over Line-Frequency
UV	Under voltage
OV	Over voltage

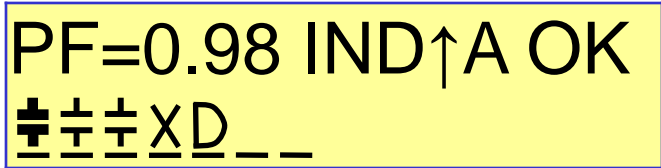
**Second** line indicates the status of each capacitor bank by symbols. The status is also shown by LEDs provided on the front fascia. Following table gives the description of symbols & LEDs.

Symbol	LED	Description
		bank is in ON state.
		bank is in OFF state.
		bank is declared as FIXED & is in ON state.
		bank is declared FAULTY & not available for use
		output stage is not used in the system.
		bank is in CAP. DISCHARGE mode (blinking Red LED)

# Front fascia:

## LCD screen, RS-232 communication port

Example of a typical LCD display screen is show below:



### Meaning of this screen contents:

Total no. of banks connected is seven.

Power Factor at Load sensing CT is 0.98 'IND' Inductive. ('CAP' defines Capacitive).

Unit is operating in 'A' Auto mode. ('M' defines Manual mode)

Total number of banks that are operational are eight.

Bank no. 1 is declared as fixed and is in ON condition.

Bank nos. 2 and 3 are in ON condition.

Bank no. 4 is declared as faulty.

Bank no. 5 is in capacitor discharging state.

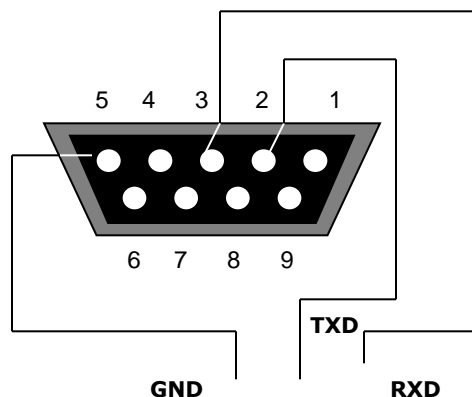
Bank nos.6 and 7 are in off state. Ready to be switched on.

Bank (output) no. 8 is not used / not connected.

## Front side RS-232 communication port connection

This port is used for downloading of data logged in the controller memory. The protocol used is RS-232. Following gives the pin configuration:

Pin	PC side	Connect	HTPF-03/xx
1	NC		
2	RXD	—————	TXD
3	TXD	—————	RXD
4			
5	GND	—————	GND
6			
7			
8			
9	NC		



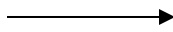
RS-232, 9-pin D type Male Connector on Controller Side



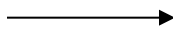
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# Front fascia – Keyboard

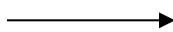
Keyboard with soft touch keys are provided on the front fascia of the controller. The various keys are:



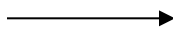
UP key. Used to scroll up the menu screen; increment values when entering numbers. Also used for changing the status of banks.



DOWN key. Used to scroll down the menu screen; decrement values when entering numbers. Also use to change status of bank.



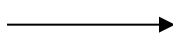
RIGHT key. Used to shift the cursor to right; Also used to increase the contrast of LCD in default display screen mode.



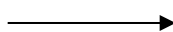
LEFT key. Used to shift the cursor to left; Also used to decrease the contrast of LCD in default display screen mode.



ENTER key. Used for entering a submenu or for setting up values.



PROGRAM key. Used for selecting modes of operation and editing of parameters



MEMORY key. Used to save all changes made in Edit Parameters menu.

## Display of various parameters:

Values of various parameters can be viewed by using UP / DN keys & then pressing ENT key. To exit a sub-menu press PROGRAM Key.

PF=0.98 IND↑AOK ████XD__	This is factory set default display screen giving information on PF, mode, bank & controller status.
Display Overall Values	Overall values gives the average values of system parameters – V, I, kW, kVAr, kVA, Ic, C-kVAr. Load side PF, kVAr, kVA & frequency.
Display Per-Phase RMS	Per Phase RMS values of voltage, current, neutral current & capacitor current.
Display Power	Displays per phase values of PF, kW, kVA, kVAr and Capacitive kVAr.
Display Energy	Displays overall energy parameters like KWH, Inductive & Capacitive kVArH, kVAH and C-kVArH.
Display Harmonics	Displays per phase THD for V, I, Neutral current & Capacitor as well as odd harmonics up-to 15 <sup>th</sup> .
Display Step kVAr	Displays the measured kVAr value of each connected output step.
Display Aux-Function	Displays the internal (cabinet) & external temperature.
Time: 17:38:00 Date: 25/09/13	Displays current time & date that is set on internal Real Time Clock.
TAS Ver. 2.0.9	Displays the version of software.

# Sub-menu for LCD Display of parameters

Overall Values	Per Phase RMS	Power	Display Load Side
Average Voltage 11000.1 V (L-L)	R-Y Voltage 11000.1 V (L-L)	R- Phase PF 1.000 IND	R-Y Voltage 11000.1 V (L-L)
Average Current 1000.5A	Y-B Voltage 11000.1 V (L-L)	Y- Phase PF 1.000 IND	Y-B Voltage 11000.1 V (L-L)
Active Power 110000.1 KW	B-R Voltage 11000.1 V (L-L)	B- Phase PF 1.000 IND	B-R Voltage 11000.1 V (L-L)
Reactive Power 000010.0 KVAR	R- Phase Current 1000.0 A	R- Phase KW 000250.0	R- Phase Current 1000.0 A
Apparent Power 000442.0 KVA	Y- Phase Current 1000.0 A	Y- Phase KW 000250.0	Y- Phase Current 1000.0 A
Cap- Current 0009.6 A	B- Phase Current 1000.0 A	B- Phase KW 000250.0	B- Phase Current 1000.0 A
C- KVAR 000006.1	Neutral Current 0001.0 A	R Phase KVAR 000005.7	R- Phase PF 1.000 IND
Load Side PF 0.998 IND	R- Phase Cap Cur 1000.0 A	Y Phase KVAR 000005.7	Y- Phase PF 1.000 IND
Load Side KVAR 000016.1	Y- Phase Cap Cur 1000.0 A	B Phase KVAR 000005.7	B- Phase PF 1.000 IND
Load Side KVA 000438.1	B- Phase Cap Cur 1000.0 A	R Phase KVA 000256.0	
Frequency 50.0 Hz		Y Phase KVA 000256.0	
		B Phase KVA 000256.0	
		R- Phase CKVAR 000002.3	
		Y- Phase CKVAR 000003.1	
		B- Phase CKVAR 000002.4	
<b>Energy</b>			
KWH 0000000.000			
IND KVARH 0000000.000			
CAP KVARH 0000000.000			
KVAH 0000000.000			
C-KVARH 0000000.000			

continued..

# Sub-menu for LCD Display of parameters, shown for HTPF-03/08

Harmonics	Step kVAr	Aux Function
Vr- THD- F 000.0%	Step[01] kVAr 0450.0	INT- Temperature 45 Deg C
Vy- THD- F 000.0%	Step[02] kVAr 0450.0	EXT- Temperature 45 Deg C
Vb- THD- F 000.0%	Step[03] kVAr 0450.0	
Ir- THD- F 000.0%	Step[04] kVAr 0450.0	
Iy- THD- F 000.0%	Step[05] kVAr 0900.0	
Ib- THD- F 000.0%	Step[06] kVAr 0900.0	
In- THD- F 000.0%	Step[07] kVAr 0900.0	
CCr- THD- F 000.0%	Step[08] kVAr 0900.0	
CCy- THD- F 000.0%		
CCb- THD- F 000.0%		

continued..

continued..

Harmonic data of various current & voltage parameters can be viewed by pressing ENT on the respective parameter screen of the Harmonics menu. Following are the sub-menus giving the harmonic data of voltage, current & capacitor current for each phase.

### Voltage (V) Harmonics

Vr- Harmonics 03 <sup>rd</sup> : 00.0 %	Vy- Harmonics 03 <sup>rd</sup> : 00.0 %	Vb- Harmonics 03 <sup>rd</sup> : 00.0 %
Vr- Harmonics 05 <sup>th</sup> : 00.0%	Vy- Harmonics 05 <sup>th</sup> : 00.0%	Vb- Harmonics 05 <sup>th</sup> : 00.0%
Vr- Harmonics 07 <sup>th</sup> : 00.0 %	Vy- Harmonics 07 <sup>th</sup> : 00.0 %	Vb- Harmonics 07 <sup>th</sup> : 00.0 %
Vr- Harmonics 09 <sup>th</sup> : 00.0%	Vy- Harmonics 09 <sup>th</sup> : 00.0%	Vb- Harmonics 09 <sup>th</sup> : 00.0%
Vr- Harmonics 11 <sup>th</sup> : 00.0 %	Vy- Harmonics 11 <sup>th</sup> : 00.0 %	Vb- Harmonics 11 <sup>th</sup> : 00.0 %
Vr- Harmonics 13 <sup>th</sup> : 00.0 %	Vy- Harmonics 13 <sup>th</sup> : 00.0 %	Vb- Harmonics 13 <sup>th</sup> : 00.0 %
Vr- Harmonics 15 <sup>th</sup> : 00.0 %	Vy- Harmonics 15 <sup>th</sup> : 00.0 %	Vb- Harmonics 15 <sup>th</sup> : 00.0 %

### Load Current (I) Harmonics

Ir- Harmonics 03 <sup>rd</sup> : 00.0 %	Iy- Harmonics 03 <sup>rd</sup> : 00.0 %	Ib- Harmonics 03 <sup>rd</sup> : 00.0 %	In- Harmonics 03 <sup>rd</sup> : 00.0 %
Ir- Harmonics 05 <sup>th</sup> : 00.0%	Iy- Harmonics 05 <sup>th</sup> : 00.0%	Ib- Harmonics 05 <sup>th</sup> : 00.0%	In- Harmonics 05 <sup>th</sup> : 00.0%
Ir- Harmonics 07 <sup>th</sup> : 00.0 %	Iy- Harmonics 07 <sup>th</sup> : 00.0 %	Ib- Harmonics 07 <sup>th</sup> : 00.0 %	In- Harmonics 07 <sup>th</sup> : 00.0 %
Ir- Harmonics 09 <sup>th</sup> : 00.0%	Iy- Harmonics 09 <sup>th</sup> : 00.0%	Ib- Harmonics 09 <sup>th</sup> : 00.0%	In- Harmonics 09 <sup>th</sup> : 00.0%
Ir- Harmonics 11 <sup>th</sup> : 00.0 %	Iy- Harmonics 11 <sup>th</sup> : 00.0 %	Ib- Harmonics 11 <sup>th</sup> : 00.0 %	In- Harmonics 11 <sup>th</sup> : 00.0 %
Ir- Harmonics 13 <sup>th</sup> : 00.0 %	Iy- Harmonics 13 <sup>th</sup> : 00.0 %	Ib- Harmonics 13 <sup>th</sup> : 00.0 %	In- Harmonics 13 <sup>th</sup> : 00.0 %
Ir- Harmonics 15 <sup>th</sup> : 00.0 %	Iy- Harmonics 15 <sup>th</sup> : 00.0 %	Ib- Harmonics 15 <sup>th</sup> : 00.0 %	In- Harmonics 15 <sup>th</sup> : 00.0 %

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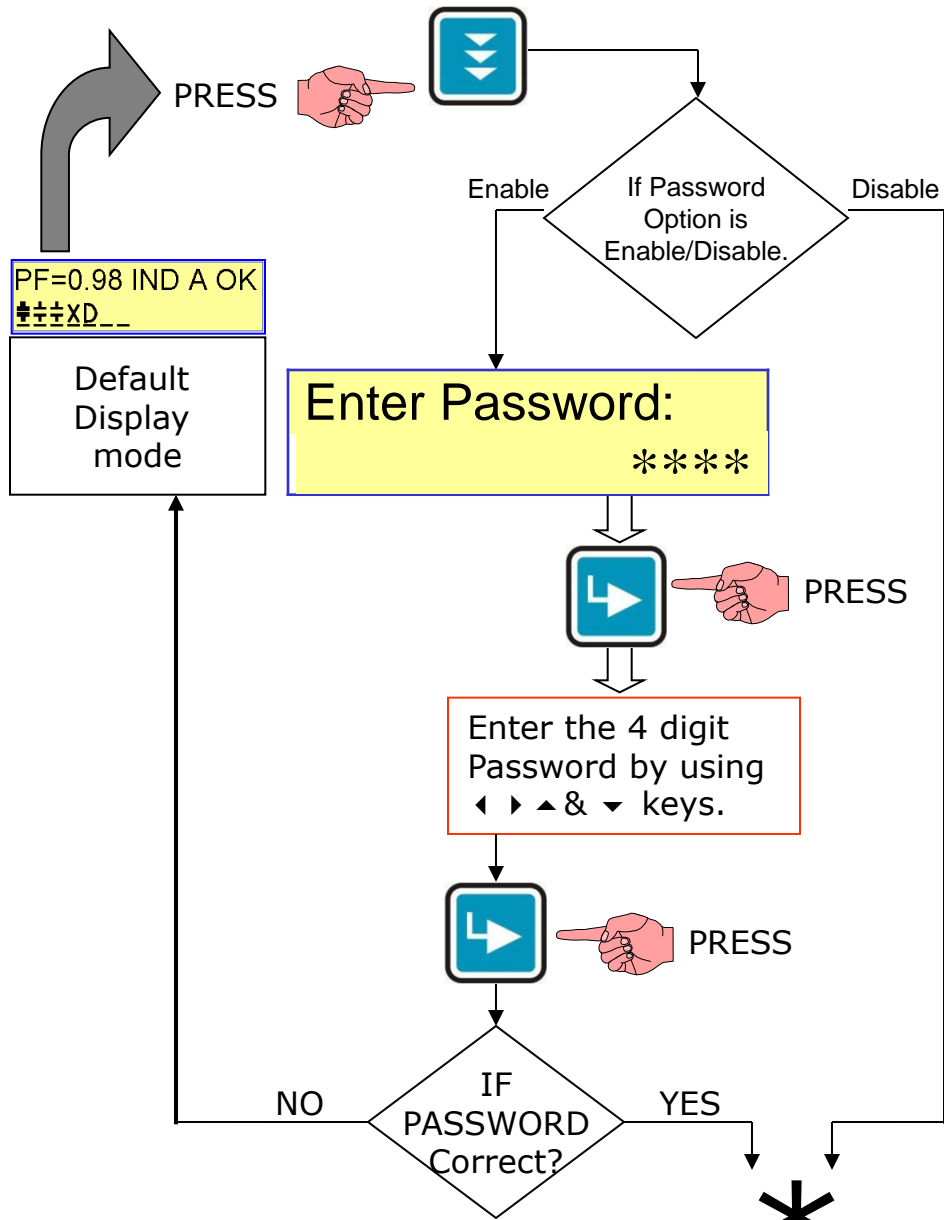
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## Capacitor Current (CC) Harmonics

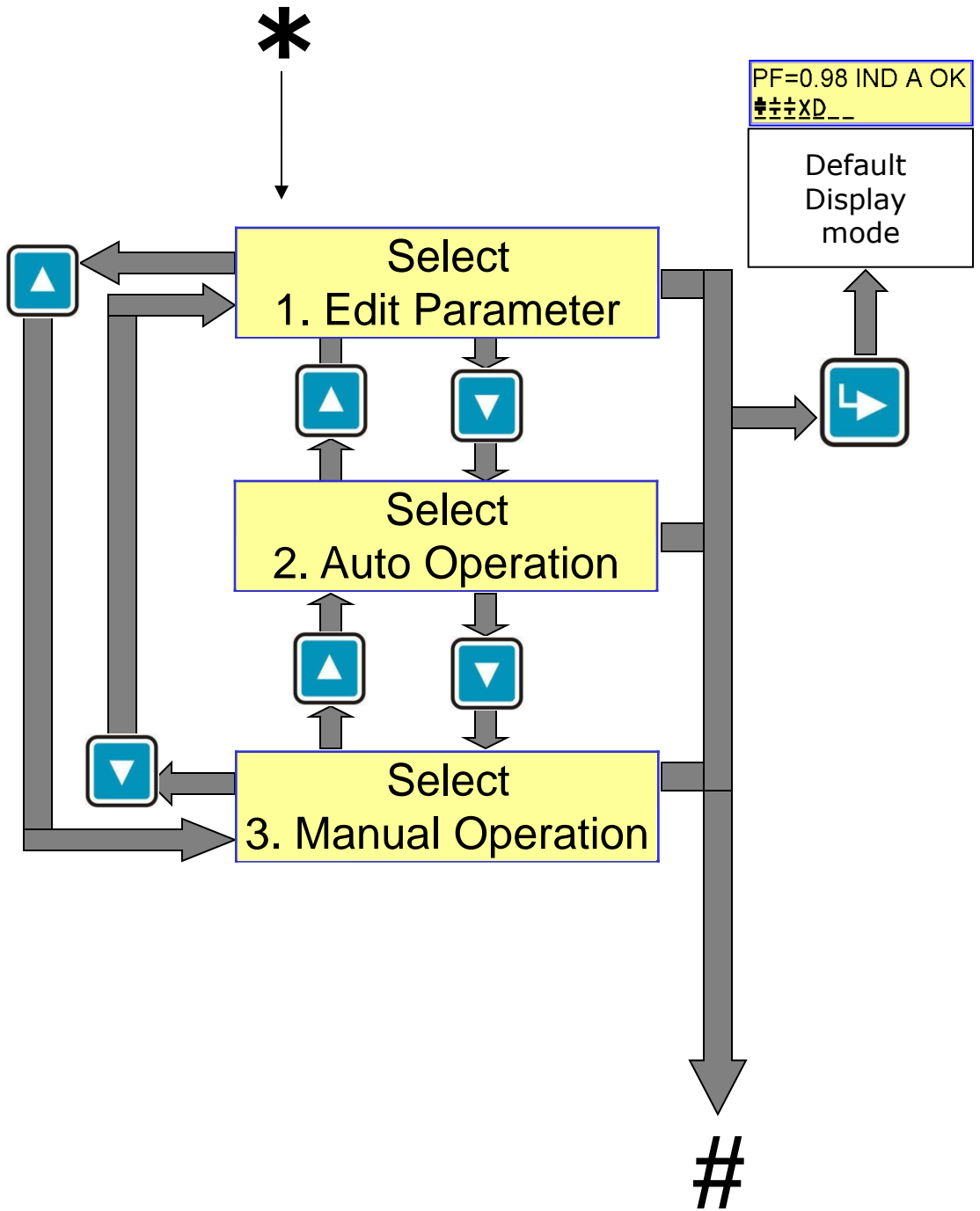
CCr- Harmonics 03 <sup>rd</sup> : 00.0 %	CCy- Harmonics 03 <sup>rd</sup> : 00.0 %	CCb- Harmonics 03 <sup>rd</sup> : 00.0 %
CCr- Harmonics 05 <sup>th</sup> : 00.0%	CCy- Harmonics 05 <sup>th</sup> : 00.0%	CCb- Harmonics 05 <sup>th</sup> : 00.0%
CCr- Harmonics 07 <sup>th</sup> : 00.0 %	CCy- Harmonics 07 <sup>th</sup> : 00.0 %	CCb- Harmonics 07 <sup>th</sup> : 00.0 %
CCr- Harmonics 09 <sup>th</sup> : 00.0%	CCy- Harmonics 09 <sup>th</sup> : 00.0%	CCb- Harmonics 09 <sup>th</sup> : 00.0%
CCr- Harmonics 11 <sup>th</sup> : 00.0 %	CCy- Harmonics 11 <sup>th</sup> : 00.0 %	CCb- Harmonics 11 <sup>th</sup> : 00.0 %
CCr- Harmonics 13 <sup>th</sup> : 00.0 %	CCy- Harmonics 13 <sup>th</sup> : 00.0 %	CCb- Harmonics 13 <sup>th</sup> : 00.0 %
CCr- Harmonics 15 <sup>th</sup> : 00.0 %	CCy- Harmonics 15 <sup>th</sup> : 00.0 %	CCb- Harmonics 15 <sup>th</sup> : 00.0 %

# Method for keyboard / display usage

Flowchart for entering into different modes:

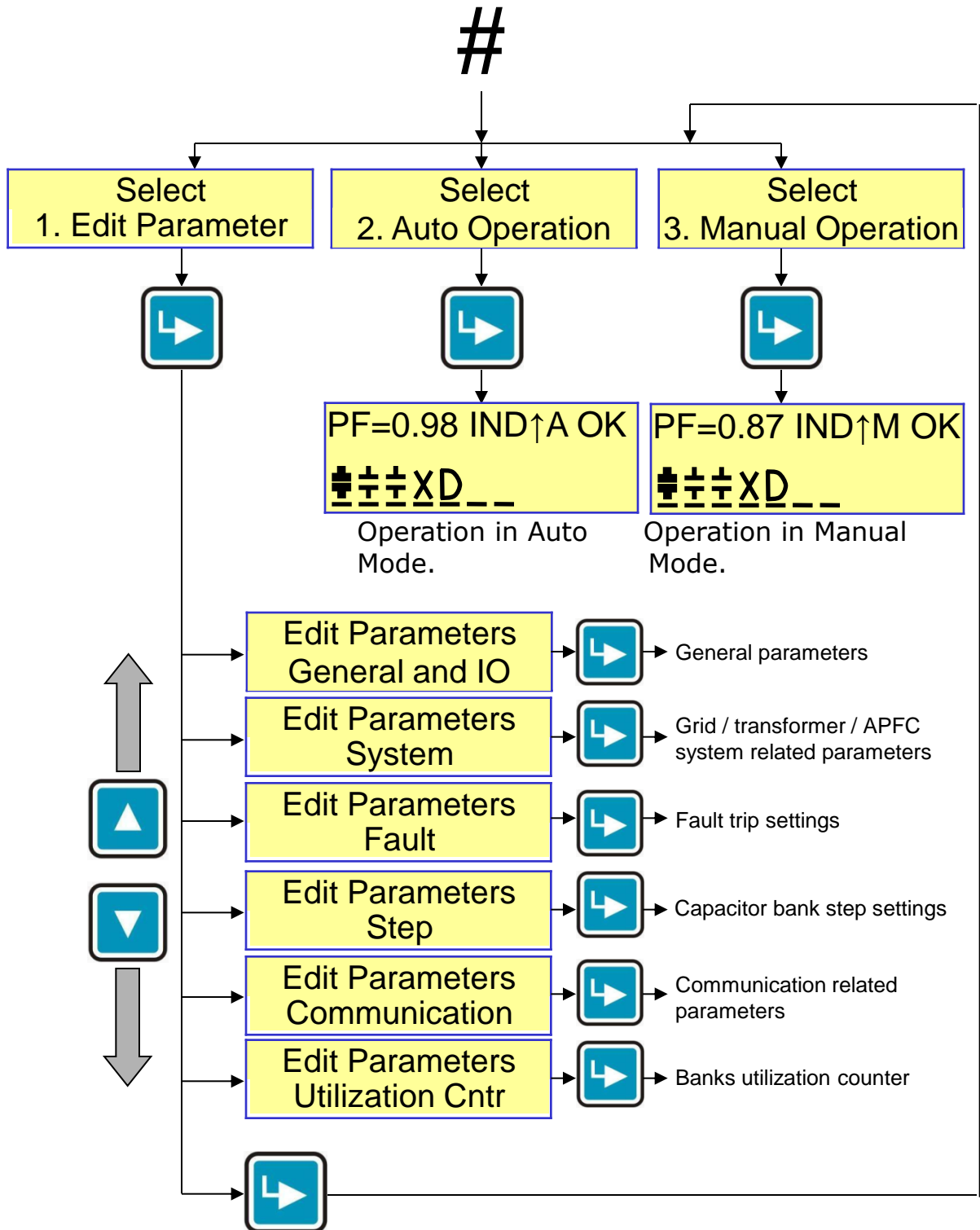


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# Keyboard / Display operations

## Mode Selection

There are two modes of operation (Manual and Auto) and one mode for data entry (Edit Parameters).

Press the PROGRAM key. Enter password (if enabled) by using ◀ ▶ ▲ ▼ keys. Press ENTER. Now using ▲ ▼ keys, select the Mode of operation:

- **AUTO OPERATION**
- **MANUAL OPERATION**
- **EDIT PARAMETERS**

Then press ENTER to enter the specific mode.

### **Auto Operation:**

For functioning in automatic compensation.

### **Manual Operation:**

Pressing ENTER button on this screen will put HTPF-03/16 or HTPF-03/08 in Manual mode. This mode would continue to run till it is purposefully changed or power down occurs.

This mode is normally used to perform the operations like:

- Resetting of faulty banks to healthy status.
- Checking the Capacitor banks by turning them ON/OFF.
- Declaring specific bank/s faulty. Masking of the banks so that once auto-mode is selected, these faulty declared banks would not be used for PF correction.

### For Declaring banks faulty or Resetting faulty banks:

In manual mode default screen, press ENTER key.

The cursor above bank 1 will start blinking. Use ◀ ▶ keys to select the specific bank. Then use ▼ key to declare it faulty.

To reset the faulty bank, bring the blinking cursor to that bank and use ▼ key again to declare that bank as healthy.

After any of these operations, press ENTER key so that cursor stops blinking. To save the status on permanent basis (so that even after Power down, the status is unchanged), press MEMORY key. After saving the settings, the unit will jump back to default mode. (Default as Auto or Manual is set in Edit Parameters).

continued..

...continued.

For Testing banks with manual ON / OFF commands:

Press ENTER key, the cursor will start blinking. Use ◀ ▶ keys to select the specific bank/s that are healthy and use ▲ key to turn ON and use ▼ key to turn OFF that capacitor banks. To come out of Manual ON/OFF edit mode, press ENTER key so that cursor stops blinking.

**❖ Following table shows the allowable simultaneous CT & PT Ratio values for a MAX. 50 MVA System: Please work-out the correct values if Measurement Voltage is other than 110 V AC, 50 Hz.**

<b>HT Controller Maximum Allowable Simultaneous PT &amp; CT Ratios for max. 50 MVA System. Measurement AC Voltage = 110.</b>	
<b>PT Ratio</b>	<b>Max. CT ratio</b>
50	5248
100	2624
150	1749
200	1312
250	1049
300	874
350	749
400	656
450	583
500	524
550	477
600	437

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### **Edit Parameters:**

This mode is used to carry out system settings. In this mode various system settings can be carried out. To do the same, use the ▲ ▼ keys and select the type of parameters to be edited. The types of parameters that can be edited are:

- General & IO** : For general settings.
- System** : For mains/generator system settings.
- Fault** : Fault settings.
- Step** : Capacitor bank step settings.
- Communication** : Communication parameters.
- Utilization counter**: Bank operations utilization counters.

After selecting the type, press ENTER to enter the sub-menu of that specific type.

The details of these sub-menus for every type is given further.

You can edit all these sub-menu settings by using the ENTER, ▲, ▼, ◀, and ▶ keys

To come out of the sub-menu press PROGRAM key once.

To store the edited parameters permanently, press SAVE when you are either in the Edit Parameters or any sub-menu area.

To come out of Edit Parameters without saving the changes press PROGRAM key again.

**Note:** In the Edit Parameters area, if no keys are pressed for more than a minute, the default display screen comes on and the changes done till that time are discarded.

# General & IO

PASSWORD	
Enable	: 1
CHANGE PASSWORD	
	: 0001
LOAD DEFAULT	
No	: 0
THD TO DISPLAY	
F-THD	: 1
RESET ENERGY CNT	
No	: 0
AUX IP1 FUNCTION	
None	: 0
AUX OP1 FUNCTION	
None	: 0
AUX OP2 FUNCTION	
None	: 0

Password: Enable or disable password.

Value: 0=Disable, 1=Enable.

Change Password: Set new value of password (4 digit). Factory default password is "0001"

Load Default: Loads factory set default parameters. 0=No, 1=Yes.

THD to Display: Type of THD to be displayed for V, I and CC. 0=R-THD (RMS), 1=F-THD (fundamental).

Reset Energy Counter: Reset all energy counters to zero. 0=No, 1=Yes.

Aux IP1 Function: Set an action through auxiliary input. 0=None, 1=O/p enable / disable, 2=Mains/Gen selection, 3=Reset faults.

Aux OP1 Function: Program the auxiliary output to become NC due to any of the following: 0=None, 1=Trip on fault, 2=System fault, 3=Out of step.

Aux OP2 Function: Same as above.

# System

Meas. Voltage	
	: 110
EXT-PT Ratio	
	100.0:1
CUR CT Primary	
Mains	: 1000
CUR CT Primary	
Genr	: 0500
CAP CUR CT Prim	
	: 1000
PF Up Lim : Mains	
[Ind :1]	0.980
PF Up Lim: Mains	
Ind : 1	[0.980]
PF Low Lim: Mains	
[Ind :1]	0.970
PF Low Lim: Mains	
Ind :1	[0.970]
PF Up Lim: Gen	
[Cap : 0]	0.820
PF Up Lim: Gen	
Cap:0	[0.820]
PF Low Lim: Gen	
[Cap:0]	0.800

Measured Voltage: Factory set parameter dependent on hardware. For viewing only.

Ext-PT ratio: By default set to 0100.0:1, but in case external PT is used, this ratio can be set again.

Cur CT Primary: (Mains & Generator): Feedback source current for Mains and Generator (if used with summation CTs). Limits: Lower: 0001 Upper: 5248.  
Capacitor Current CT Primary: For capacitor current. Limits: Lower: 0001 Upper: 5248.

Power Factor Limits: HTPF-03/08 and HTPF-03/16 has 2 set points. One for Mains & another for Generator. For both set-points, upper & lower limits can be defined as Upper PF and Lower PF. PF limits can be set as inductive or capacitive.

Mains / Generator: Defines if unit should use set-points defined for Mains (0) or for Generator (1)

continued..

PF Low Lim: Gen Cap:0 [0.800]
Mains Generator Mains : 0
EXT. Temp. Meas Disable :0

Ext. Temp. Meas: Enable or disable measurement of external (Outside APFC) temperature, that is Panel Inside Temperature.

## Fault

For most of the types of faults defined here, the options available are as hereunder:

Over vol fault Off Fix : 3
Over voltage Limit (%) :110
Over voltage Resume (%) :105
Under Vol fault Off Fix : 3
Under voltage Limit (%) :070
Under voltage Resume (%) :085
Over load fault Disable : 0
Over load Limit (%) :130
Over load Resume (%) :125
Under load kW fault Disable : 0
Under Ld. Limit (%) :020
Under Ld. Resume (%) :025

**0**=Disable

**1**=Indicate (Display a Fault Message & or store in Flash)

**2**=Off Step (Switch off Non-Fixed Steps one by one)

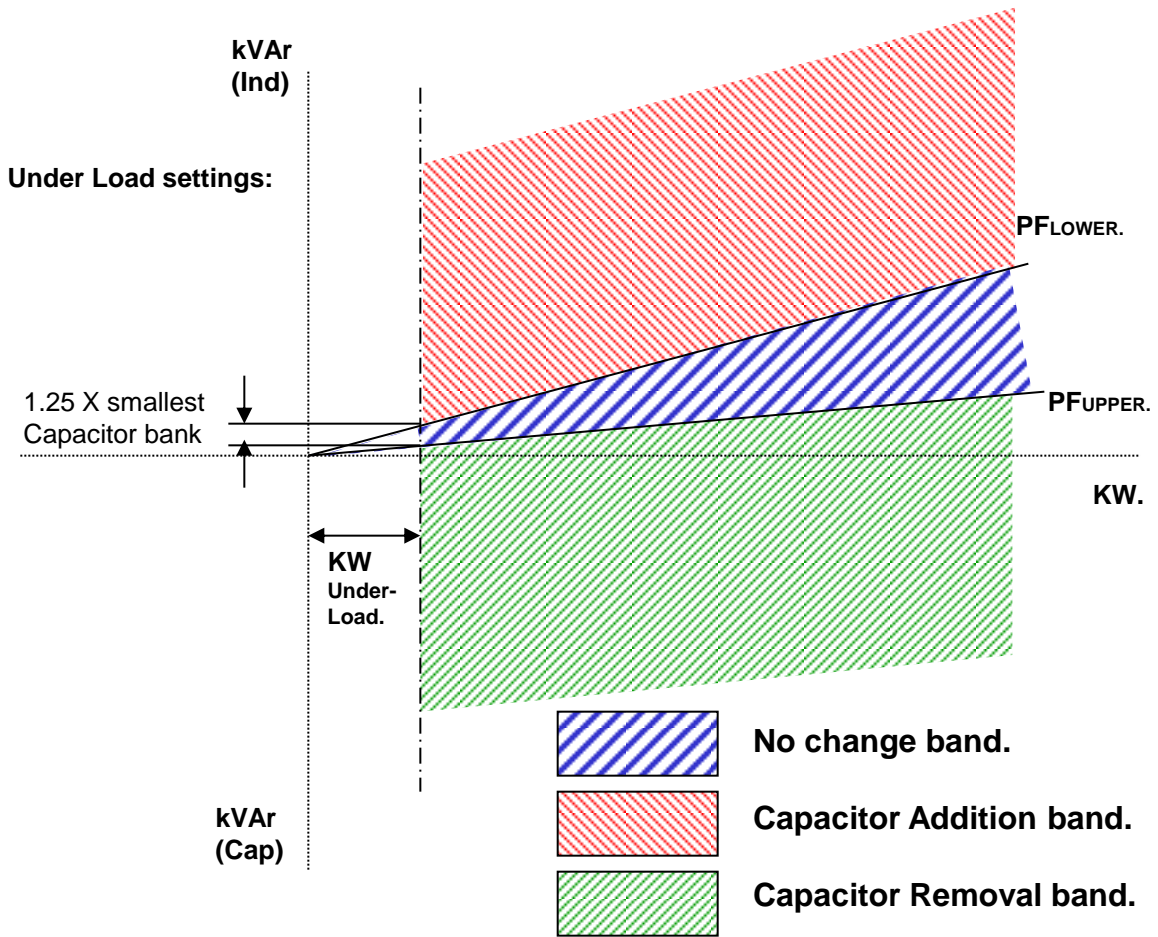
**3**=Off Fixed-Step Also (Switch off All Steps one by one)

**4**=Fast-Off Step (Switch off all Steps in one shot)

For all the faults, normally two limits are defined. One is Detection Limit and another Resume Limit. Detection Limit if exceeded by the parameter would mean the action as defined by parameter in type of fault (as given here-above). Resume Limit defines the parameter value below which the fault is deactivated.

- Over Voltage: As name suggests, its for Over-Voltage conditions.
- Under Voltage: For Under-Voltage conditions.
- Over Load: If HTPF-03/16 or HTPF-03/08 detects the supply system is over-loaded, then it is sometimes recommended to remove the capacitors out of circuit to reduce the fault current levels. Under such circumstances, this parameter is set. Alternately, it can be set to be Indicative.
- Under Load fault: The values here are set as % of Maximum rated KW. This is useful in case of banks are put in circuit to take care of no load compensation. Value for this Under-Load KW can be calculated as shown here.

continued..



For PF<sub>UPPER</sub> Inductive and PF<sub>LOWER</sub> Inductive :

$$\text{Under-Load KW value setting} = \frac{1.5 \times \text{Smallest bank kVAr.}}{[\tan\{\cos^{-1}(\text{PF}_{\text{LOWER}})\} - \tan\{\cos^{-1}(\text{PF}_{\text{UPPER}})\}]}$$

For PF<sub>UPPER</sub> Capacitive and PF<sub>LOWER</sub> Inductive :

$$\text{Under-Load KW value setting} = \frac{1.5 \times \text{Smallest bank kVAr.}}{[\tan\{\cos^{-1}(\text{PF}_{\text{UPPER}})\} + \tan\{\cos^{-1}(\text{PF}_{\text{LOWER}})\}]}$$

For PF<sub>UPPER</sub> Capacitive and PF<sub>LOWER</sub> Capacitive:

$$\text{Under-Load KW value setting} = \frac{1.5 \times \text{Smallest bank kVAr.}}{[\tan\{\cos^{-1}(\text{PF}_{\text{UPPER}})\} - \tan\{\cos^{-1}(\text{PF}_{\text{LOWER}})\}]}$$

...continued.

Load UN bal Flt Disable : 0
Load UN bal Limit (%) : 020
Over CAP -I Flt Disable : 0
Over CAP -I Flt Limit (%) : 130
Over CAP Current Limit (%) : 130
Over CAP Current Resume (%) : 125
Over CC Auto Rstrt Enable : 1
Auto Restart Time Seconds : 0120
Temperature Flt Disable : 0
Temperature L. Limit : 55
Temperature U. Limit : 65
Ext. Temp Flt Disable : 0
Ext. Temp Flt L. Limit : 030
Ext. Temp Flt U. Limit : 050
CapCur THD Flt Disable : 0
CapCur THD Limit (%) : 010
CapCur THD Resume(%) : 008
Step Health Chk Disable : 0
Cap Cur Flt Tolerance % : 10
Out of banks Flt Disable : 0
NV RAM Bat. Fault Enable : 1

- Load Unbalance fault: Limits defined here are in % of maximum of the three phase source current compared with the minimum of three phase source current.
- Over Capacitor Current Fault: If put in indicative mode, it works as normal Limit and Resume operation. If put in any tripping modes, the capacitors are out of circuit. Under this case for restart, Auto-Restart "Enable" needs to be set along with Auto-Restart time. Note that with Auto-Restart feature enabled & capacitor taking over-current even after restart may put system in hunting mode.
- Under Capacitor Current Fault: This fault can be only in two options. 0 - Disable and 1 - Indicative. This fault is not for tripping the capacitor banks. Thus, here there is no need for Auto-Restart and unit work with Normal Limit & Resume settings.
- Internal Temperature Fault: Unit monitors the temperature inside the HTPF-03/08 or HTPF-03/16 housing. This temperature can go up either due to ambient temperature in the APFC panel has gone up beyond limit or if some component failure in HTPF-03/16 or HTPF-03/08 hardware itself. Upper limit is for tripping and lower limit is for normal operation (resume).
- Capacitor Current THD: Capacitors are vulnerable to harmonics. The unit can sense the THD value of the capacitor current and in case of THD exceeding can give this fault.
- Step Health Check: HTPF-03/16 or HTPF-03/08 carries out on-line monitoring of the kVAr values of every step. This is when the step is put in the circuit. In case the tolerance limit defined here is exceeded, that specific bank is declared faulty.
- Out of Banks Fault: This is only with 0 - Disable and 1 - Indicative options. If on 1, then, unit will indicate this fault if: "Two consecutive correction cycles, PF is more inductive than Lower PF set point and all the healthy capacitor banks are in ON state.
- NV-Ram Battery Fault: For internal NV-RAM & RTC, a small battery is provided inside HTPF-03/16 or HTPF-03/08. Health of battery is checked on regular basis. If it is found un-healthy, & if this parameter is enabled, it will stop data logging & give indication (as it may otherwise write error data).



# Step

Steps connected : 08
Default mode Auto : 0
Compensation kVAR Mean : 1
Cap Bank Voltage (L-L) 11000V
Correction Time Minutes : 005
Discharge Time Minutes : 010
Step Response Time Cycles : 00045
Fix-bank Setting -----
Correction Type Un- Equal : 1
C - Series : 00 11111222
Bin/ C/E Series Bank Bank kVAR : 250
Ext Fix Bank Kvar : 000
Unequal Bank [1] KVAR : 450
Unequal Bank [2] KVAR : 450
Unequal Bank [3] KVAR : 450
Unequal Bank [4] KVAR : 450
Unequal Bank [5] KVAR : 900
Unequal Bank [6] KVAR : 900
Unequal Bank [07] KVAR : 900
Unequal Bank [08] KVAR : 900

**Steps Connected:** Defines the number of steps operational. Depending on PF system banks, this parameter is set.

- **Default Mode:** 0: Auto and 1: Manual. This parameter defines the mode during Power-up. (Default is 0: Auto)
- **Compensation kVAR:** 0: Instantaneous & 1: Mean. Defines the method for kVAR compensation. If it should be instant at which the compensation is made or it is mean of kVAR that is required from previous compensation to present compensation.
- **Capacitor Bank Voltage:** Capacitor bank voltage line to line value is defined here. i.e. it defines the Voltage value at the defined kVAR.
- **Correction Time:** Defined in minutes. This is the Time between two consecutive kVAR compensations.
- **Discharge Time:** Time defined here is the time for discharge of the capacitors to a level, so that they can be turned ON again.
- **Step Response Time:** Defines the time after which the kVAR of any step should be measured when the step turns on .
- **Fix-Bank Setting:** Defines the banks that are to be declared as fixed. These banks even in spite of overcompensation cannot be turned OFF. The banks can only be turned OFF under fault conditions. (if settings in fault are defined).
- **Correction Type:** HTPF-03/16 or HTPF-03/08 can have bank configurations that are defined by four various methods. 0=Binary, 1=Unequal, 2=C Series, 3=E Series. Binary is in ratio of 1:2:4:8:16---. Unequal is used with banks not having definite ratio. C series is predefined Control Series. The standard ratios are preloaded in HTPF-03/16 or HTPF-03/08 that can be selected here. E series is User defined Control Series. The bank ratios that are not defined in C series can be defined here. Digits can be 1,2,-- 9,A,B,C,D,E,F. i.e. the ratio can be maximum 1:F i.e. 1:15.

continued..

...continued.

• **C Series: Various control series (C Series) can be selected  
(For HTPF-03/16)**

00: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10: 1 1 2 2 2 4 4 4 4 4 4 4 4 4 4 4
01: 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	11: 1 1 2 2 4 4 4 4 4 4 4 4 4 4 4 4
02: 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3	12: 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2
03: 1 2 3 4 4 4 4 4 4 4 4 4 4 4 4 4	13: 1 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3
04: 1 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4	14: 1 1 2 4 4 4 4 4 4 4 4 4 4 4 4 4
05: 1 2 3 6 6 6 6 6 6 6 6 6 6 6 6 6	15: 1 1 2 4 8 8 8 8 8 8 8 8 8 8 8 8
06: 1 2 4 8 8 8 8 8 8 8 8 8 8 8 8 8	16: 1 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3
07: 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2	17: 1 2 3 4 4 8 8 8 8 8 8 8 8 8 8 8
08: 1 1 1 1 1 6 6 6 6 6 6 6 6 6 6 6	18: 1 2 2 4 4 4 4 4 4 4 4 4 4 4 8 8
09: 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2	19: 1 2 2 2 4 4 4 4 4 4 4 4 4 4 8 8

• **C Series: Various control series (C Series) can be selected  
(For HTPS-03/08)**

00: 1 1 1 1 1 1 1 1	10: 1 1 2 2 2 4 4 4
01: 1 2 2 2 2 2 2 2	11: 1 1 2 2 4 4 4 4
02: 1 2 3 3 3 3 3 3	12: 1 1 1 2 2 2 2 2
03: 1 2 3 4 4 4 4 4	13: 1 1 2 3 3 3 3 3
04: 1 2 4 4 4 4 4 4	14: 1 1 2 4 4 4 4 4
05: 1 2 3 6 6 6 6 6	15: 1 1 2 4 8 8 8 8
06: 1 2 4 8 8 8 8 8	16: 1 2 2 3 3 3 3 3
07: 1 1 1 1 2 2 2 2	17: 1 2 3 4 4 8 8 8
08: 1 1 1 1 1 6 6 6	18: 1 2 2 4 4 4 4 4
09: 1 1 2 2 2 2 2 2	19: 1 2 2 2 4 4 4 4

• **E-Series:** As explained earlier, this series is the user defined series. Digits can be adjusted from 1 to F i.e. 1 to 15.

• **C/E/Bin Series Bank KVAR:** The kVAR defined here is the capacitor bank kVAR of the smallest bank i.e. the value defined by digit '1' in C series, E series or Binary.

• **Unequal Bank KVAR [1....16]:** If unequal kVAR bank configuration is used, these parameters are to be defined for every bank KVAR (at defined Capacitor Bank Voltage). HTPF-03/16 and HTPF-03/08 has a in built intelligent algorithm to select the best possible combination to suit the exact kVAR requirement for compensation.

# Communication

UINT ID : 0000
BAUD RATE 9600 : 1
TIME 01:58:40
DATE 01/01/04
INITIALIZE RTC No : 1
CLEAR NVRAM No : 0
COM2 Function None : 0
BAUD RATE – COM2 9600 : 1
SERVICE PROVIDER 9890012345
SMS RECEIVER NO 9890585734

Unit ID: Value: 0000 to 9999. Default value 0001. Defines the 4 digit unit ID used for serial communication on RS-232 Dedicated protocol.

- Baud Rate: selectable.  
0 – 4800bps, 1 – 9600bps, 2 – 19200bps, 3 – 38400bps, 4 – 57600bps.

- Time: Defines time setting in HH:MM:SS, 24 Hours Format.

- Date: Defines the date setting, in DD/MM/YY Format.

- Initialize RTC: 0 – No, 1 – Yes.  
Defining Yes initializes RTC (real time clock/calender) to the above specified values. (This is after pressing SAVE command).

- Clear NVRAM: 0 – No, 1 – Yes.  
Defining Yes clears NVRAM (in real time clock) in HTPF-03/xx. This will also clear Energy counters, this is generally used to clear NVRAM Checksum fault (This is after pressing SAVE command).

- COM2 FUNCTION: The rear side port can be configured for either GSM by connecting an external GSM modem or as an RS-232 port for data downloading.

- GSM Service Provider: GSM service provider number is to be given. It is normally a 10 digit number.

- SMS Receiver No: Defines the number to where the SMS communication is to be sent. Normally it is a Master control unit Receiver Number.

# Step Utilization

UTILIZATION CNTR BANK [1]: 000000
UTILIZATION CNTR BANK [2]: 000000
UTILIZATION CNTR BANK [3]: 000000
UTILIZATION CNTR BANK [4]: 000000
----- -----
UTILIZATION CNTR BANK [8]: 000000
CLR UTILIZATION [1] CNTR No: 0
CLR UTILIZATION [2] CNTR No: 0
CLR UTILIZATION [3] CNTR No: 0
CLR UTILIZATION [4] CNTR No: 0
----- -----
CLR UTILIZATION [8] CNTR No: 0

Utilization cntr: Bank nn: This gives the number of ON/OFF operations of the “nn”th bank.

- Reset Utilization Counter: Bank nn: Options are “Yes” and “No”. Declaring specific bank no with Yes and pressing save command will reset the specific bank utilization counter to zero. This is normally done in case the specific bank is replaced with the new one.

---

# Do's and Dont's for HT PF Controller

## ❖ DO's:

- 1] Always do tighten screws of terminals with 1 N-meter torque calibrated screw driver.
- 2] Always do check the CT shorting terminals are provided externally, so that in case of CT connections are to be opened, these external terminals should be kept short.
- 3] Always use tubular pin type lugs with 1.5 sq-mm Cu-breaded wires for all the control terminals. If 5 Amp CTs are selected then only use 2.5 sq-mm Cu-breaded wires.
- 4] Ensure Auxiliary Input Operating Power Supply to the unit is given from separate reliable supply source. (NOT FROM VOLTAGE FEEDBACK PTs).
- 5] Please always find the correct specifications of the unit for measurement input voltage range, measurement input current range, auxiliary input power supply range, potential free normally open relay contact voltage and current ratings etc., before applying power as well as input signals to the unit.
- 5] Only trained personnel should do the parameter editing, manual synchronization and final commissioning.
- 6] Do set password after complete commissioning.
- 7] Do use R-C snubbers and / or a MOV of suitable voltage rating & size, across the Contactor Coil Load, operated by Controller Unit.
- 8] Do install the controller in an environmentally protected environment for ambient temperature, relative humidity, conductive dust, electromagnetic interference, mechanical shocks and vibrations, chemical and corrosive gases.
- 9] Press Front panel keys gently to avoid damage to the Keys.
- 10] Use correct RS-232 serial communication interface cable for downloading logged data from the controller in to a PC or a Hand-Held-Unit (HHU).
- 11] Always use **unique** Unit ID for EACH APFC Controller used in a project, to avoid conflicting of logged data during post-processing on a PC.

---

## ❖ DONT'S :

- 1] Do not try to open the PF controller or damage warranty seal.
- 2] Don't clean the external of unit with brush or pressurized air.  
Only use a vacuum cleaner to suck the dust away from the Controller.
- 3] Don't open the LIVE CT Terminals from the Unit without externally shorting them. Otherwise, it can extensively damage the Unit due to flash-over / fire.
- 4] Don't use PT voltage feedback for auxiliary supply.  
Use a separate reliable AC power supply source.
- 5] Don't drop or mis-handle the PF Controller. Handle Unit with care.
- 6] Don't use the PF Controller in extreme chemicals-prone / conductive dust-prone environment.
- 7] Do **not** install the controller in an environmentally un-protected environment such as wide ambient temperature variations, high relative humidity, saline atmosphere, chances of water condensation, conductive dust, electromagnetic interference, mechanical shocks and vibrations, chemical and corrosive gases.
- 8] Do not allow direct Sunrays falling on the LCD Display of the Controller.
- 9] Do not throw the discharged or used 3.0 Volt coin type Lithium Battery into fire.
- 10] Do not press Front panel keypad heavily, to cause damage to the keys.
- 11] Do not apply excessive voltage and current inputs beyond the Unit's specifications, else irreparable damage will take place.

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## **Commissioning Instructions:**

Before panel is powered- up for the first time:

### **1. Panel Wiring Check:**

Ensure that all connections in the panel is tightened properly and there are no loose connections. Also ensure that the wiring is done as per the wiring diagram.

### **2. Power Wiring Check:**

Ensure that the power cables are connected properly from the Panel I/C to the feeder I/C or the transformer bushings. The connection has to be after the Load Feed back CT looking from the Transformer side.

Ensure that the Bus Bars and/or Lugs are clean and free of Dust, Corrosion or Oxidation on the contact sides so that good electrical connection is maintained. The surface area should be flat so as to get maximum contact area.

If required Clean the Bus Bars and/ or Lugs by rubbing it with Polish Paper to remove the oxidation layer. Provide contact paste in between the contacts surfaces.

Not performing this, can result in to a weaker source point for Capacitor charging during Step on and this can generate undesirable Noise which can hamper the performance of equipments installed in the capacitor panel.

### **3. Load Feed Back CT connection:**

Ensure that the load feed back CT connections are done properly. Confirm that correct phase CT is connected with the correct phase input terminals. (Even though auto sync is capable of taking care of wrong CT polarities or CT position interchanging, but then on display, the Phase readings may be seen to be interchanged. (May be R-phase reading would be seen in B-phase and vice-versa.

CT connections to be done carefully so as to ensure that the wire does not get open and there is no loose connection.

Loose connection or open CT secondary can result in very high voltages getting developed in the circuit which can damage the CT and also produce high levels of noise in the system.

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## After panel is powered-up

- ❑ Remove the fuses/switch off MCBs/MCCBs which are in series with every capacitor bank. Connect supply to the **HTPF-03/16 and HTPF-03/08**. Keep the load feedback and capacitor current feedback in shorted condition.
- ❑ Turn ON the supply to the panel and set Date/time & various other parameters as per the panel configuration. It is important to understand the meaning of every parameter from the instructions given before and then put the appropriate values in them. Wrong values entered can give the wrong performance of the panel.
- ❑ Once the parameterization is complete, put the **HTPF-03/16 and HTPF-03/08** in Manual mode to check every bank command is transmitted to the switch. This can be observed by turning ON the contactor coil supply MCB on. The corresponding output should be checked for physical turn ON / OFF of the contactor.
- ❑ Once all the contactors are seen to be getting the correct commands, switch off the supply to the panel and replace all the fuses (or turn on MCBs/MCCBs if they are provided instead of fuses). Turn on the panel.
- ❑ Put **HTPF-03/16 and HTPF-03/08** back in Manual mode and turn ON/OFF the individual steps. Use Tong tester (ac current measurement) to check that current in all three phase of the corresponding bank are OK. In case any bank is not giving the desired current, check for capacitor bank healthiness or power circuits.
- ❑ Keep all the banks in off mode. Remove the short of Load feedback CT. In case KW value is seen as -ve for any phase, CT is with wrong polarity. Either **perform "Manual-synchronization" (Procedure of Manual synchronization mentioned after the end of this point)** or change CT polarity.
- ❑ Remove the capacitor feedback CT short. Now turn ON the capacitor banks one by one and observe that capacitor current increases as per the rating of the steps on capacitor Current display. Turn ON all the banks to see that almost full rated current flows through the capacitors.
- ❑ Switch OFF all the banks manually and put the **HTPF-03/16 and HTPF-03/08** in Automatic mode. Switch Off the supply to panel and put it ON. Observe panel performance for about 2hrs after commissioning.



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## Manual Synchronization Method:

1. Set all the normal site related parameters and system related parameters on the controller with usual method as specified in the Operations Manual.
2. Then put the controller in "Manual Mode" of operation. This would initially keep all the Capacitor banks OFF.
3. Scroll down the display and observe the values of R, Y and B phase Active Power (R kW, Y-kW, B-kW) and observe Reactive Power (R-kVAR, Y-kVAR, B-kVAR) values. Please note the values with +ve or -ve polarities as can be seen on PF controller display.
4. Go back to default screen of Manual mode and switch ON all the capacitor banks one by one.
5. Scroll down again to observe all the Active Power and Reactive Power values as mentioned in point no.3 here above.
6. Compare the phase-wise values observed in point no.3 (capacitors OFF) and in point no.5(capacitors ON). i.e. R-Phase kW and kVAR with capacitor OFF would be compared with R-Phase kW and kVAR with capacitor ON respectively. Similarly for other two phases.
7. If synchronization is correct, then kW observed with capacitor ON and capacitor OFF would be almost same (very little change can be observed due to load variation). And then even observe kVAR with capacitor ON and capacitor OFF which should show substantial difference almost equivalent to the kVAR rating of all the capacitor banks put together.

- 
8. In case, there is substantial change in kW value between capacitor OFF and capacitor ON, OR there is far lesser change in kVAr value between capacitor OFF and capacitor ON, this means that there is wrong phase sequence. In such case change the phase sequence of the voltage feedback terminals and repeat the steps no.2 to 8. There are six possible voltage combinations with which sequence can be tried out R-Y-B, B-R-Y, Y-B-R, R-B-Y, Y-R-B, B-Y-R. In any of the said combination, as mentioned in point no.7, the kW change is observed negligible between capacitor ON and OFF and kVAr change observed is almost equal to combined all capacitor banks kVAr, then jump out of this loop and go further with point no.9.
  9. Once the right synchronization is done, one needs to know the CT right polarity. For the selected combination, check the kW values of R, Y and B phase. If any of the phases show negative (-ve) values, change the polarity of that corresponding CT. This would complete the manual synchronization procedure.

**Note:** In case of extreme high variation of Load, there is a possibility of getting some wrong values in above steps while comparing Capacitor ON and OFF power values. Thus, such procedure should be carried out only when supplied load is stable and not varying much.

## Fault finding guidelines

Fault Type	Probable Reason	Action to Take
Unit Does not turn ON.	<ul style="list-style-type: none"> <li>• Input auxiliary supply not coming.</li> <li>• Input side fuses blown</li> </ul>	<ul style="list-style-type: none"> <li>• Check the input supply to restore</li> <li>• Check fuses in the unit for OK.</li> </ul>
Unit does not turn On any capacitors even if PF is below Lower PF limit.	<ul style="list-style-type: none"> <li>• The load KW is too low.</li> <li>• Control connections from RLY module to contactor coils are not proper.</li> </ul>	<ul style="list-style-type: none"> <li>• Load may be highly fluctuating so need of manual synchronization.</li> <li>• This is OK condition.</li> <li>• Check control supply and connections from RLY to contactors.</li> </ul>
"BF" flashing indication. <i>OR</i> "NV RAM Checksum error" display. <i>OR</i> Corruption of date & time.	<p>In all these three conditions, the battery needs to be checked.</p> <ul style="list-style-type: none"> <li>• Internal Li-Ion 3 Vdc battery used for RTCC and NV RAM must be drained down.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace this battery in consultancy with TAS trained personnel.</li> </ul>
Some Capacitor banks are declared as faulty even if they are checked to be OK.	<ul style="list-style-type: none"> <li>• Individual step health monitoring is enabled and tolerance limits set are too stringent.</li> <li>• Capacitor current THD factor is continuously fluctuating.</li> </ul>	<ul style="list-style-type: none"> <li>• Set the tolerance limits for individual steps monitoring as relaxed.</li> <li>• With continuously fluctuating THD of Capacitor current and higher level of THD can cause some errors in individual step kVAR measurement. Under this condition, best is to keep this feature disabled.</li> </ul>

continued..

## Fault finding guidelines ... continued

Fault Type	Probable Reason	Action to Take
Serial Communication is not working.	<ul style="list-style-type: none"> <li>• Baud rate selection is not proper.</li> <li>• Unit ID is not set properly.</li> <li>• Serial communication cable connections are not proper.</li> </ul>	<ul style="list-style-type: none"> <li>• Select proper baud rate.</li> <li>• Set the unit ID correctly.</li> <li>• Check the serial cable continuity as per the connections given earlier in this manual.</li> </ul>
Data logging is not taking place.	<ul style="list-style-type: none"> <li>• If Battery Health monitoring is enabled and battery is weak. Possibility of battery unhealthy message being displayed.</li> <li>• Improper settings in PC software and/or PC</li> </ul>	<ul style="list-style-type: none"> <li>• Change the battery by help of TAS's authorized person.</li> <li>• Ensure proper settings in date/time format of PC, and settings in the PC S/W are correct</li> </ul>
<b>HTPF-03/16 and HTPF-03/08</b> resets occasionally on turning OFF of any contactor.	<ul style="list-style-type: none"> <li>• The contactor supply phase may be the same as used for <b>HTPF-03/16 and HTPF-03/08</b> auxiliary supply.</li> <li>• R-C snubbers and / or MOV for AC Load OR free-wheeling diodes for DC Load, are not put with EACH contactor coils.</li> </ul>	<ul style="list-style-type: none"> <li>• Use the different phase for control supply of contactors and for <b>HTPF-03/16 and HTPF-03/08</b> supply</li> <li>• Usage of R-C snubbers and / or MOV OR free-wheeling diodes is mandatory for EACH. (R=330 ohm, 1 Watt, C= 0.1MFD/1kV DC)</li> </ul>

## ❖ HTPF-03/16 and HTPF-03/08 Factory Default Settings

PARAMETER	MIN	MAX	STEP SIZE	FACTORY DEFAULT
<b>GENERAL I/O</b>				
1] Password (Enable: 1/ Disable: 0)	0	1	1	1
2] Change Password	0000	9999	1	0001
3] Load Default (Yes: 1/ No: 1)	0	1	1	0
4] THD to display (F-THD: 1/R-THD: 0)	0	1	1	1
5] Reset Energy Counter (Yes: 1/ No: 0)	0	1	1	0
6] Auxiliary IP1 function None: 0 O/P En Di: 1 Mains/ Generator: 2 Reset Flt: 3	0	3	1	0
7] Auxiliary OP1 function None: 0 Trip Fault: 1 Sys fault: 2 Out Of Step: 3	0	3	1	0
8] Auxiliary OP2 function None: 0 Trip Flt: 1 Sys Fault: 2 Out Of Step: 3	0	3	1	0
<b>SYSTEM</b>				
1] Measurement voltage (not editable)	-	-	-	110
2] EXT-PT ratio	0000.1	0600.1	1	0100.0:1
3] Current CT primary (Mains)	1	According to 50 MVA formula	1	1000
4] Current CT primary (Generator)	1	According to 50 MVA formula	1	0500
5] Cap Current CT primary	0.100	0.999	0.001	1000
6] PF Upper limit: Mains (Ind: 1/ Cap: 0)	0.100	0.999	0.001	[Ind: 1] 0.980
7] PF Lower Limit: Mains (Ind: 1/ Cap: 0)	0.100	0.999	0.001	[Ind: 1] 0.970

<b>PARAMETER</b>	<b>MIN</b>	<b>MAX</b>	<b>STEP SIZE</b>	<b>FACTORY DEFAULT</b>
8] PF Upper Limit: Generator (Ind: 1/ Cap: 0)	0.100	0.999	0.001	[Cap:0] 0.820
9] PF Lower Limit: Generator (Ind: 1/ Cap: 0)	0.100	0.999	0.001	[Cap: 0]0.800
10] Mains Generator (Mains: 0/ Generator: 1)	0	1	1	0
11] EXT. Temp. Meas (Enable: 1/ Disable: 0)	0	1	1	0
<b>FAULT</b>				
1] Over Voltage Fault Disable: 0 Indicate: 1 Off Step: 2 Off Fixed : 3 Fast Off : 4	0	4	1	3
2] Over Voltage Limit (%)	Resume	150	1	110
3] Over Voltage Resume (%)	100	Limit	1	105
4] Under Voltage Fault Disable: 0 Indicate: 1 Off Step: 2 Off Fixed : 3 Fast Off : 4	0	4	1	3
5] Under Voltage Limit (%)	0	Resume	1	070
6] Under Voltage Resume (%)	Limit	100	1	085
7] Over Load Fault Disable: 0 Indicate: 1 Off Step: 2 Off Fixed : 3 Fast Off : 4	0	4	1	0
8] Over Load Limit (%)	Resume	150	1	130
9] Over Load Resume (%)	100	Limit	1	125
10] Under Load KW Fault Disable: 0 Indicate: 1 Off Step: 2 Off Fixed : 3 Fast Off : 4	0	4	1	0
11] Under Load Limit (%)	0	Resume	1	020
12] Under Load Resume (%)	Limit	100	1	025

<b>PARAMETER</b>	<b>MIN</b>	<b>MAX</b>	<b>STEP SIZE</b>	<b>FACTORY DEFAULT</b>
13] Load Unbalance Fault Disable: 0 Indicate: 1 Off Step: 2 Off Fixed Step: 3 Fast Off Step: 4	0	4	1	0
14] Load Unbalance Limit (%)	10	100	1	020
15] Over Cap I-Fault (Enable: 1/ Disable: 0)	0	1	1	0
16] Over Cap Current Limit (%)	Resume	150	1	130
17] Over Cap Current Resume (%)	100	Limit	1	125
18] OverCC Auto restart (Enable: 1/ Disable: 0 )	0	1	1	0
19] Auto Restart Time (seconds)	30	600	1	0120
20] Temperature Fault Disable: 0 Indicate: 1 Off Step: 2 Off Fixed : 3 Fast Off : 4	0	4	1	0
21] Temperature lower Limit	0	Upper Limit	1	55
22] Temperature Upper Limit	Lower Limit	100	1	65
23] External Temperature fault Disable: 0 Indicate: 1 Off Step: 2 Off Fixed : 3 Fast Off : 4	0	4	1	0
24] External Temperature Fault Lower Limit	10	Upper Limit	1	030
25] External Temperature Fault Upper Limit	Lower Limit	250	1	050
26] Cap Current THD Fault (Enable: 1/ Disable: 0)	0	1	1	0
27] Cap Current THD Limit (%)	Cap. Harmonic Resume	150	1	010

PARAMETER	MIN	MAX	STEP SIZE	FACTORY DEFAULT
28] Cap Current THD Resume (%)	0	Harmonic resume	1	008
29] Step Health Check (Enable: 1/ Disable: 0)	0	1	1	0
30] Cap Current Fault Tolerance	0	60	1	10
31] Out Of Banks Fault (Enable: 1/ Disable: 0)	0	1	1	0
32] NV RAM Battery Fault (Enable: 1/ Disable: 0)	0	1	1	1
<b>STEPS</b>				
1] Steps Connected	01	08 (For HTPF-03/08), 16 (For HTPF-03/16) <b>Factory Loaded</b>	1	08 (For HTPF-03/08) 16 (For HTPF-03/16)
2] Default Mode (Auto: 0/ Manual:1)	0	1	1	0
3] Compensation KVAR (Instant: 0/ Mean: 1)	0	1	1	1
4] Cap Bank Voltage (L-L)	50	65530	1	11000
5] Correction Time (Minutes)	2	480	1	005
6] Discharge Time (Minutes)	10	120	1	010
7] Step Response Cycles (Seconds)	01	05	1	00045
8] Fix-bank Setting				
9] Correction Type Binary: 0 Un-Equal: 1 C-series: 2 E-Series: 3	0	3	1	1
10] C-Series (Selectable from 00 to19)	Refer to the Table at the End			00
11] E-Series				11111222
12] Bin/C/E Series Bank KVAR	1	250	1	250
13] Ext Fix Bank KVAR	000	999	1	000
14] Unequal Bank [1] KVAR	0001	2500	1	450
15] Unequal Bank [2] KVAR	0001	2500	1	450
16] Unequal Bank [3] KVAR	0001	2500	1	450
17] Unequal Bank [4] KVAR	0001	2500	1	450
18] Unequal Bank [5] KVAR	0001	2500	1	900
19] Unequal Bank [6] KVAR	0001	2500	1	900



PARAMETER	MIN	MAX	STEP SIZE	FACTORY DEFAULT
20] Unequal Bank [7] KVAr	0001	2500	1	900
21] Unequal Bank [8] KVAr	0001	2500	1	900
<b>COMMUNICATION</b>				
1] Unit ID	0000	9999	1	0000
2] Baud Rate- COM1: 4800: 0 9600: 1 19200: 2 38400: 3 57600: 4	0	4	1	1
3] Time (HH/MM/SS) 24Hrs clock format	-	-	-	Current Time
4] Date (DD/MM/YY)	-	-	-	Current Date
5] Initialize RTC (Yes: 1/No: 0)	0	1	1	0
6] Clear NVRAM (Yes: 1/ No: 0)	0	1	1	0
7] COM 2 Function: None: 0 Modbus ASCII: 1 Modbus RTU: 2 GSM: 3	0	3	1	2
8] Baud Rate- COM2 4800: 0 9600: 1	0	1	1	1
9] Service Provider	Defines a 10 Digit GSM service provider Number			
10] SMS Receiver No.	Defines a 10 digit number where the SMS is to be sent.			
<b>UTILIZATION COUNTER</b>				
1] Utilization counter Bank [1] (not editable)	0000000	9999999	1	
2] Utilization counter Bank [2] (not editable)	0000000	9999999	1	
3] Utilization counter Bank [3] (not editable)	0000000	9999999	1	
4] Utilization counter Bank [4] (not editable)	0000000	9999999	1	
5] Utilization counter Bank [5] (not editable)	0000000	9999999	1	
6] Utilization counter Bank [6] (not editable)	0000000	9999999	1	
7] Utilization counter Bank [7] (not editable)	0000000	9999999	1	
8] Utilization counter Bank [8] (not editable)	0000000	9999999	1	

<b>PARAMETER</b>	<b>MIN</b>	<b>MAX</b>	<b>STEP SIZE</b>	<b>FACTORY DEFAULT</b>
9] Clear Bank [1] Counter (Yes: 1/ No: 0)	0	1	1	0
10] Clear Bank [2] Counter (Yes: 1/ No: 0)	0	1	1	0
11] Clear Bank [3] Counter (Yes: 1/ No: 0)	0	1	1	0
12] Clear Bank [4] Counter (Yes: 1/ No: 0)	0	1	1	0
13] Clear Bank [5] Counter (Yes: 1/ No: 0)	0	1	1	0
14] Clear Bank [6] Counter (Yes: 1/ No: 0)	0	1	1	0
15] Clear Bank [7] Counter (Yes: 1/ No: 0)	0	1	1	0
16] Clear Bank [8] Counter (Yes: 1/ No: 0)	0	1	1	0

<b>C- Series (For HPTF-03/08)</b>	
00	11111111
01	12222222
02	12333333
03	12344444
04	12444444
05	12366666
06	12488888
07	11112222
08	11116666
09	11222222
10	11224444
11	11224444
12	11122222
13	11233333
14	11244444
15	11248888
16	12233333
17	12344888
18	12244444
19	12224444

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<b>C- Series (For HTPF-03/16)</b>	
00	1111111111111111
01	1222222222222222
02	1233333333333333
03	1234444444444444
04	1244444444444444
05	1236666666666666
06	1248888888888888
07	1111222222222222
08	1111166666666666
09	1122222222222222
10	1122244444444444
11	1122444444444444
12	1112222222222222
13	1123333333333333
14	1124444444444444
15	1124888888888888
16	1223333333333333
17	1234488888888888
18	1224444444444488
19	1222444444444488

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