SPF-35
Automatic Power Factor Controller

User Manual

Rev. 3.0 Dated 1st Feb 2016

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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. office.

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. The warranty contained in the contract between the parties is the sole warranty of TAS PowerTek. Any statements contained herein do not create new warranties or modify the existing warranty.

CAUTIONS:

1. High Voltages are involved in this application!

2. To be installed & commissioned by a technically qualified person only.

3. SPF-35 may only be used indoor!

4. Make sure that the Capacitor Bank Discharge time set in the HT PF Controller matches with the actual Capacitor Bank Discharge time!

5. This User Manual is applicable to SPF-35 APFC Unit with Firmware Version 1.7.0 as of 1st Feb. 2016.

Because of continuous improvements carried out 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 without any prior notice.

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

Index

Unit PSIN number: (Ordering Information)

SPF-35 / nn / V_{fb} / I_L I_C / V_{aux} / Com / Add / Sw

nn: Defines the number of bank outputs. 04, 06, 08, 12, 14, 16.

V_{fb}: Feedback Nominal Voltage levels: 0, 1.
0 – 110Vac Line-Line value, 3phase, 3 wire.
1 – 415Vac Line-Line value, 3phase, 3 wire.

I_L: Nominal Load current feedback value: 1, 5.
1 – 1Amp. ac CT secondary.
5 – 5Amp. ac CT secondary.

I_C: Nominal Capacitor current feedback value: 1, 5.
1 – 1Amp. ac CT secondary.
5 – 5Amp. ac CT secondary.

V_{Aux}: Auxiliary Input Nominal Operating Supply Voltage: 0, 1, 2, 3.
0 – 63.5Vac.
1 – 110Vac.
2 – 240Vac.
3 – 415Vac.

Com: Serial communication Features: R2, M3
R2 – RS-232 port with GSM protocol on 2nd port (bottom side).
M3 – RS-485 port with MODBUS on 2nd port (bottom side).
(Standard feature: RS-232 port with TAS protocol on front side).

Add: Additional feature for LCD Display: L2
L2 – LCD display with 2 Lines of 16 Characters per Line.

Sw: PC-side Software: S1, S2, S3
S1 – PC side software to view logged data.
S2 – PC side software to view logged data and Billing Software.
S3 – PC side software to view data through GSM.
(For S3 please select R2 on **Com** port at bottom side).

Features:

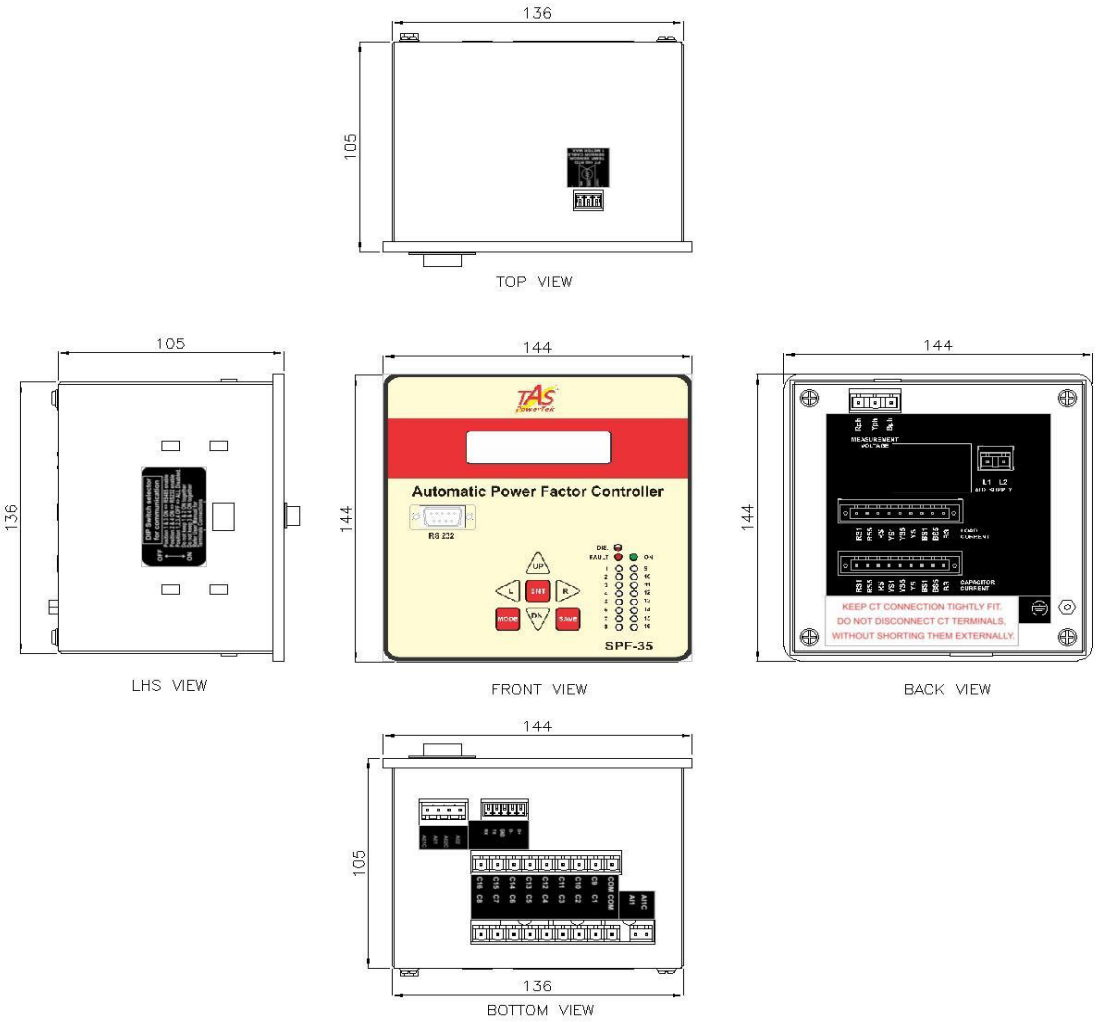
- Totally Fast Micro-Controller based Digital Signal processing logic for measurements, monitoring, control, logging etc.
- All Voltage & Current measurements with 0.5 Class accuracy.
- Automatic Synchronization capable of giving the correct results for wrong connections at CT terminals (even wrong polarity of CTs).
- Load side Voltage , Current and Cap. current THD measurement with odd harmonic coeff. up to 15th Harmonic, Neutral current analysis too.
- Various modes for switching, viz:
    - Binary
    - Un-equal (user defined)
    - C-Series (preset series)
    - E-Series (user defined)
- Up-to maximum 16 Relay Contact Outputs for Capacitor Banks control.
- Capable of doing the kVAr measurements every cycle of the mains waveform.
- Optional GSM connectivity.
- DIN Standard 144 x 144 mm cabinet for panel-door flush mounting.
- Serial communication through standard TAS protocol. In case of requirements with MOD-BUS connectivity, this can be provided on optional basis.
- One RS-232 communication port with TAS protocol is provided on front fascia.
- Data logging of 2 Months data in the form of Hourly Records, Fault Records & Daily Records – recording all electrical values.
- One more optional serial communication port for RS-232 or RS-485 (half-duplex) communication can be provided on back side.
- Protections provided (user settable):
    - Over/Under Measurement Input Voltage
    - Capacitor Over Current
    - Voltage, Load Current, Capacitor Current THD%.
    - Over/Under Line Frequency
    - Over Load current
    - Under Load kW.
    - Load current Unbalance.
    - Internal & External Over Temperature.
    - Out of Capacitor Banks Steps, that is insufficient Capacitive kVAr (only for indication).
    - Battery-backed NV-RAM, Battery down.

Specifications:

- Feed-back Voltage: 3-ph, 3-wire, 110/415Volt (+20%/-30%).
- Current Input : 1A/5A for load current and capacitor current feed-back.
- Measurement Accuracy: 0.5%
- Auxiliary Supply: For selected range +20% to –20%.
  (63.5/110/240/415 Volt, 1 Phase, as per the ordered model)
- P.F. Correction time:
  Selectable in Seconds from 1 Second to 250 Seconds.
- Capacitor Bank Discharge time:
  Selectable in Seconds from 1 Second to 250 Seconds.
- Capacitor Banks Switching Output commands: Max. 16 Outputs.
  (Isolated 'N.O.' Relay Contacts of rating Inductive 0.5Amp ac / 250Vac).
- RS-232 baud rate selectable up to 57600 baud.
- Operating temperature: 0 to +55° C.
- 0.5 Class measurement for Operating Temperature: 0 to +50° C.
- Storage Temperature: -5 to +60° C.
- Relative Humidity: 10% to 90% (Non-Condensing).
- Measurement Supply Line Frequency: 47 Hz to 53 Hz.

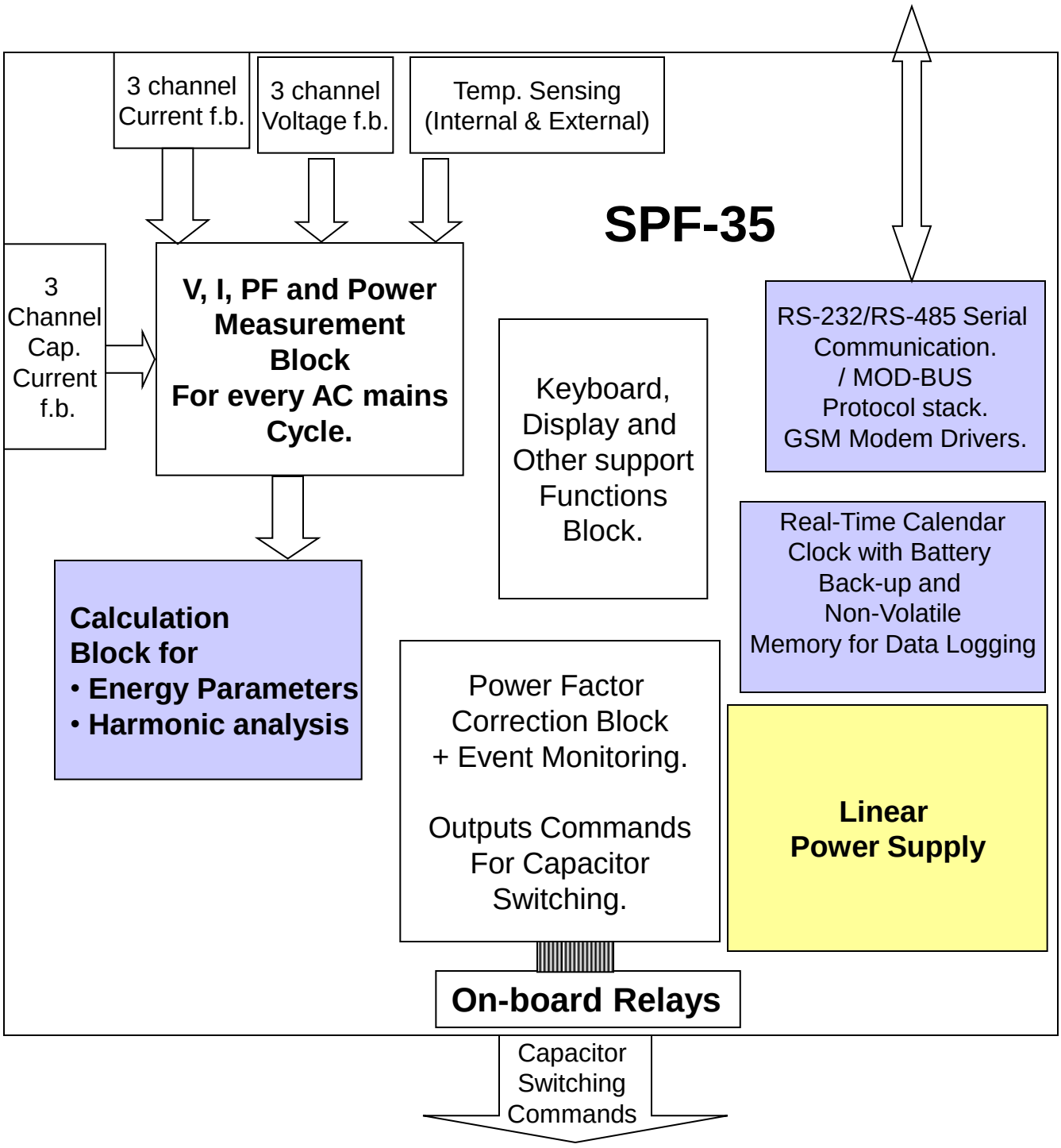
SPF-35 Mechanical Dimensions:

(All Dimensions are in m.m.)



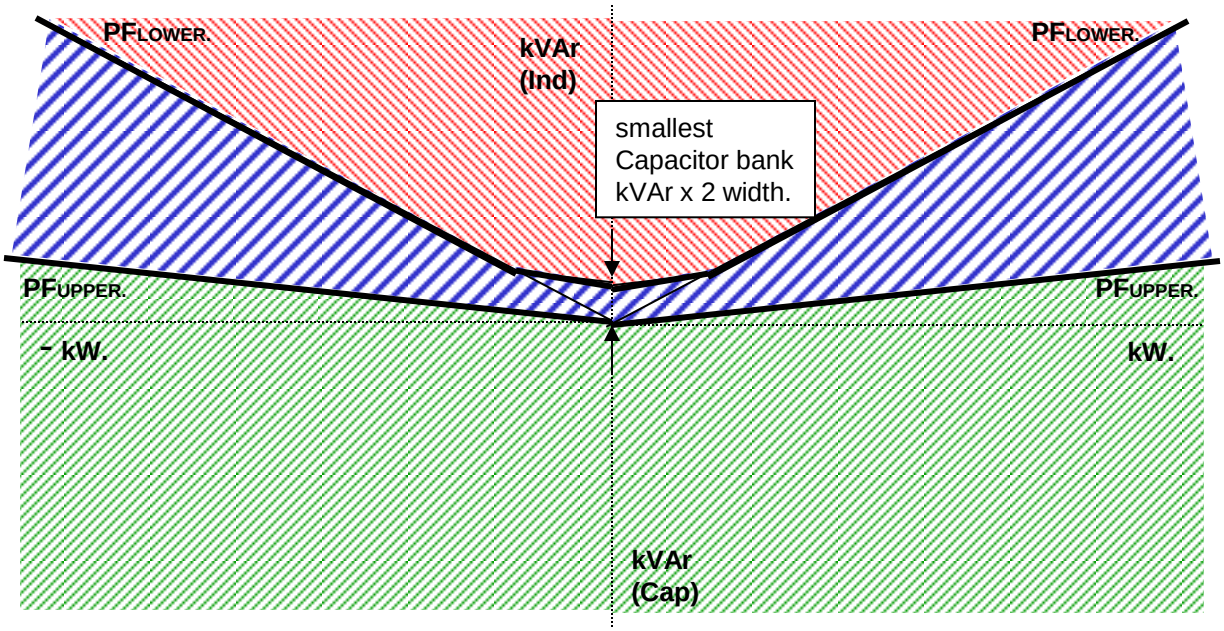
Maximum weight: (with clamps and terminals) = Approx. 2.5 Kg.

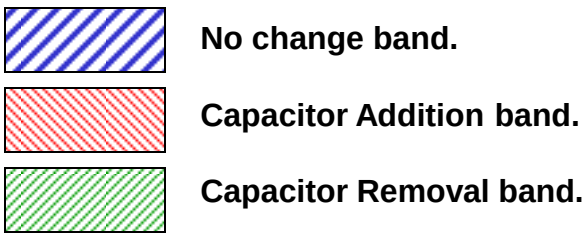
Functional Block Diagram:



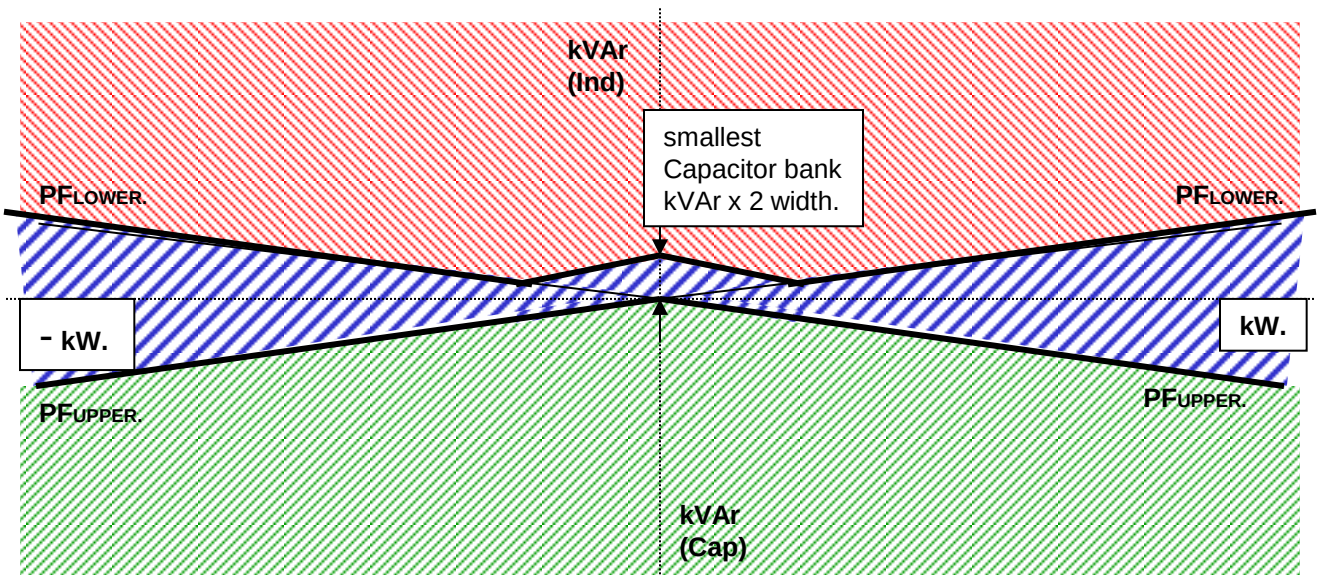
PF correction technique:

PF$_{UPPER}$ & PF$_{LOWER}$ both set as inductive:

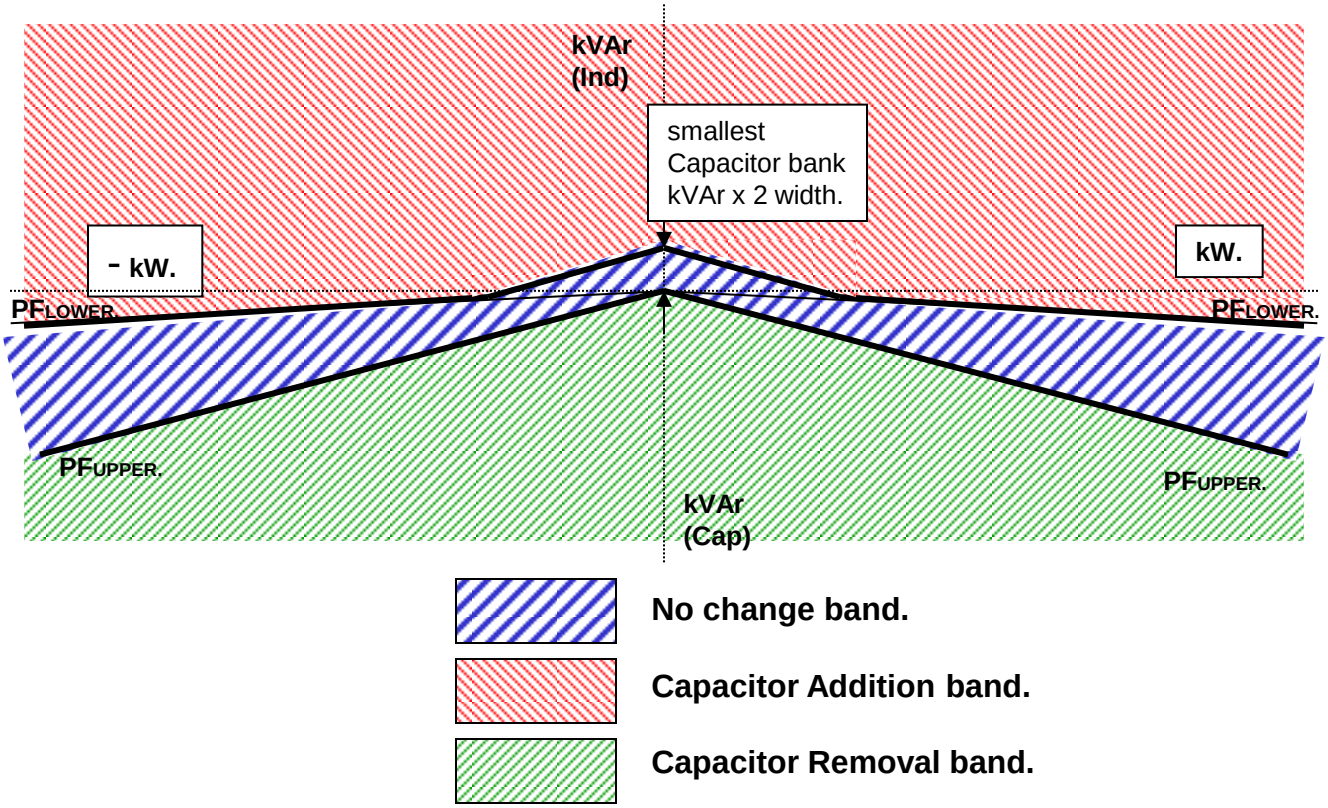




PF$_{UPPER}$ as Capacitive & PF$_{LOWER}$ as inductive:



PF$_{UPPER}$ & PF$_{LOWER}$ as Capacitive:



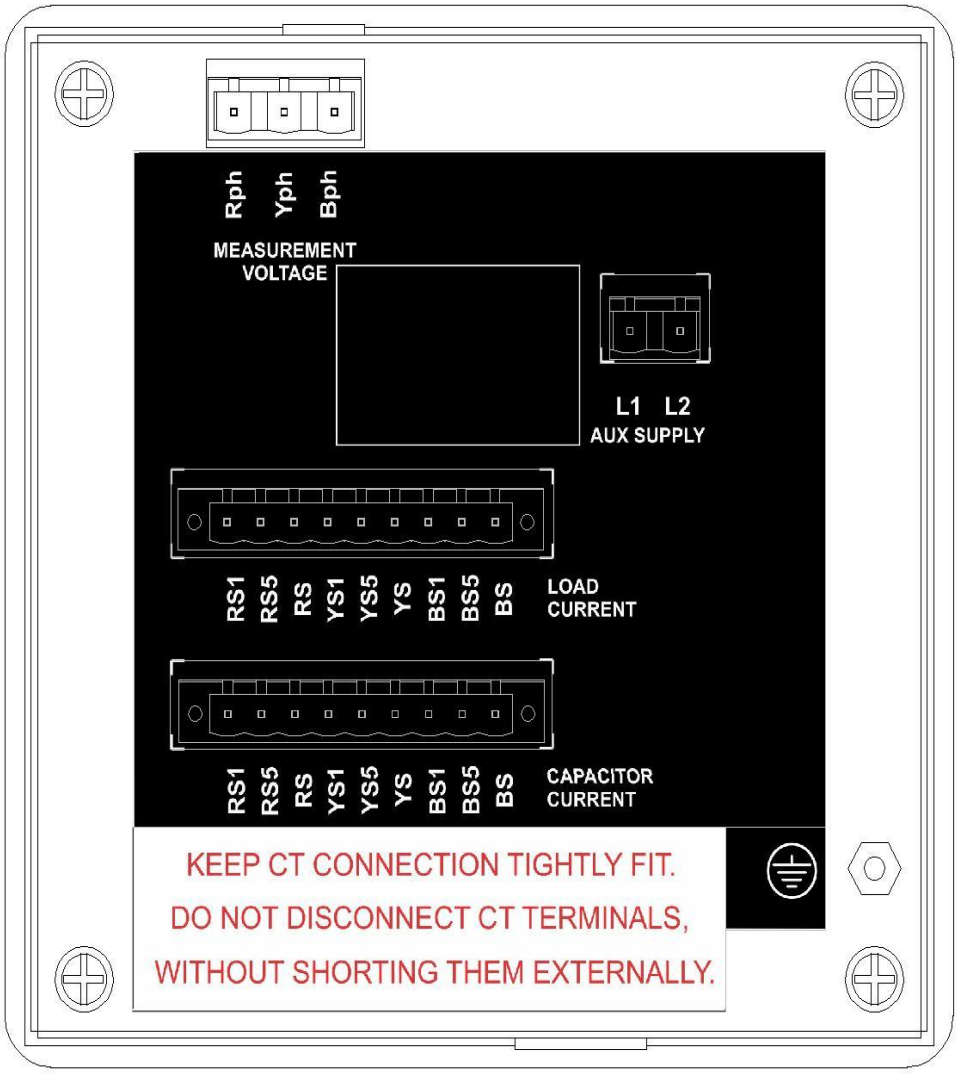
All the three conditions specified in the diagram, the four quadrant operation is achieved if "Auto-Synchronization" is not activated. If this feature is activated, the SPF-35 works with only kW +Ve two quadrants. Thus, with 4 quadrant operations requirements, Auto-Synchronization should be kept off. Typical example of 4 quadrant operation is with "Co-Generation Plants" and "Wind-Power Generation". But with most conventional consumer applications, only +Ve kW is seen, where the Auto Synchronization feature can be kept ON.

It can be seen that there are two PF set points to be set in SPF-35. The Upper and the Lower. SPF-35 ensures that PF$_{UPPER}$ is never exceeded.
Additionally, "No change band" to minimum kVAr band size equal to smallest bank kVAr x 2 ensures no hunting during the low kW loading.

SPF-35 is normally set for PF settings as per first two diagrams shown where PF$_{LOWER}$ 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 to the switched capacitors as well as to the switching devices.

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 the SPF-35 user friendly and thus easy to commission.

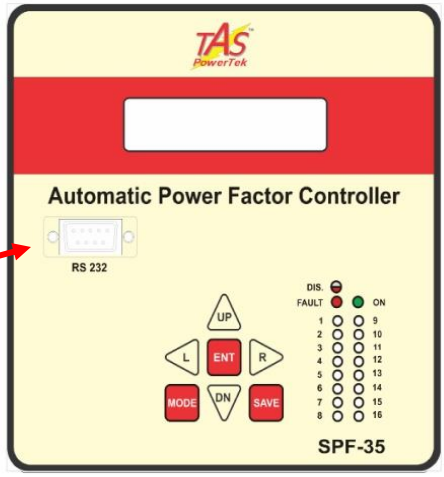
Back Side Terminals:



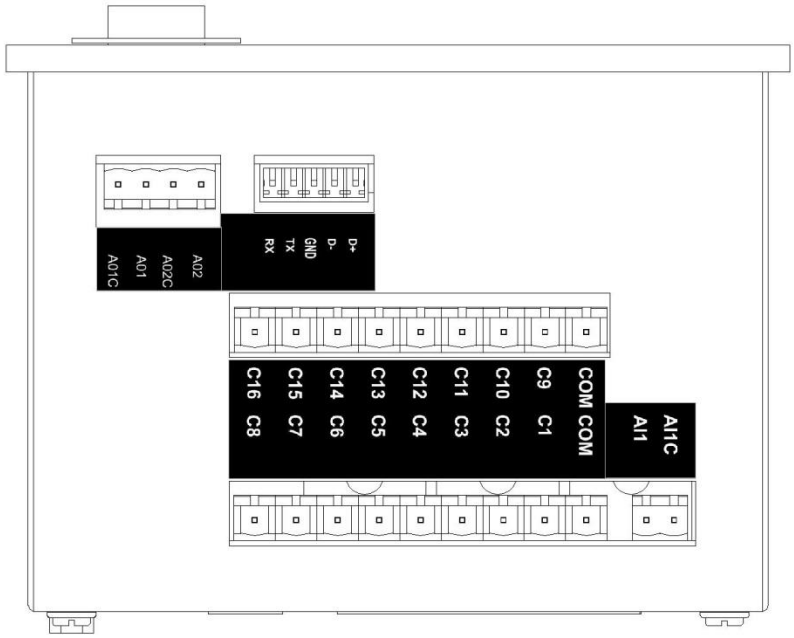
BACK VIEW

Front side communication:

Front side communication port with RS-232 with TAS protocol.

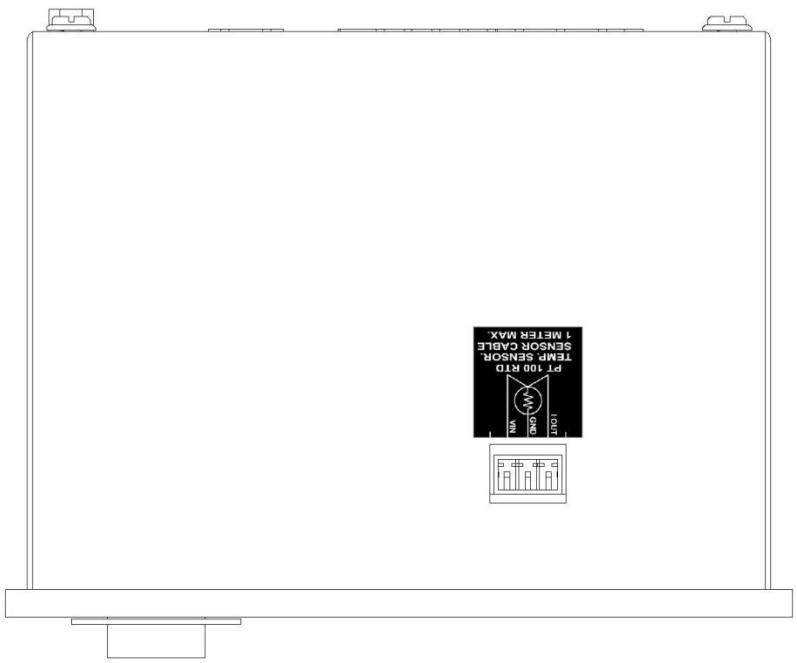


Bottom Side terminals:



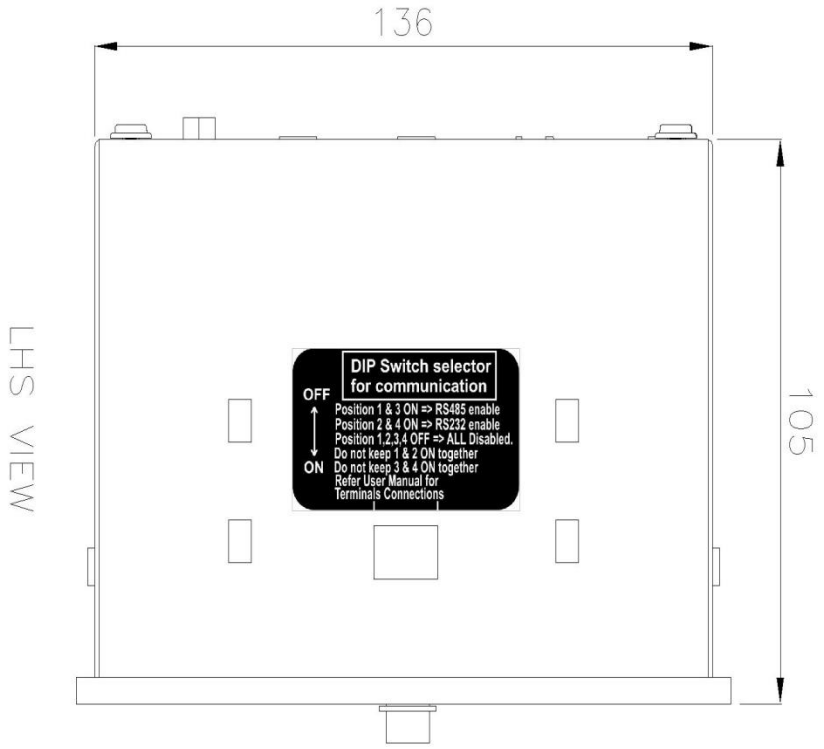
BOTTOM VIEW

Top Side terminals:

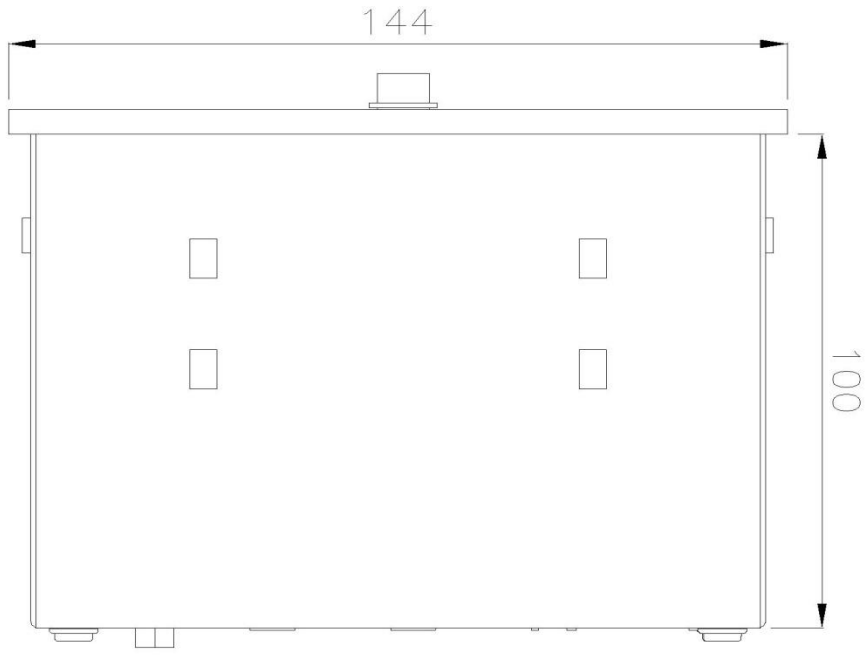


TOP VIEW

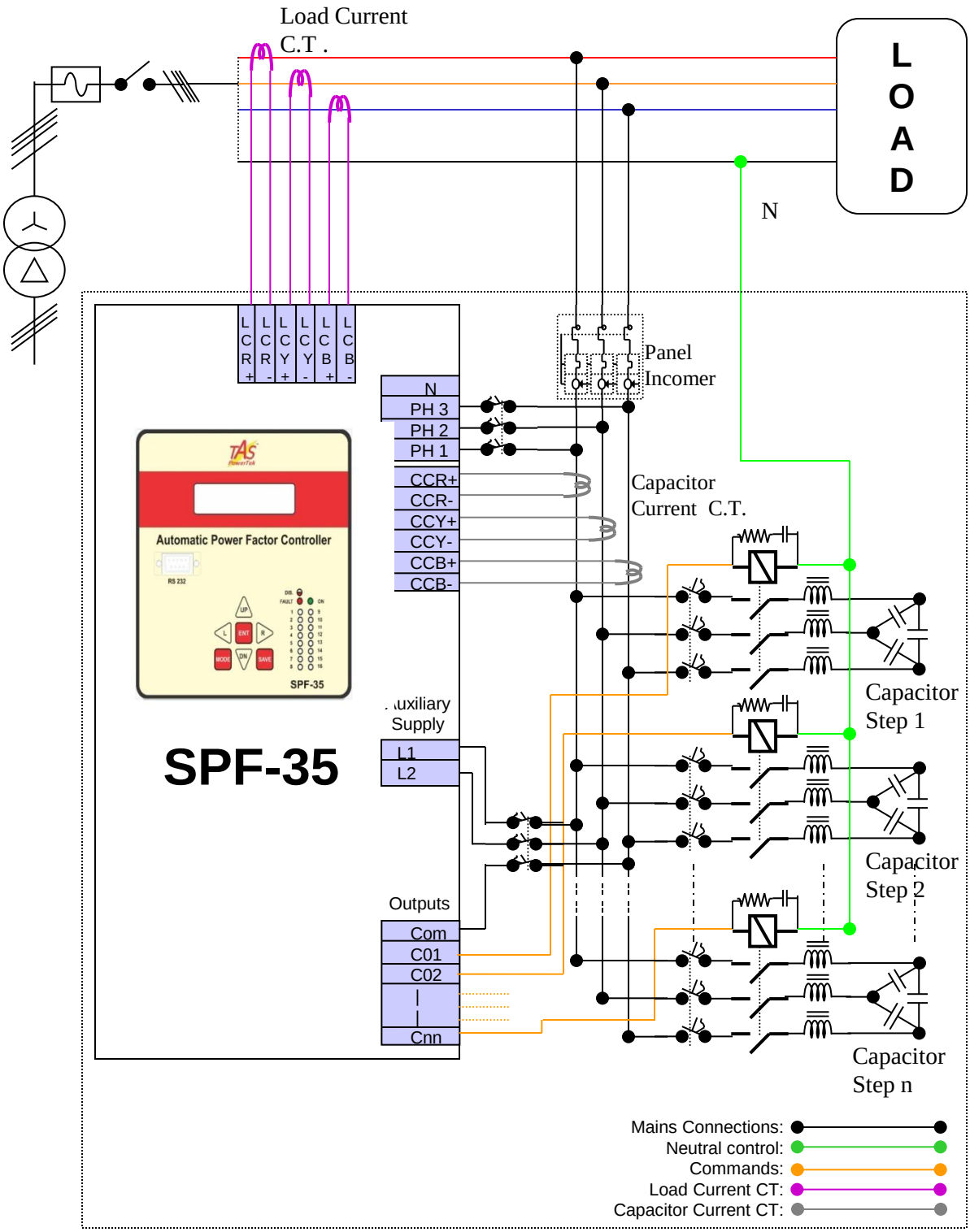
LHS VIEW :



RHS VIEW :

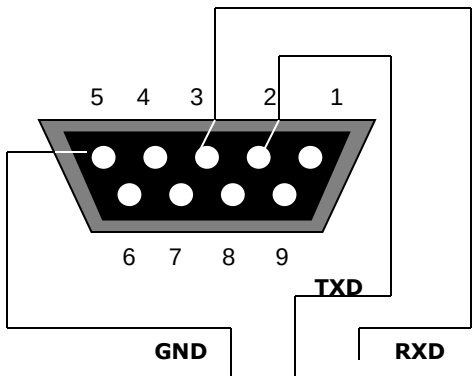


Typical wiring with SPF-35 PF correction system.



Communication port diagram.

RS-232 serial communication 9 pin D male connector on front panel:

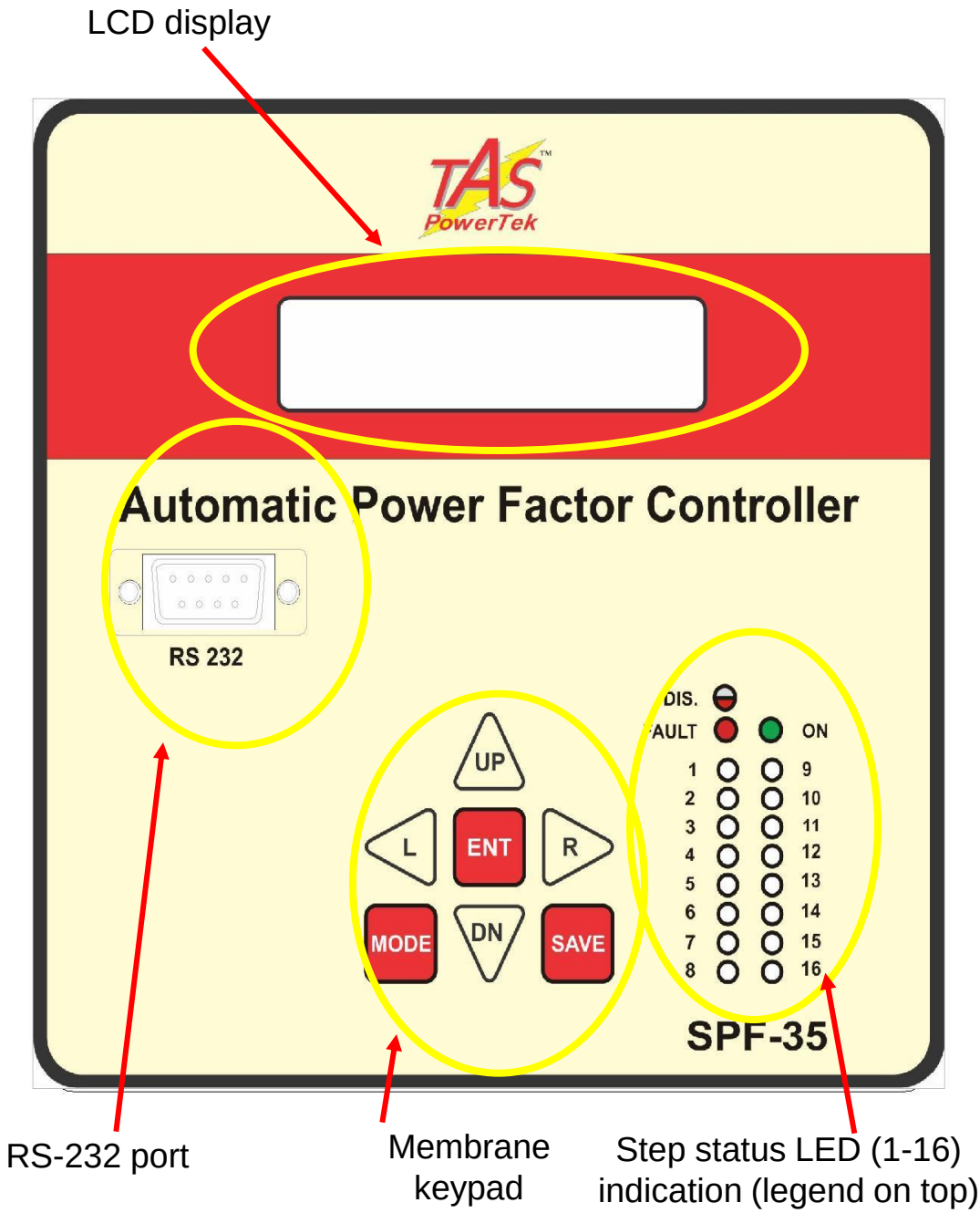


RS-232 cable connection Details:

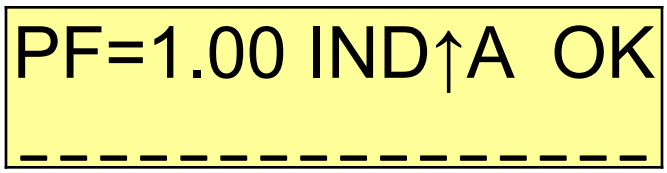
PIN NO	PC-side Connection	CONNECTION	SPF-35
1	NC		
2	RXD		TXD
3	TXD		RXD
4			
5	GND		GND
6			
7			
8			
9	NC		

Communication Terminals: SPF-35 has two serial communication ports. One is on front 9-Pin D type male connector and another is on a 5-way connector on the back side of the controller. By default, only front terminal is given and is active for communication. The default is RS-232.
The back side RS-232 port is optional and is provided in case of external GSM Modem is to be fixed to it. Alternately, it can also be used for SCADA communication configuring and using it for RS-485 Mod-Bus.

Front Fascia of SPF-35:



Default Display:



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.
"↑" or "↓" indicates controller on Mains or Generator Supply respectively.
"A" or "M" indicates the Auto and Manual mode of operation respectively.
"OK" (blinking) indicates status of the system, healthy or faulty.

Second line of display indicates the status of each capacitor bank by symbols. The status is also shown by LEDs for each step :

Symbol indicates that the bank is on state.

Symbol indicates that the bank is in off state.

Symbol indicates that bank is declared as fixed bank and is on state.

Symbol indicates that bank is declared faulty and not available for use.

Symbol indicates that this output stage is not used in System.

Symbol indicates that this output is in discharge mode (blinking red LED).

Default Screen Example:

Meaning of this screen:
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)
"↑" arrow indicates Controller on Mains Supply.
Total number of banks that are operational are eight.
Bank no.1 is declared as fixed and is in ON condition.
Bank no.2, 3 and 7 are in ON condition.
Bank no.4 and 6 are in OFF condition.
Bank no.5 is declared as faulty.
Bank no.8 is in discharging state.

Display of Various Parameters:

Values of various parameters can be viewed by using the UP / DN keys and then pressing ENT key. To exit a sub-menu press, MODE key.

PF=0.98 IND A OK ±‡‡_X_‡	This is factory set default display screen giving information on PF, mode and bank status.
Display Overall Values	Overall values gives the overall system parameters like PF, freq, kW, kVA, kVAr, Average V & I etc.
Display Per-Phase RMS	Per Phase RMS values for the instantaneous parameters like V, I, Cap. Current and Neutral current.
Display Power	Power parameter gives per phase values of PF, kW, kVA, kVAr and Capacitive kVAr.
Display Energy	Gives overall energy parameters like kWH, Inductive & Capacitive kVArH, kVAH and C-kVArH.
Display Harmonics	This gives per phase V, I, Neutral current & Capacitor per phase current THD as well as odd harmonics coefficients up-to 15th.
Display Step KVAR	Gives the values of kVAr that is measured for every output step.
Display Aux-Function	Auxiliary functions like Internal, External Temperature.
Time: 00:03:15 Date: 07/11/05	Displays Date and Time that is set on internal RTCC.
TAS PowerTek P.L SPF35 1.7.0	Displays the version of software. This may change as per the latest product version / revision.

Sub-menu for display of parameters

Overall Values	Per Phase RMS	Display Power	Display Energy	Display Harmonics	Step KVAR	Aux-Function
Average Voltage 00000.0 (L-L)	R-Y Voltage 00000.0 (L-L)	R-Phase PF 1.000 IND	KWH 000000000.0	Vr-THD -F 000.0 %	Step [01] KVAR 0000.0	INT-Temperature 00 Deg C
Average Current 0000.0 A	Y-B Voltage 00000.0 (L-L)	Y-Phase PF 1.000 IND	IND KVARH 000000000.0	Vy-THD-F 000.0 %	Step [01] KVAR 0000.0	EXT-Temperature 000 Deg C
Active Power 00000.0 KW	B-R Voltage 00000.0 (L-L)	B-Phase PF 1.000 IND	CAP KVARH 000000000.0	Vb-THD -F 000.0 %	Step [02] KVAR 0000.0	
Reactive Power 00000.0 KVAr	R-Phase Current 00000.0 A	R-Phase KW 00000.0	KVAH 000000000.0	Ir-THD -F 000.0 %	Step [03] KVAR 0000.0	
Apparent Power 00000.0 KVA	Y-Phase Current 00000.0A	Y-Phase KW 00000.0	CKVARH 000000000.0	Iy-THD -F 000.0 %	Step [04] KVAR 0000.0	
Cap-Current 0000.0A	B-Phase Current 00000.0A	B-Phase KW 00000.0		Ib-THD -F 000.0 %	Step [05] KVAR 0000.0	
C-KVAR 000000.0	Neutral Current 00000.0A	R-Phase KVAR 00000.0		In-THD -F 000.0 %	Step [06] KVAR 0000.0	
Load Side PF 1.000 IND	R-Phase Cap Cur 00000.0 A	Y-Phase KVAR 00000.0		CCr-THD -F 000.0 %	Step [07] KVAR 0000.0	
Load Side KVAR 000000.0	Y-Phase Cap Cur 00000.0 A	B-Phase KVAR 00000.0		CCy-THD -F 000.0 %	Step [08] KVAR 0000.0	
Load Side KVA 000000.0	B-Phase Cap Cur 00000.0 A	R-Phase KVA 00000.0		CCb-THD -F 000.0 %	Step [09] KVAR 0000.0	
Frequency 00.0 Hz		Y-Phase KVA 00000.0			Step [10] KVAR 0000.0	
		B-Phase KVA 00000.0			Step [11] KVAR 0000.0	
		R-Phase CKVAR 000000.0			Step [12] KVAR 0000.0	
		R-Phase CKVAR 000000.0			Step [-- n] KVAR 0000.0	
		R-Phase CKVAR 000000.0			-	

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.

V Harmonics

Vr-THD-(R/F) 3rd: 00.0 %	Vy-THD-(R/F) 3rd: 00.0 %	Vb-THD-(R/F) 3rd: 00.0 %
Vr-THD-(R/F) 5th: 00.0 %	Vy-THD-(R/F) 5th: 00.0 %	Vb-THD-(R/F) 5th: 00.0 %
Vr-THD-(R/F) 7th: 00.0 %	Vy-THD-(R/F) 7th: 00.0 %	Vb-THD-(R/F) 7th: 00.0 %
Vr-THD-(R/F) 9th: 00.0 %	Vy-THD-(R/F) 9th: 00.0 %	Vb-THD-(R/F) 9th: 00.0 %
Vr-THD-(R/F) 11th: 00.0 %	Vy-THD-(R/F) 11th: 00.0 %	Vb-THD-(R/F) 11th: 00.0 %
Vr-THD-(R/F) 13th: 00.0 %	Vy-THD-(R/F) 13th: 00.0 %	Vb-THD-(R/F) 13th: 00.0 %
Vr-THD-(R/F) 15th: 00.0 %	Vy-THD-(R/F) 15th: 00.0 %	Vb-THD-(R/F) 15th: 00.0 %

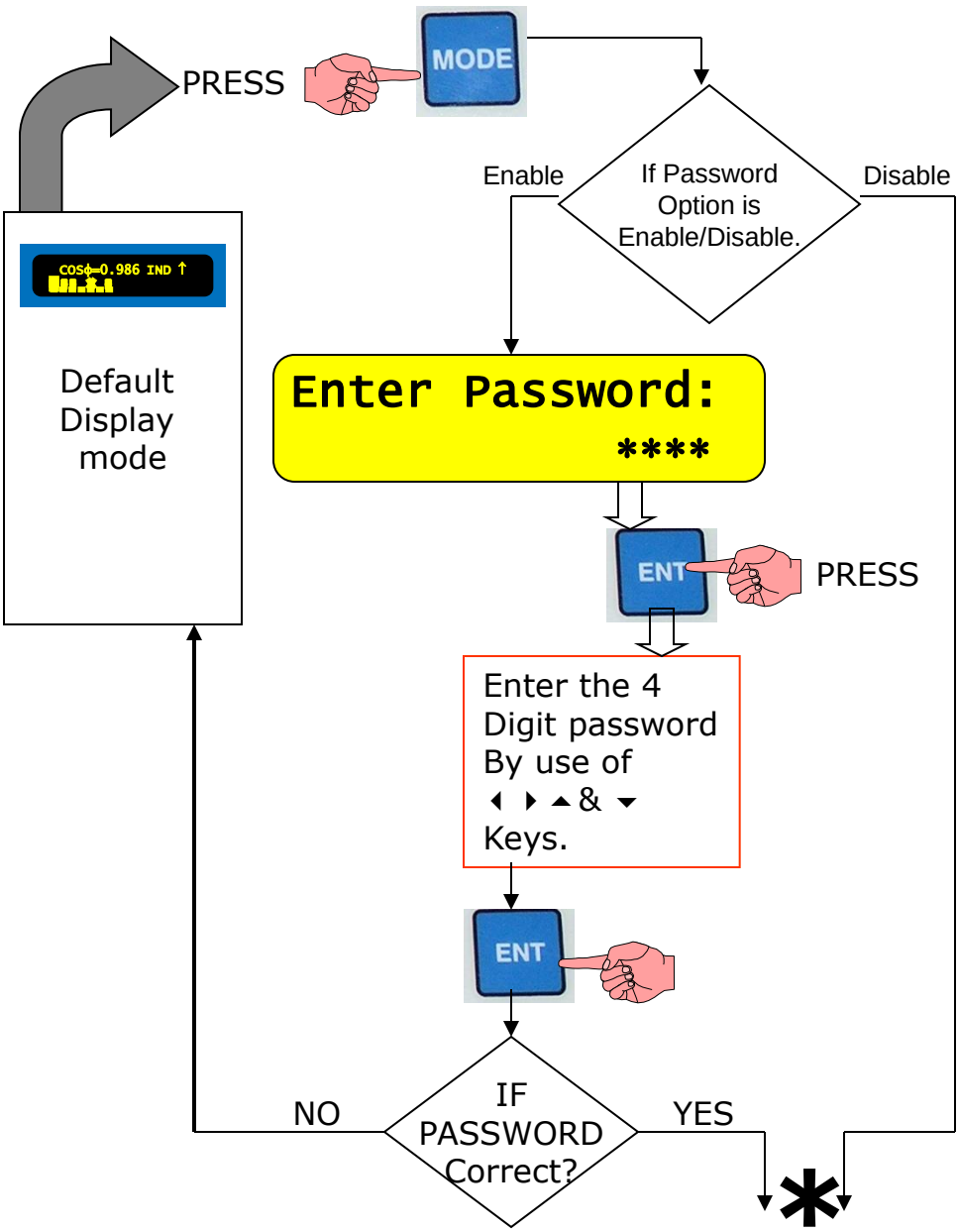
I Harmonics

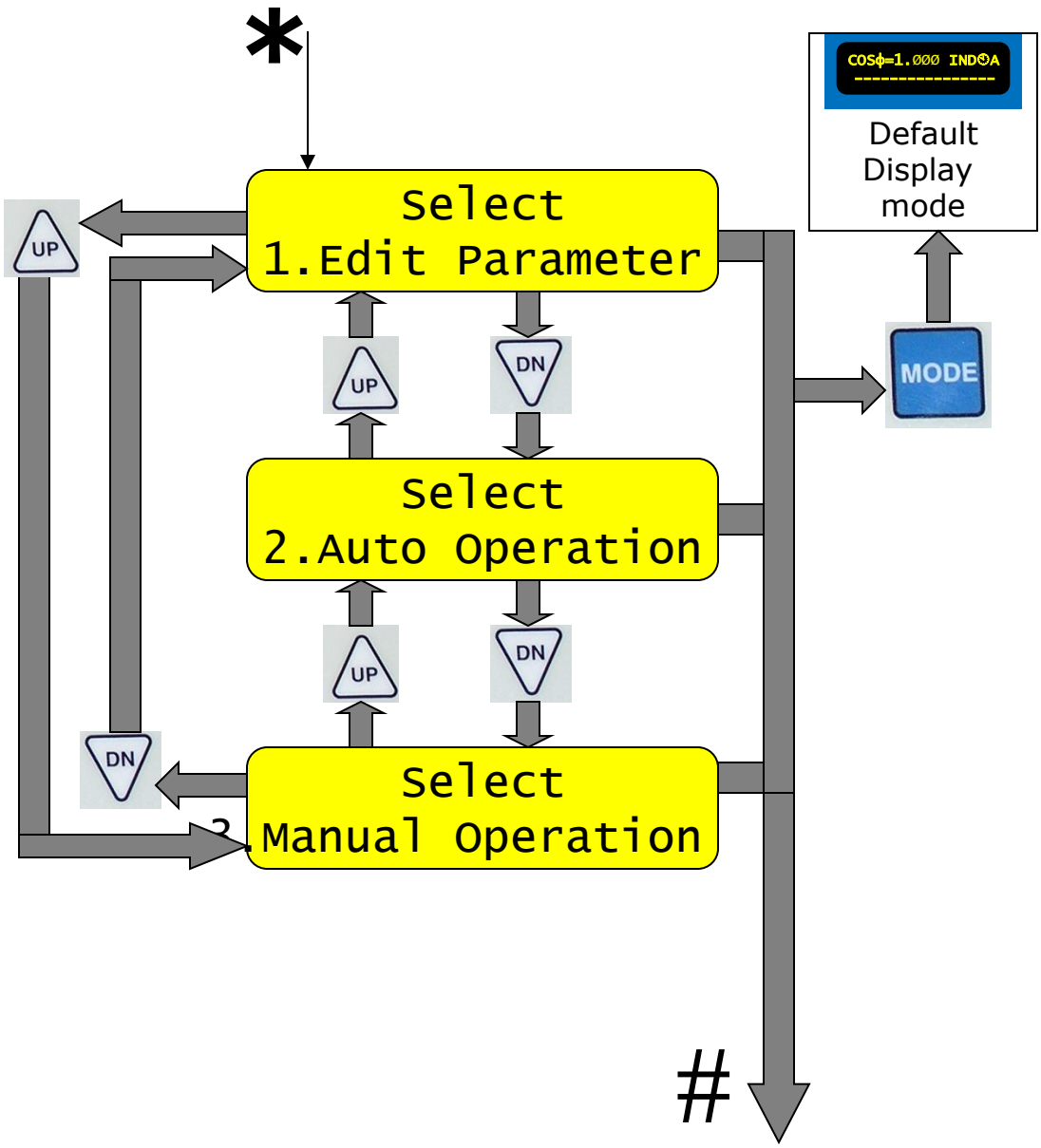
Ir-THD-(R/F) 3rd: 00.0 %	Iy-THD-(R/F) 3rd: 00.0 %	Ib-THD-(R/F) 3rd: 00.0 %	In-THD-(R/F) 3rd: 00.0 %
Ir-THD-(R/F) 5th: 00.0 %	Iy-THD-(R/F) 5th: 00.0 %	Ib-THD-(R/F) 5th: 00.0 %	In-THD-(R/F) 5th: 00.0 %
Ir-THD-(R/F) 7th: 00.0 %	Iy-THD-(R/F) 7th: 00.0 %	Ib-THD-(R/F) 7th: 00.0 %	In-THD-(R/F) 7th: 00.0 %
Ir-THD-(R/F) 9th: 00.0 %	Iy-THD-(R/F) 9th: 00.0 %	Ib-THD-(R/F) 9th: 00.0 %	In-THD-(R/F) 9th: 00.0 %
Ir-THD-(R/F) 11th: 00.0 %	Iy-THD-(R/F) 11th: 00.0 %	Ib-THD-(R/F) 11th: 00.0 %	In-THD-(R/F) 11th: 00.0 %
Ir-THD-(R/F) 13th: 00.0 %	Iy-THD-(R/F) 13th: 00.0 %	Ib-THD-(R/F) 13th: 00.0 %	In-THD-(R/F) 13th: 00.0 %
Ir-THD-(R/F) 15th: 00.0 %	Iy-THD-(R/F) 15th: 00.0 %	Ib-THD-(R/F) 15th: 00.0 %	In-THD-(R/F) 15th: 00.0 %

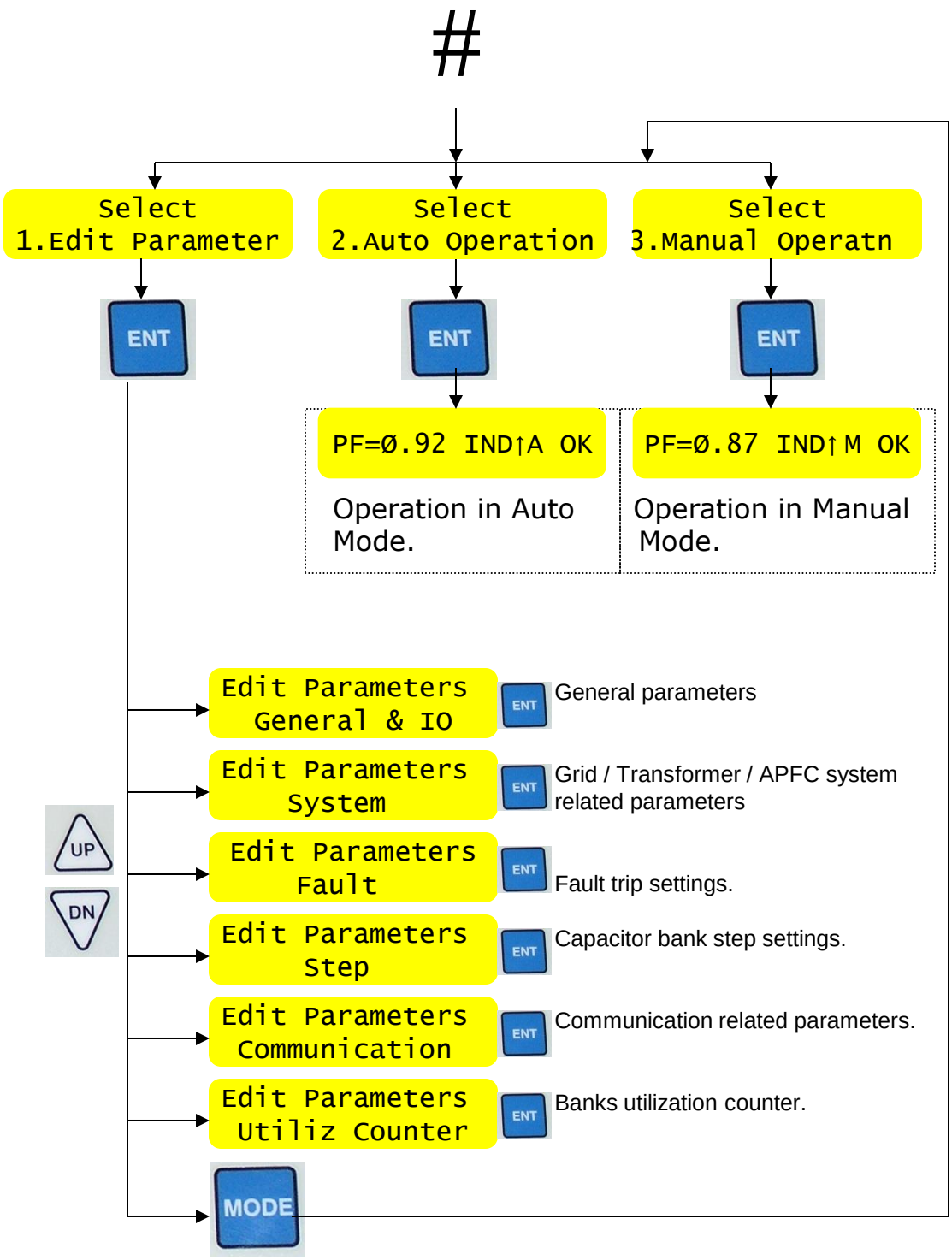
CC Harmonics

CCr-THD-(R/F) 3rd: 00.0 %	CCy-THD-(R/F) 3rd: 00.0 %	CCb-THD-(R/F) 3rd: 00.0 %
CCr-THD-(R/F) 5th: 00.0 %	CCy-THD-(R/F) 5th: 00.0 %	CCb-THD-(R/F) 5th: 00.0 %
CCr-THD-(R/F) 7th: 00.0 %	CCy-THD-(R/F) 7th: 00.0 %	CCb-THD-(R/F) 7th: 00.0 %
CCr-THD-(R/F) 9th: 00.0 %	CCy-THD-(R/F) 9th: 00.0 %	CCb-THD-(R/F) 9th: 00.0 %
CCr-THD-(R/F) 11th: 00.0 %	CCy-THD-(R/F) 11th: 00.0 %	CCb-THD-(R/F) 11th: 00.0 %
CCr-THD-(R/F) 13th: 00.0 %	CCy-THD-(R/F) 13th: 00.0 %	CCb-THD-(R/F) 13th: 00.0 %
CCr-THD-(R/F) 15th: 00.0 %	CCy-THD-(R/F) 15th: 00.0 %	CCb-THD-(R/F) 15th: 00.0 %

Method for Keyboard/Display usage.
Flow chart for entering into different modes:




*
COSϕ=1.000 IND⊙A
Default
Display
mode
Select
1.Edit Parameter
UP
UP
DN
MODE
Select
2.Auto Operation
UP
DN
DN
Select
3.Manual Operation
#


#
Select
1.Edit Parameter
Select
2.Auto Operation
Select
3.Manual Operatn
ENT
ENT
ENT
PF=Ø.92 IND↑A OK
PF=Ø.87 IND↑M OK
Operation in Auto Mode.
Operation in Manual Mode.
Edit Parameters General & IO
General parameters
Edit Parameters System
Grid / Transformer / APFC system related parameters
Edit Parameters Fault
Fault trip settings.
Edit Parameters Step
Capacitor bank step settings.
Edit Parameters Communication
Communication related parameters.
Edit Parameters Utiliz Counter
Banks utilization counter.
UP
DN
MODE

Keyboard / Display Operations:

Mode Selection:

Press “MODE”.
Enter Password (If enabled) by using ◄ ► ▲ ▼ keys then press “ENT”.
Using ▲ ▼ keys, select the Mode for
• EDIT PARAMETERS
• AUTO OPERATION
• MANUAL OPERATION
Then press “ENT” to enter the specific mode.

Edit Parameters: For carrying out the system settings.

Auto Operation: For functioning of SPF-35 in automatic compensation.

Manual Operation:
Pressing “ENT” button on this screen will put SPF-35 in Manual mode. This mode would continue to run till it is purposefully changed or Power down.

This mode is normally used to perform the Operation 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 Declaring banks faulty or Resetting faulty banks:
In manual mode default screen press “ENT”.
The cursor above bank 1 will start blinking. Use ◄ ► keys to select the specific bank. Then use ▼ key to declare the bank faulty.
To reset the faulty bank, bring the blinking cursor to that bank and use ▼ key again to declare the bank as healthy.
Once the specific banks are declared faulty or reset from faulty to a healthy status, press “ENT” key so that cursor stops blinking.
For saving the status on permanent basis (so that even after Power down, the status is unchanged), press “SAVE” key. After this save command, the unit will jump back to default mode. (Default as auto or manual is set in edit parameters)

For Testing banks with Manual On / Off commands:
Press “ENT”, 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 the capacitor banks. To come out of Manual On/Off edit mode, press “ENT” key so that cursor stops blinking.

Edit Parameters:

In this mode, the various system settings can be carried out.
To do the same,
Using ▲ ▼ keys, select the type of Parameters to be edited.
The types are

- **General & IO** : For General settings.
- **System** : For Mains/Generator related system settings
- **Fault** : Fault settings.
- **Step** : Capacitor Banks step settings.
- **Communication** : Communication parameters.
- **Utilization Counter** : Bank operations utilization counters.

After selecting the type, press "ENT" to enter the sub-menus 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 "ENT", ▲, ▼, ◀, ▶ keys. Coming out of sub-menu is by "MODE" key once.
To store the edited Parameters permanently, press "SAVE" when either in Edit Parameters type or sub-menu areas.
To, come out of EDIT Parameters without saving the changes, press "MODE" key again.
(Note that in 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).

Here are the Details of Various types of Parameters:

General and IO
Password Disable :
Change Password : 0000
Load Default No :
THD To Display F-THD :
Reset energy Cnt No :
AUX IP1 FUNCTION None :
AUX OP1 FUNCTION None :
AUX OP2 FUNCTION None :

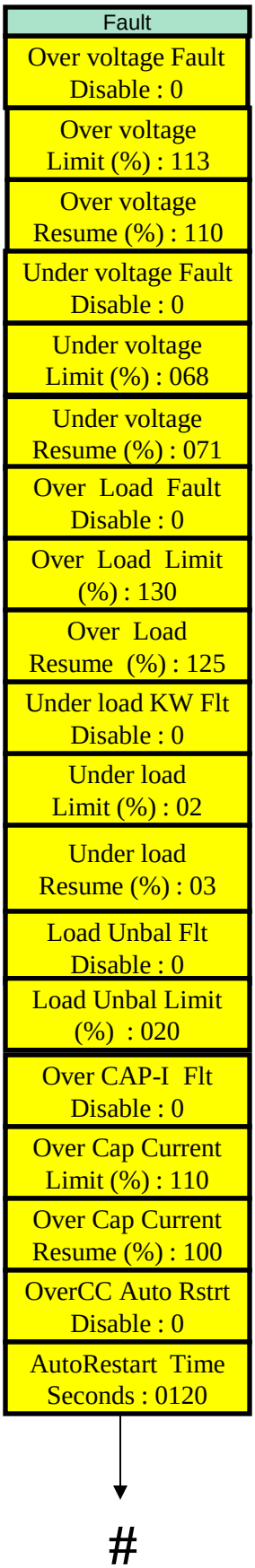
General and IO:

Password: Value: 0 / 1
0-Disable 1-Enable
Enable / Disable Password
Change Password: Set new value of password (4 digit).
The factory default Password is '0001'.
Load Default: Value: 0 / 1
0-No 1-Yes
Load all default parameters.
THD to Display: 0=R-THD (RMS THD) & 1=F-THD (Fundamental THD)
Select the type of THD to be displayed for V, I and Cap.Current
Reset Energy Counter: Value: 0 / 1
0-No 1-Yes
Resets the Energy Counters.
Aux IP1 Function : Set an action through auxiliary input None ,O/P En Di (output enable disable) , Mains/generator, Reset Flt. When controller is on Mains then on main screen shows ↑ (arrow). And if controller is on generator then on main screen shows ↓ (arrow). Aux OP Function : Program the auxiliary output to become NC due to any of the following :None, TripFlt, Sys Flt, Ou tOf Bank

SYSTEM
Meas. Voltage : 000
EXT-PT Ratio 0001.0 : 1
CUR CT Primary Mains : 0000
CUR CT Primary Gener : 0000
CAP CUR CT Primary : 0000
PF Up Lim: Mains [Cap : 0] 0.999
PF Up Lim: Mains Cap: 0 [0.999]
PF Low Lim: Mains [Ind : 1] 0.990
PF Low Lim: Mains Ind : 1 [0.999]
PF Up Lim: Gen [Cap : 0] 0.820
PF Up Lim: Gen Cap: 0 [0.820]
PF Low Lim: Gen [Ind : 1] 0.800
PF Low Lim: Gen Ind : 1 [0.800]
Mains Generator Mains : 0 :
Phase Auto Sync No : 0
Auto Sync fault Tol (%) : 5:
Reset Auto Sync No : 0
EXT. Temp. Meas Disable : 0

System:

- Measured Voltage:
  This is a factory set parameter and is only available for viewing. As this parameter is dependent on the hardware configuration, user is not allowed to change it.
- Ext-PT ratio: This is by default set to 0001.0:1, but in case the external PT is used, this ratio can be set.
  Limits: Lower: 0000.1 Upper: 6000.0
- Cur CT Primary: (Mains & Generator): The feedback source current for mains and Generator (if used with summation CTs). Limits: Lower: 0001 Upper: 9999.
- Capacitor Current CT Primary: The feedback Capacitor current. Limits: Lower: 0001 Upper: 9999.
- Power Factor Limits: SPF-35 has two set points sets. One is for Mains and another is for Generator. For every set, the limits can be set as Upper PF and Lower PF. Due to these settings, the characteristics for PF compensation are already defined earlier in this manual. The PF limits can be set up-to third decimal and can even be set as inductive or capacitive.
- Mains / Generator: This parameter defines weather unit should consider the set-points defined in Mains or in Generator.
  0 – Mains 1 – Generator.
- Phase Auto Synchronization: Auto Synchronization feature is enabled or disabled.
  0 – Disable. 1 – Enable.
- Auto Synchronization Fault: Unit if put in auto-synchronization, carries out some Power parameter checks. In this process, the tolerance of these parameters is defined here. If this tolerance is exceeded then unit declares failure of Auto-synchronization. In this condition, unit stops compensating the PF correction.
- Reset Phase Auto Synchronization: If auto-synchronization fault is detected, by 1 – Yes parameterizing, unit can start normal PF correction.
- EXT. Temp Meas : If enabled, External Temp. measurement can be done using a PT100 RTD Type 3-Wire Temperature Sensor.



Fault:

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

0=Disable
1=Indicative :Only Flash a Fault Message/& 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, there are 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 SPF-35 detects the supply system is overloaded, 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 Indicative.
- Under Load fault: The values here are set as % of Maximum rated KW. This is useful in case of fixed banks are put in circuit to take care of no load compensation. Value for this Under-Load KW can be calculated as shown in figure : Under Load Calculation

- Load Unbalance Fault: The 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 and Capacitor taking over-current even after restart may put system in hunting mode.

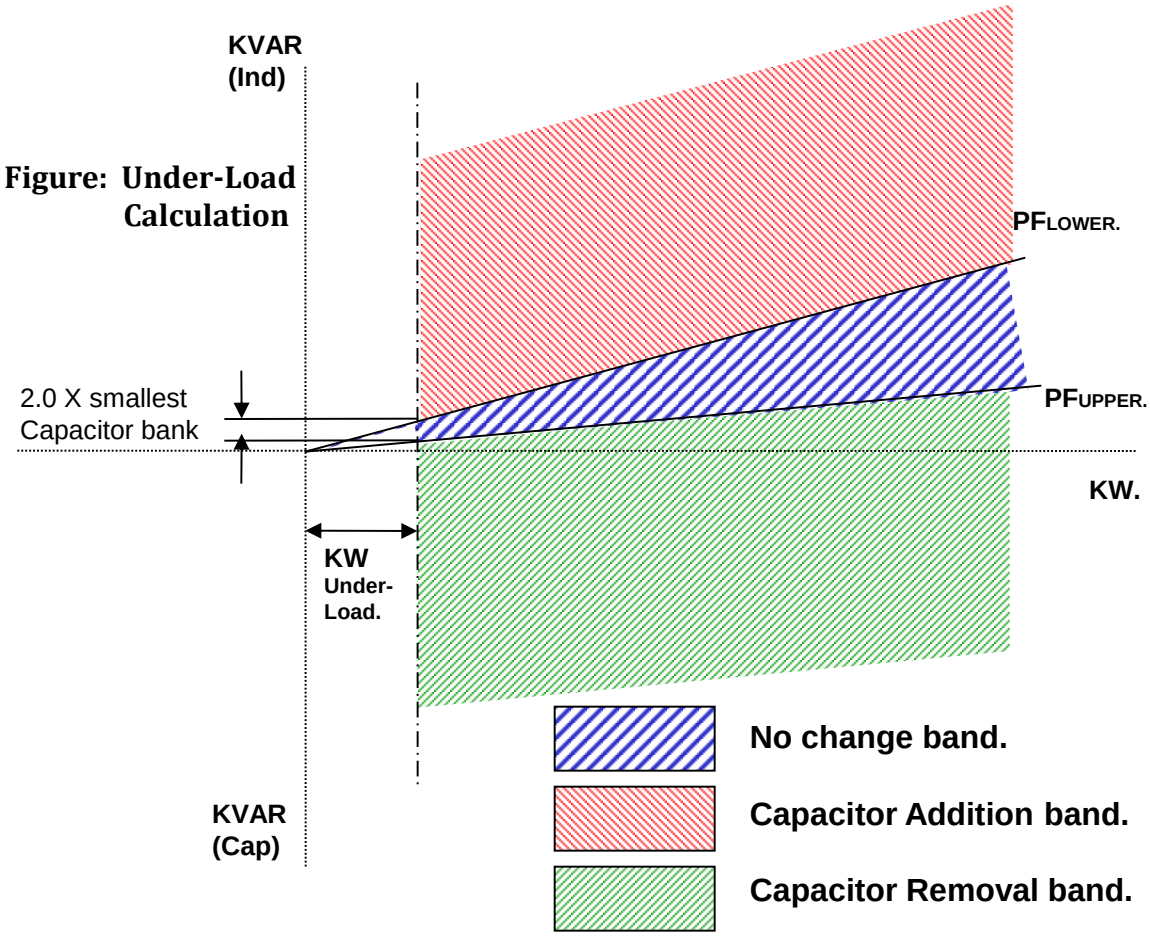


Figure: Under-Load Calculation

For PF_{UPPER} Inductive and PF_{LOWER} Inductive :

$$\textbf{Under-Load KW value setting} = \frac{\textbf{2.0 x Smallest bank kVAr.}}{[\tan\{\cos^{-1}(PF_{LOWER})\} - \tan\{\cos^{-1}(PF_{UPPER})\}]}$$

For PF_{UPPER} Capacitive and PF_{LOWER} Inductive :

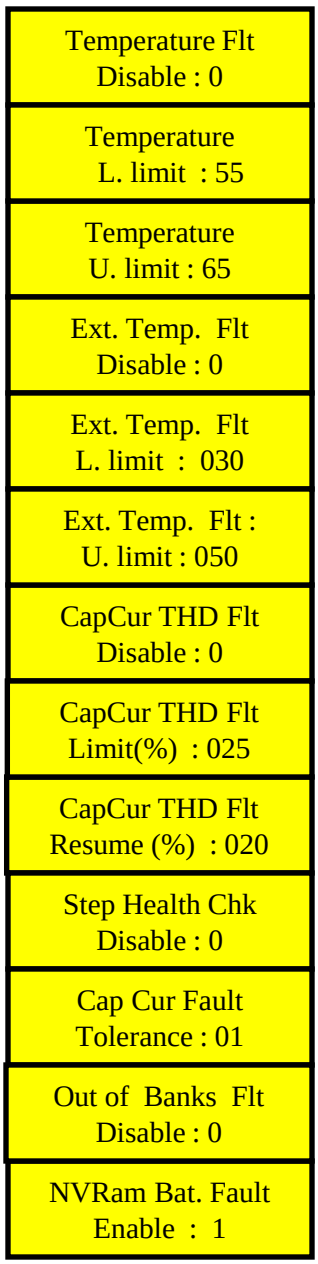
$$\textbf{Under-Load KW value setting} = \frac{\textbf{2.0 x Smallest bank kVAr.}}{[\tan\{\cos^{-1}(PF_{UPPER})\} + \tan\{\cos^{-1}(PF_{LOWER})\}]}$$

For PF_{UPPER} Capacitive and PF_{LOWER} Capacitive:

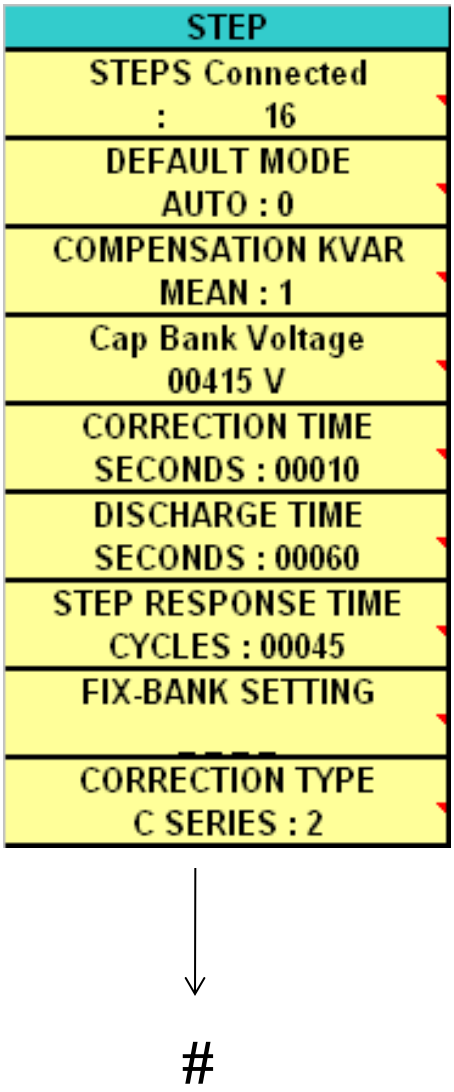
$$\textbf{Under-Load KW value setting} = \frac{\textbf{2.0 x Smallest bank kVAr.}}{[\tan\{\cos^{-1}(PF_{UPPER})\} - \tan\{\cos^{-1}(PF_{LOWER})\}]}$$

…continued.

#

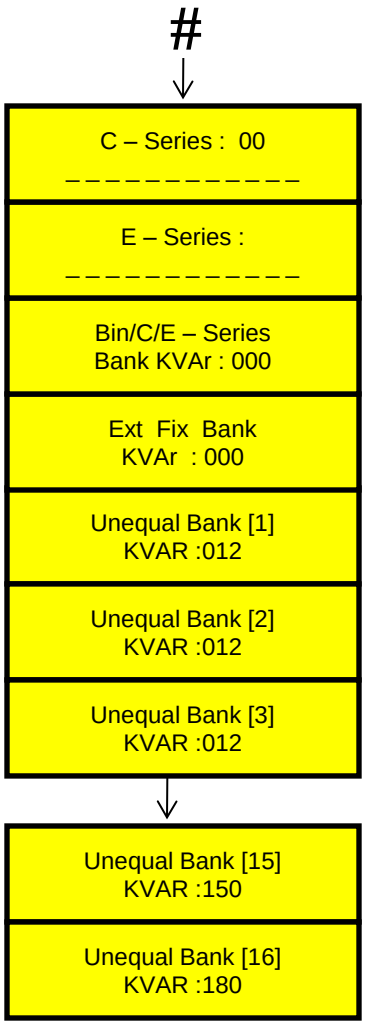


- Internal Temperature Fault: Units monitors the temperature inside the SPF-35 housing. This temperature can go up either due to ambient temperature in the APFC panel has gone up beyond limit or if some component failure in SPF-35 hardware itself. Upper limit is for tripping and lower limit is for normal operation (resume).
- External Temperature Fault: External input from PT 100 is used to monitor the temperature outside the SPF-35 housing. The Temperature inside the APFC panel or ambient temperature can be monitored through the external temperature input. 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: SPF-35 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. i.e. APFC panel is unable to compensate due to non availability of okay capacitor bank step .
- NV-Ram Battery Fault: For internal NV-RAM and RTC, a small battery is provided inside SPF-35. The health of this battery is checked by SPF-35 on regular basis. If it is found un-healthy, if this parameter is enabled will give the indication and will stop data-logging operation (as it may write error prone data).



Step:

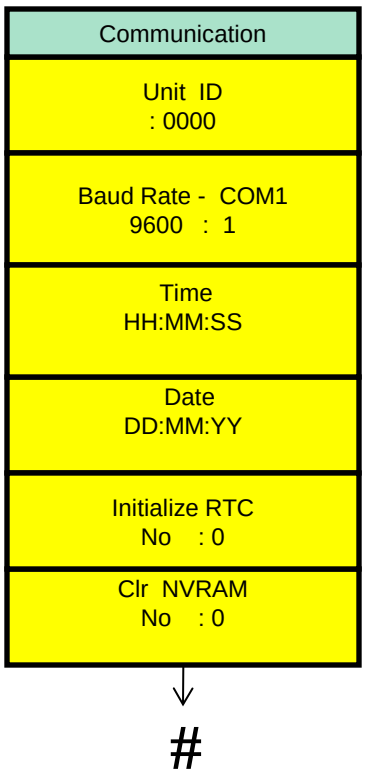
- Steps Connected: Defines the number of steps operational. Depending on PF system banks, this parameter is set.
- Default Mode: 0: Auto and 1: Manual. This parameter defines the mode during Power up. (Default is 0: Auto)
- Compensation kVAr: 0:Instantaneous & 1:Mean. Defines the method for kVAr compensation. 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 seconds. 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: SPF-35 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---.
  Un-equal is used with banks not having definite ratio.
  C series is predefined Control Series. The standard ratios are preloaded in SPF-35 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.



- C Series: Various control series (C Series) can be selected

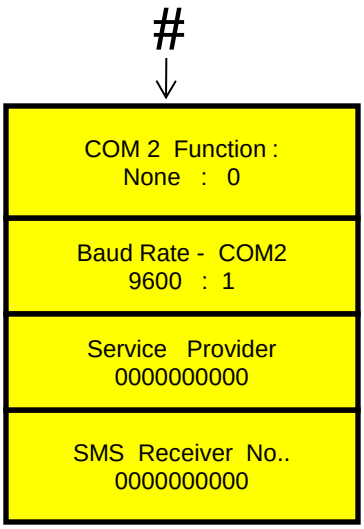
00:	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1.	10:	1 1 2 2 2 4 4 4 4 4 4 4 4 4 4 4.
01:	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2.	11:	1 1 2 2 4 4 4 4 4 4 4 4 4 4 4 4.
02:	1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3.	12:	1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2.
03:	1 2 3 4 4 4 4 4 4 4 4 4 4 4 4 4.	13:	1 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3.
04:	1 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 4 4.
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 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.
- Bin/C/E 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). SPF-35 has a in built intelligent algorithm to select the best possible combination to suit the exact kVAr requirement for compensation.

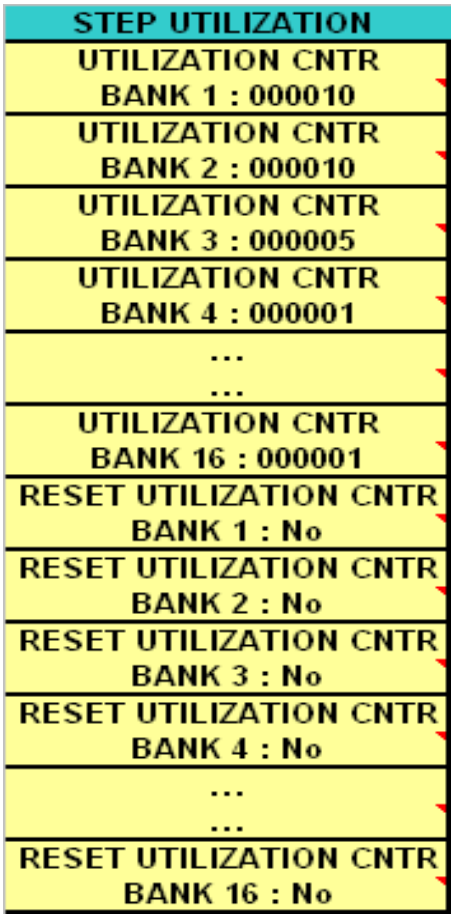


Communication:

- Unit ID: Value: 0000 to 9999. Default value 0001. Defines the 4 digit unit ID used for serial communication on RS-232 TAS protocol.
- Baud Rate COM 1: selectable. 0 – 4800bps, 1 – 9600bps, 2 – 19200bps, 3 – 38400bps, 4 – 57600bps.
- Time: Defines the Real-Time setting in HH:MM:SS 24 Hours Format.
- Date: Defines the Date in DD:MM:YY format setting.
- Initialize RTC: 0 – No, 1 – Yes. Defining Yes initializes RTC (real time clock) 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 SPF-35. This will also clear Energy counters, this is generally used to clear NVRAM Checksum fault (This is after pressing SAVE command).



- COM 2 Function : selectable
0 - None , 1 - Mod-bus ASCII , 2 : Mod-bus RTU ,
3 - GSM .
- Baud Rate COM 2: selectable.
0 – 4800bps, 1 – 9600bps,
- Service Provider: Service provider number is is to be given. It is normally a 10 digit number.
- SMS Receiver No: This defines the number to where the SMS communication is to be sent. Normally it's a Master control unit Receiver Number.



Utilization Counter:

- 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.

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

Commissioning Instructions:

After the panel is powered up.

1. Remove the fuses/switch off MCBs/MCCBs in series with every capacitor bank. Connect the supply to the **SPF-35**. Keep the load feedback and capacitor current feedback in shorted condition.

2. Turn On the supply to the panel and set Date/time and various other parameters as per the panel configuration. Its 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. Keep Auto-Synchronization in Disabled state.

3. Once the parameterization is complete, put the **SPF-35** 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.

4. 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.

5. Put **SPF-35** back in Manual mode and turn ON/Off the individual steps. Use tong tester (ac current measurement) to check that current in all the three phase of the corresponding bank are OK. In case of any bank not able to give the desired current, check for capacitor bank healthiness or power circuits.

6. 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 select "Auto-synchronization" in Enable mode or change CT polarity.

7. 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.

8. Switch OFF all the banks manually and put the **SPF-35** in Automatic mode. Switch Off the supply to panel and put it ON. If auto-synchronization is enabled, **SPF-35** will first turn ON all the capacitor banks and turn them off. This is one of the routine steps for auto-synchronization during power up.
   In case of message of "Auto-Synchronization Failure", **SPF-35** will go in "No compensation". In case of such failures (normally seen with very high fluctuating loads only), manual synchronization is mandatory by physically checking the CT connections and polarity.

   Observe the panel performance for a period of about 2 Hours after the commissioning.

Fault Finding Guidelines:

Fault Type	Probable Reason	Action to Take
Unit Does not turn ON.	•Input auxiliary supply not coming. •Input side fuses blown	•Check the input supply to restore •Check fuses in the unit for OK.
Unit does not turn On any capacitors even if PF is below Lower PF limit.	•If auto-sync failure message is there at Power On. • The load KW is too low. •Control connections from RLY module to contactor coils are not proper.	• Load may be highly fluctuating so need of manual synchronization only. • This is OK condition. •Check control supply and connections from RLY to contactors.
"BF" flashing indication. *OR* "NV RAM Checksum error" display. *OR* Corruption of date & time.	In all these three conditions, the battery needs to be checked. • Internal Li-Ion 3.3 Vdc battery used for RTC and NV RAM must be drained down.	• Replace this battery in consultancy with TAS PowerTek trained personnel.
Some Capacitor banks are declared as faulty even if they are checked to be OK.	•Individual step health monitoring is enabled and tolerance limits set are too stringent. • Capacitor current THD factor is continuously fluctuating.	•Set the tolerance limits for individual steps monitoring as relaxed. • 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.

Fault Finding Guidelines (continued):

Fault Type	Probable Reason	Action to Take
Serial Communication is not working.	• Baud rate selection is not proper. • Unit ID is not set properly. • Serial communication cable connections are not proper.	• Select proper baud rate. • Set the unit ID correctly. • Check the serial cable continuity as per the connections given earlier in this manual.
Data logging is not taking place.	• If Battery Health monitoring is enabled and battery is weak. Possibility of battery unhealthy message being displayed. •Improper settings in PC software and/or PC	• Change the battery by help of TAS's authorized person. •Ensure proper settings in date/time format of PC, and settings in the PC S/W are correct
SPF-35 resets occasionally on turning OFF of any contactor.	• The contactor supply phase may be the same as used for **SPF-35** auxiliary supply. • RC snubbers and / or MOVs for AC Inductive Loads and free-wheeling diodes for DC Loads are not put with contactor coils.	• Use the different phase for control supply of contactors and for **SPF-35** supply • Usage of R-C snubbers and / or MOVs for AC Inductive Loads and free-wheeling diodes for DC Loads is mandatory.

Factory Default Settings

PARAMETER	MIN	MAX	INCREMENT/ DECREMENT STEP SIZE	FACTORY DEFAULT
GENERAL I/O				
Password (Enable:/ Disable)	Disable	Enable	-	Enable (password : 0001)
Change password	0000	9999	1	0000
Load default (Yes/ No)	No	Yes	-	No
THD to display (F–THD for Fundamenta / R- THD for rms)	R-THD	F-THD	-	F-THD
Reset energy counter (Yes/No)	No	YES	-	No
Aux IP1 FUNCTION (None / OP_En_ Di / Mains_ Genr/ Reset Flt .	None	Reset Flt	-	None
Aux OP1 FUNCTION (None / TripFlt / Sys Flt/OutOfStep	None	OutOfstep	-	None
Aux OP2 FUNCTION (None / TripFlt / Sys Flt/OutOfStep	None	OutOfstep	-	None

PARAMETER	MIN	MAX	INCREMENT/ DECREMENT STEP SIZE	FACTORY DEFAULT
SYSTEM			-	
Meas. Voltage.	-	415	-	415
EXT-PT Ratio	1: 1	5999.9:1	1	1
Current CT Primary Mains	1	5999	1	1000
Current CT Primary Gener	1	5999	1	0500
CAP CUR CT Prim	1	5999	1	1000
PF Upper limit: Mains [Cap/Ind]	Cap	Ind	-	[Ind : 1] 0.980
PF Upper limit: Mains [0.980]	0.100	0.999	1	Ind : 1 [0.980]
PF Lower limit: Mains [Cap /Ind]	Cap	Ind	-	[Ind : 1] 0.970
PF Lower limit: Mains [0.970]	0.100	0.999	1	Ind : 1 [0.970]
PF Upper limit: Gen [Cap/Ind]	Cap	Ind	-	[CAP:0] 0.820
PF Upper limit: Gen [0.820]	0.100	0.999	1	CAP:0 [0.820]
PF Lower limit: Gen [Cap /Ind]	Cap	Ind	-	[CAP:0] 0.800
PF Lower limit: Gen [0.800]	0.100	0.999	1	CAP:0 [0.800]
Mains Generator	Mains	Generator	-	Mains :0
Phase Auto Synch (No/Yes)	No	Yes	-	No :0
Auto Sync Fault Tol (%)	01	49	1	Tol (%) :15
Reset Auto Sync	No	Yes	-	No :0
EXT. Temp. Meas (Disable/Enable)	Disable	Enable	-	Disable : 0

PARAMETER	MIN	MAX	INCREMENT/ DECREMENT STEP SIZE	FACTORY SETTINGS
Faults				
Over Voltage Fault (Disable/Enable)	Disable	Enable	-	Disable : 0
Over Voltage limit (%)	110	149	1	115
Over Voltage resume (%)	100	110	1	110
Under Voltage Fault (Disable/Enable)	Disable	Enable	-	Disable : 0
Under Voltage limit (%)	000	089	1	085
Under Voltage resume (%)	000	099	1	090
Over Load Fault (Disable/Enable)	Disable	Enable	-	Disable : 0
Over Load limit (%)	130	149	1	130
Over Load Resume (%)	100	129	1	125
Under Ld. kW Fault (Disable, Indicate , Off Step, Off Fix ,Fast Off)	Disable	Fast Off	-	Disable : 0
Under load limit (%)	000	025	1	020
Under load resume(%)	025	099	1	025
Load Unbalance Fault (Disable/Enable)	Disable	Enable	-	Disable : 0
Load Unbal limit (%)	010	099	1	020
Over Capacitor Current Fault (Disable/Enable)	Disable	Enable	-	Disable : 0
Over Capacitor Current Limit (%)	130	149	1	130
Over Capacitor Current Resume (%)	100	129	1	125

PARAMETER	MIN	MAX	INCREMENT/ DECREMENT STEP SIZE	FACTORY DEFAULT
Over Capacitor current AutoRstrt (Enable/Disable)	Disable	Enable	-	Enable
AutoRestart Time seconds	0030	0599	1	0120
Temperature Fault (Disable, Indicate , Off Step , Off Fix ,Fast Off)	Disable	Fast off	1	Disable
Temp lower limit	00	59	1	55
Temp upper limit	00	99	1	65
External Temperature Fault (Disable, Indicate , Off Step , Off Fix ,Fast Off)	Disable	Fast off	1	Disable
External Temp Fault Lower limit	10	49	1	30
External Temp Fault Upper limit	030	99	1	50
Capacitor current THD Fault (Enable/Disable)	Disable	Enable	-	Disable
Capacitor current THD Limit (%)	008	099	1	10
Capacitor current THD Resume (%)	000	008	1	08
Step Health Chk (Enable/Disable)	Disable	Enable	-	Disable
Capacitor Currrent Fault Tolerance	00	59	1	10
Out of Banks Fault (Enable/Disable)	Disable	Enable	-	Disable
NV Ram Bat. Fault (Enable)	-	Enable	-	Enable

PARAMETER	MIN	MAX	INCREMENT/ DECREMENT STEP SIZE	FACTORY Setting
STEP				
Steps Connected : 1 to 16	1	16	1	16
Default Mode (Auto/Manual)	Auto	Manual	-	Auto
Compensation KVAr (Instant /Mean)	Instant	Mean	-	Mean
Capacitor Bank Voltage (L- L)	00050	59999	1	00415
Correction Time (Seconds)	10000	59999	1	00020
Discharge Time (Seconds)	00000	59999	1	00002
Step Response Cycles	-	-	-	00045
Fixed bank setting	1	16	1	_
Correction Type (Binary/Unequal/C-Series/E-Series)	Binary	E-Series	-	C – Series :2
C -Series :	00	19	1	00
E -Series :	-1	16	-	-
Bin/C/E Series Bank Kvar	001	199	1	020
Ext Fix Bank KVAR :	000	999	1	000
Unequal Bank [1] KVAr	1	199	1	001
Unequal Bank [2] KVAr	1	199	1	001
Unequal Bank [3] KVAr	1	199	1	001
Unequal Bank [4] KVAr	1	199	1	001
Unequal Bank [5] KVAr	1	199	1	001
Unequal Bank [6] KVAr	1	199	1	001
Unequal Bank [7] KVAr	1	199	1	001
Unequal Bank [8] KVAr	1	199	1	001
Unequal Bank [.....n] KVAr	1	199	1	001

PARAMETER	MIN	MAX	INCREMENT/ DECREMENT STEP SIZE	FACTORY Settings
Communication				
Panel ID	0000	9999	1	0000
Baud Rate – COM1 4800 , 9600, 19200,38400 , 57600	4800	57600	-	9600
Set Time (HH/MM/SS)	–	–	–	Current Time
Set Date (DD/MM/YY)	–	–	–	Current Date
Initialize RTC (Yes/No)	–	–	–	No
Clear NVRAM (Yes/ No)	–	–	–	No
COM 2 Function : None, Mod-bus ASCII. Mod-bus RTU, GSM (RS-232). Note: MOD-Bus is RS-485 Signal Levels.	None	GSM (RS-232)	-	Mod-bus RTU on RS-485
Baud Rate – COM 2 4800 /9600	4800	9600	1	9600
Service Provider	0000000000	9999999999	1	0000000000
SMS Receiver No	0000000000	9999999999	1	0000000000

PARAMETER	MIN	MAX	INCREMENT/ DECREMENT STEP SIZE	FACTORY DEFAULT
Utilization Counters (not editable in the field)				
Utilization Counter Bank [1]	000000	999999	-	000000
Utilization Counter Bank [2]	000000	999999	-	000000
Utilization Counter Bank [3]	000000	999999	-	000000
Utilization Counter Bank [4]	000000	999999	-	000000
Utilization Counter Bank [5]	000000	999999	-	000000
Utilization Counter Bank [6]	000000	999999	-	000000
Utilization Counter Bank [7]	000000	999999	-	000000
Utilization Counter Bank [8]	000000	999999	-	000000
Utilization Counter Bank [..... n]	000000	999999	-	000000
Clr Bank [1] Cntr No / Yes	No	Yes	-	No
Clr Bank [2] Cntr No / Yes	No	Yes	-	No
Clr Bank [3] Cntr No / Yes	No	Yes	-	No
Clr Bank [4] Cntr No / Yes	No	Yes	-	No
Clr Bank [5] Cntr No / Yes	No	Yes	-	No
Clr Bank [6] Cntr No / Yes	No	Yes	-	No
Clr Bank [..... n] Cntr No / Yes	No	Yes	-	No

Maintenance Copy: Please fill-in the below after successful commissioning.

PARAMETER	As on date	As on date	As on date
GENERAL I/O			
Password (Enable:/ Disable)			
Change password			
Load default (Yes/ No)			
THD to display (F–THD/ R-THD)			
Reset energy counter (Yes/No)			
Aux IP1 FUNCTION (None / OP_En_ Di / Mains_ Genr/ Reset Flt .			
Aux OP1 FUNCTION (None / TripFlt / Sys Flt/OutOfStep			
Aux OP2 FUNCTION (None / TripFlt / Sys Flt/OutOfStep			

PARAMETER	As on date	As on date	As on date
SYSTEM			
Meas. Voltage.			
EXT-PT Ratio			
Current CT Primary Mains			
Current CT Primary Generator			
CAP CUR CT Prim			
PF Upper limit: Mains [Cap/Ind]			
PF Upper limit: Mains [0.980]			
PF Lower limit: Mains [Cap /Ind]			
PF Lower limit: Mains [0.970]			
PF Upper limit: Gen [Cap/Ind]			
PF Upper limit: Gen [0.820]			
PF Lower limit: Gen [Cap /Ind]			
PF Lower limit: Gen [0.800]			
Mains Generator			
Phase Auto Synch (No/Yes)			
Auto Sync Fault Tol (%)			
Reset Auto Sync			
EXT. Temp. Meas (Disable/Enable)			

PARAMETER	As on date	As on date	As on date
Faults			
Over Voltage Fault (Disable/Enable)			
Over Voltage limit (%)			
Over Voltage resume (%)			
Under Voltage Fault (Disable/Enable)			
Under Voltage limit (%)			
Under Voltage resume (%)			
Over Load Fault (Disable/Enable)			
Over Load limit (%)			
Over Load Resume (%)			
Under Ld. kW Fault (Disable, Indicate , Off Step, Off Fix ,Fast Off)			
Under load limit (%)			
Under load resume(%)			
Load Unbalance Fault (Disable/Enable)			
Load Unbal limit (%)			
Over Capacitor Current Fault (Disable/Enable)			
Over Capacitor Current Limit (%)			
Over Capacitor Current Resume (%)			
Over Capacitor current AutoRstrt (Enable/Disable)			
AutoRestart Time seconds			
Temperature Fault (Disable, Indicate , Off Step , Off Fix ,Fast Off)			
Temp lower limit			
Temp upper limit			

PARAMETER	As on date	As on date	As on date
External Temperature Fault (Disable, Indicate , Off Step , Off Fix ,Fast Off)			
External Temp. Fault Lower limit			
External Temp. Fault Upper limit			
Capacitor current THD Fault (Enable/Disable)			
Capacitor current THD Limit (%)			
Capacitor current THD Resume (%)			
Step Health Chk (Enable/Disable)			
Capacitor Current Fault Tolerance			
Out of Banks Fault (Enable/Disable)			
NV Ram Bat. Fault (Enable)			

PARAMETER	As on date	As on date	As on date
STEP			
Steps Connected : 1 to 16			
Default Mode (Auto/Manual)			
Compensation KVAr (Instant /Mean)			
Capacitor Bank Voltage (L- L)			
Correction Time (Seconds)			
Discharge Time (Seconds)			
Step Response Cycles			
Fixed bank setting			
Correction Type (Binary/Unequal/C-Series/E-Series)			
C -Series :			
E -Series :			
Bin/C/E Series Bank Kvar			
Ext Fix Bank KVAR :			
Unequal Bank [1] KVAr			
Unequal Bank [2] KVAr			
Unequal Bank [3] KVAr			
Unequal Bank [4] KVAr			
Unequal Bank [5] KVAr			
Unequal Bank [6] KVAr			
Unequal Bank [7] KVAr			
Unequal Bank [8] KVAr			
Unequal Bank [9] KVAr			
Unequal Bank [10] KVAr			
Unequal Bank [11] KVAr			
Unequal Bank [12] KVAr			
Unequal Bank [13] KVAr			
Unequal Bank [14] KVAr			
Unequal Bank [15] KVAr			
Unequal Bank [16] KVAr			

PARAMETER	As on date	As on date	As on date
Communication			
Panel ID			
Baud Rate – COM1 4800 , 9600, 19200,38400 , 57600			
Set Time (HH/MM/SS)			
Set Date (DD/MM/YY)			
Initialize RTC (Yes/No)			
Clear NVRAM (Yes/ No)			
COM 2 Function : None, Mod-bus ASCII, Mod-bus RTU, GSM (RS-232). Note: MOD-Bus = RS-485			
Baud Rate – COM 2 4800 /9600			
Service Provider			
SMS Receiver No			

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