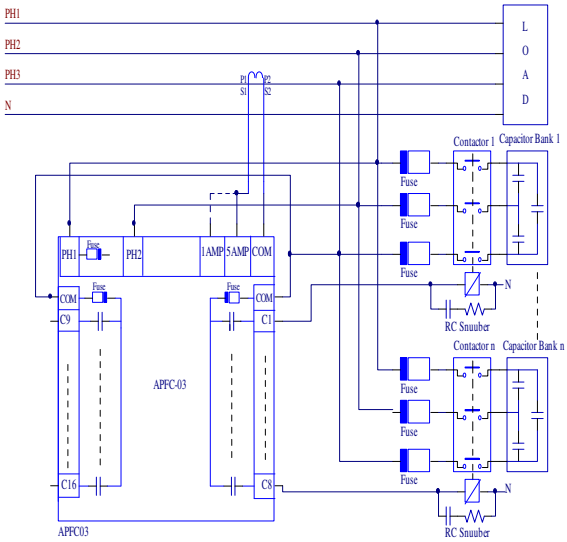
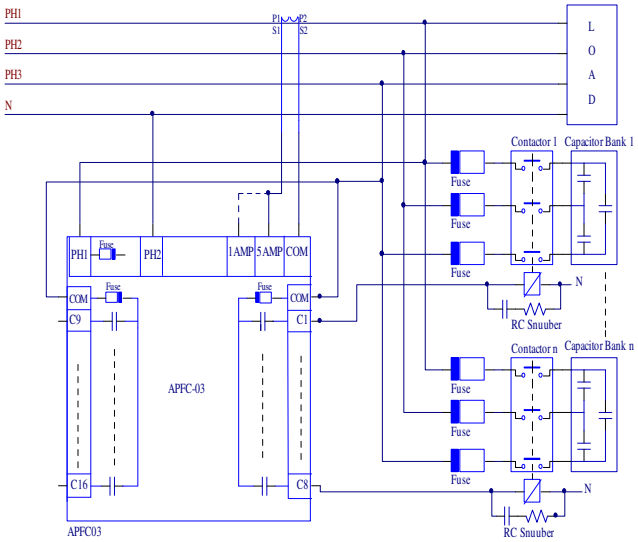
TAS PowerTek
APFC-03/ (04/08/12/16)
Automatic Power Factor Controller

User Operations Guidelines

Typical Wiring Schemes:



Quadrature Mode Method of Wiring
(Basic & Expert Mode)



In-Phase Mode Method of Wiring.
(Expert Mode only)

Mechanical Dimensions: DIN Standard 144 mm x 144 mm.

Front Height: 144 mm, Front Width: 144 mm, Rear Depth behind the Panel Door: 75 mm
Recommended Panel Cut-out for instrument mounting: 138 mm x 138 mm
Maximum weight: (with clamps and terminals): Approx. 650 gms.

Keyboard in Front:

Up Key	Right Shift Key	Mode Key
Down Key	Left Shift Key	Memory / Save Key
		Enter Key

Features:

1. P.F. Controller for universal application, requires no settings, is self-configuring in "Basic" mode.
2. Advanced Microcontroller based logic for measurements, monitoring, analysis and control. It is suitable for balanced 3-Phase Compensation by capacitor switching.
3. 16 Character, 2 Lines, alpha-numeric, dot-matrix LCD display with LED back-light.
4. 7 Keys, tactile switches key-pad for user interaction, with LCD Display.
5. Front panel flashing LED indication for PF Controller healthy (running) status.
6. Phase-to-Phase input voltage measurement with over-voltage transients protection.
7. Single Phase Supply (Load) current CT secondary input, field selectable for 1 Amp or 5 Amp range.
8. 4 Models, as per Order Code, suitable for 4, 8, 12 or 16 Capacitor Banks control.
9. Independent, fast-blow fuse protection for relay contact outputs, for banks 1 to 8 and 9 to 16.
10. Potential free, "normally-open" relay contact outputs for external contactor switching control.
11. Two auxiliary digital outputs, "normally-open" relay contacts for external Alarm activation etc.
12. THD% measurements of voltage and supply (load) current inputs. Odd harmonics up to 15th.
13. In "Expert" Mode facility of Un-equal bank size selection. Including user defined bank values in kVAr.
14. Capacitor Bank Step Protection features like
    - Over / Under Voltage at measurement input.
    - Harmonic overload, both for voltage and current.
    - Over-Temperature inside the **APFC-03** Controller Unit.
    - Over / Under AC Mains Line Frequency.
15. DIN Standard 144 x 144 mm Plastic Cabinet for Panel-door flush-mounting. Rear side dimensions as 137 x 137 mm with recommended Panel door cut-out as 138 x 138 mm. Max. Depth of 76 mm on rear side of panel mounting door.
16. Three-Sides Closed Screw Terminals on the rear side suitable for fork type lugs providing easy field wiring connections.
17. "Expert Configuration" allows Line-to-Neutral as voltage sensing input.
18. Use of SMPS which facilitates wide range Auxiliary Supply voltage, with externally accessible input auxiliary input operating supply slow-blow fuse protection.
19. Most important and advanced feature is the "BASIC Configuration". Controller in Basic Configuration has the following features:
    - Automatic detection and usage of the optimum capacitor banks.
    - Fully automatic capacitor bank step value setting and self-adapting.
    - System parameters (voltage, current, active power, reactive power, apparent power, Maximum values of these parameters, kVAr value of every bank that are connected) are displayed in terms of percentage of its rated 100% values.

Specifications:

1. Balanced 3-Phase Reactive Power Compensation using 3-Phase Balanced Connected Power Capacitor Banks.
2. Operating Auxiliary and Measurement voltage: 100V to 500V AC Line-to-Line value, and Supply frequency Nominal as 50 (+/-3) Hz or 60 (+/-3) Hz.
3. Active Power Measurements with Class 1.0 accuracy, Reactive Power Measurement with Class 2.0 accuracy for recommended Measurement Voltage, Load Current phase I/P's, as per line diagram at rear side of **APFC**.
4. Single-CT Supply (Load) Current Input (from CT secondary): 1A or 5A, selectable at the rear terminal block.
5. Output Stages: Standard Models with 4, 8, 12 or 16 Outputs, as per Order Code.
6. Relay Output N.O. contact rating: Max: 250Vac, 0.5Amp, resistive/ inductive load, continuous.
7. Operating Temperature Range: 0 to +55° C.
8. Storage Temperature Range: 0 to +65° C.
9. Relative Humidity Range: 10% to 95% (Non-condensing)
10. Un-packed Net Weight of the Unit: 650 grams.

Operations Modes: Unit can operate in two different Modes. **(1) Basic Mode.** **(2) Expert Mode.**
Basic Mode: **APFC-03** operates with minimum basic functionality as Automatic PF correction mode. The display shows % values of electrical parameters and major protections are de-activated.
Recommended only for those users who are not much conversant with the functionality of the **APFC-03** Unit.
Expert Mode: All the functionalities of **APFC-03** are available in this mode. User need to enter the editable parameters. The display shows the real, instantaneous values of electrical parameters measured/computed. Expert mode is recommended for the users having complete knowledge of the APFC Units in general and the **APFC-03** Unit, in particular.

Automatic Set-up: Automatic set-up is invoked by simultaneously pressing of "Right Shift Key" and "Left Shift Key" for a period of about One Second.
Automatic set-up automatically configures **APFC-03** Unit to initially perform system configuration sensing tests which can take typically between 3 to 15 min. Success rate of Auto-Setup is 97% approximately.
Jn Expert Mode 'Auto phase synchronization' can be invoked, where **APFC-03** checks the phase sequence of voltage & Supply (load) current inputs & corrects the phase sequence, CT polarity automatically, in case of any incorrect phase sequence/polarity.
(The Automatic set-up can be invoked in Basic mode & 'Auto phase synchronization' is invoked in Expert mode).

LCD Display:
Contrast of LCD**:** LCD Contrast can be adjusted 'Darker' by repetitive pressing of Left Shift Key & 'Lighter' by repetitive pressing of Right Shift Key. To save the new LCD Contrast settings, Press Memory/ Save Key.

First line of display indicates P.F. value, inductive / capacitive PF, mode of operation, and fault/OK status:
"PF = 1.000" indicates overall P.F. of the system. "+" or "-" indicates if PF is inductive or capacitive respectively.
"A" or "M" indicates the Auto and Manual mode of operation respectively.

Last two characters on the LCD Display 1st Line of the represent one of the following status:

OK = Controller Status is OK,	AS = Auto-Synchronization Pending
OV = Over-Voltage at measurement terminals,	UV = Under-Voltage at measurements terminals
VH = Voltage Over-Harmonics THD%,	IH = Current Over-Harmonics THD%
UF = Under-Frequency of AC Mains Supply,	OF = Over-Frequency of AC Mains Supply
OB = Out of Banks (Insufficient Total Capacitive kVAr) – Warning,	OT = Over-Temperature internal to **APFC** Unit.

The bottom line of the LCD Display shows the Capacitor Bank status. The numbers 1 to 16 below the LCD display are for specific outputs (Capacitor Bank number that is controlled by **APFC-03**). The LCD display above this number indicates the status of that specific Relay Output / Capacitor Bank.

A dash (-) symbol = Bank is connected, but is in OFF state. A Capacitor symbol = Bank is connected & it is in ON state.
A BOLD Capacitor symbol = Bank is declared as fixed bank & is ON. A X symbol = Bank is declared faulty and is OFF.
A D symbol = Capacitor Bank has just turned off and it is in discharging state.
During Power Up, till the time all Banks are showing D status, the keyboard would not be operational. This is to ensure that at Power-Up, all the Capacitors Banks are allowed to be discharged first.

Display of Electrical Parameters:

- MAIN SCREEN: This is factory set default screen, indicating information on PF, functionality mode, operating mode and controller health status.
- MEASURED VALUES: Indicates the measured values of the system parameters like V, I, kW, kVAr, kVA, capacitive kVAr and AC Mains Line Frequency.
- MAX VALUES: Indicates the maximum values of V, I, kW, kVAr and kVA, detected after the last reset. This also has the facility of resetting the maximum values manually which after resetting would be the actual instantaneous values and not zero.
- Display THD%: THD% for voltage and current. Also displays odd harmonics up to 15th level.
- DISPLAY STEP: The measured kVAr values of each connected output capacitor bank step.
- DISPLAY AUX FUNC: The **APFC** Unit's internal temperature in degree Celsius and auxiliary digital outputs such as trip fault, over-temperature, etc. are displayed.
- DISPLAY UTILIZATION CNTR: The bank utilization counter, i.e. number of times the bank is utilized and also displays the cleared Capacitor Bank counter to 0. This helps in proper maintenance of the contactors.
- DISPLAY SR NO.: The unique serial number of the particular **APFC** Controller.
- DISPLAY UNIT DETAILS: the name and version of software. The firmware version number may be different, dependent on date of design update.

MEASURED VALUES	MAX VALUES	HARMONICS	STEP kVAr	DISPLAY AUX-FUNCTION	DISPLAY UTILIZATION CNTR
MEASURED VOLTAGE	MAX-VOLTAGE	V-THD-F	STEP[01]kVAr		UTILIZATION CNTR
MEASURED CURRENT	MAX -CURRENT	I-THD-F	.	AUX OP1: TRIP FLT	BANK[1]:0000000000
ACTIVE POWER	MAX-KW		.	AUX OP2: OVR TEMP	.
REACTIVE POWER	MAX-kVAr		STEP[16]kVAr	INT-TEMPERATURE	BANK[16]:0000000000
APPARENT POWER	MAX-KVA				CLR BANK[1] CNTR
C-KVAR	RESETMAX-VALUES				-
FREQUENCY					CLR BANK[16] CNTR

Programming Parameters (user editable) :

Parameter	Min.	Max.	Factory Default
General I/O			
Mode password (Basic or Expert)	0000	9999	0001
Program password (Only for Expert configuration)	0000	9999	0002
Load default (Yes/No)	-	-	No
Aux OP 1: NONE TRIP FLT OVER TEMP OUT OF BANK	-	-	TRIP FLT
Aux OP 2: NONE TRIP FLT OVER TEMP OUT OF BANK	-	-	OVER TEMP
System	**Min.**	**Max.**	**Factory Default**
Volt meas. Mode (Line-to-Neutral/Line-to-Line)	-	-	L-to-L
Rated Supply Voltage (Line-to-Line) / (Line-to-Neutral)	110 110	500 288.5	415 240
CT ratio Primary	1	6500	1000
PF Target (Ind / Cap)	-	-	Ind
PF Target	0.700	0.999	0.999
Power-on auto sync (Yes/No)	-	-	No
Faults	**Min.**	**Max.**	**Factory Default**
Over voltage fault (Fast OFF /Disable)	-	-	Fast OFF
Over voltage limit (%)	105	125	110
Under voltage fault (Fast OFF: /Disable:)	-	-	Fast OFF
Under voltage limit (%)	70	95	85
APFC Temperature fault (Fast OFF /Disable)	-	-	Fast OFF
APFC Temperature limit (Deg. Celsius)	50	65	60
Harmonic overload(Enable /Disable)	-	-	Enable
V-THD threshold limit (%)	1	20	5
I-THD threshold limit (%)	3	150	25
HAR. FLT AUTO – RST (Enable /Disable)	--	-	Enable
STEP HEALTH CHK (Enable /Disable)	-	-	Disable
Out of Capacitor BANKS FLT (Enable /Disable)	-	-	Enable

Step	Min.	Max.	Factory Default
P. F. Correction time (seconds)	1	1200	00120
Capacitor Bank Discharging time (seconds)	1	1200	00060
Inter-Leaving Delay (seconds)	1	1	00001
Smallest kVAr Safety Factor	1.1	1.9	1.5
COMP No Action Band Offset in %	0	100	50
Number of Capacitor Bank Steps connected	1	16	16
Fixed bank setting (Capacitor Bank(s) Number(s))	-	-	-
Capacitor Bank Voltage (Line-to-Line)	110	600	00440
Bank [1] kVAr…	1	65535	1
Bank[2] kVAr	1	65535	2
Bank[3] kVAr	1	65535	4
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Bank [16] kVAr	1	65535	180

For other Details, Installation, Commissioning and Fault-Finding instructions, refer to the detailed User Manual of this product, which can be availed from **TAS PowerTek,** on request**,** or down-loaded it from our website: http://www.taspowertek.com

Note: The Product Features, Specifications etc. are subject to change, without any prior notice.
Document Revision Dated: **25th Jan. 2017.** To Learn in-depth on the subject, buy e-Book "Reactive Power Compensation on LV Supply", Author: Mr. Tushar P. Mogre, C.E.O., Director, **TAS PowerTek Pvt. Ltd.,**
Web link: http://www.amazon.com/gp/aw/d/B00o7YLLYY