User Manual

93PFC POWER FACTOR CONTROL RELAY

CELEC Enterprises

Other Product Range

- Power Factor Control Panels (1phase & 3phase)
- Static Power Factor Control Panel. (2phase & 3phase)
- Multifunction Power & Energy Analyzer (1ø & 3ø with computer software) & Remote Display.
- Maximum Demand Controller.
- Peak Load Controller.
- Digital Time Switches Multifunctional
- Digital Panel Meters.
  Complete Range (144mm x 144mm)
  (96mm x 96mm)
  (96mm x 48mm)

Welcome to the world of Powerfactor correction systems from CELEC™ & thanks for purchasing CELEC™ product.

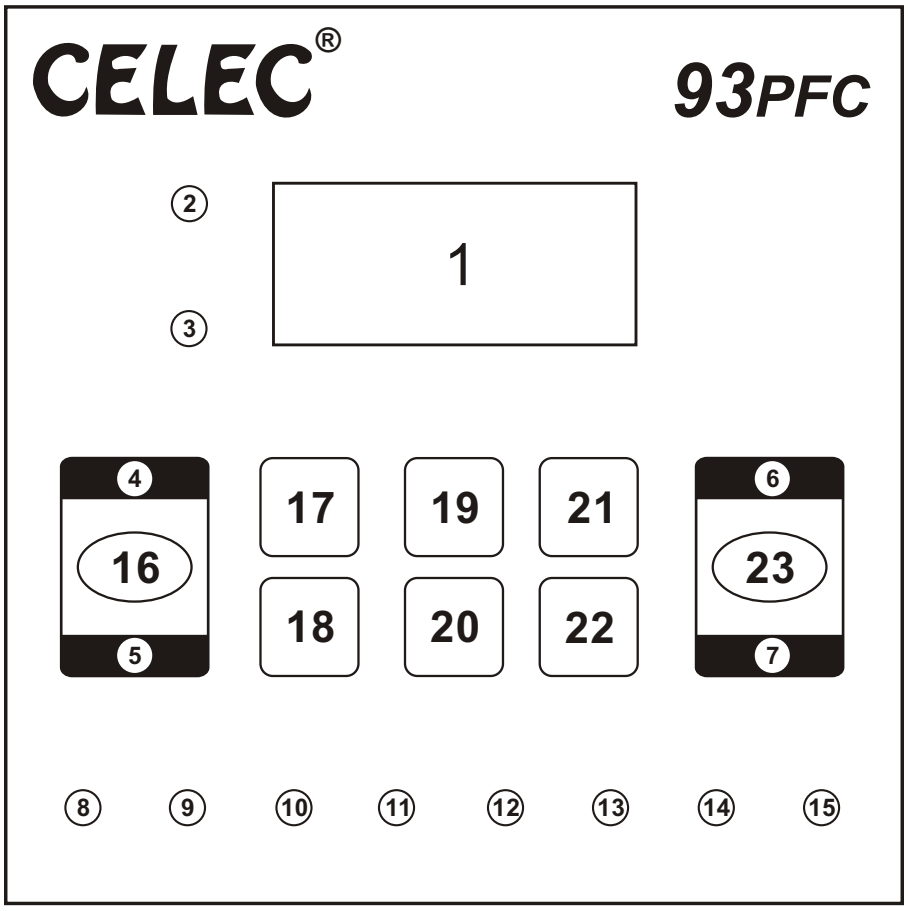
Contents :

1. Specifications

1. Voltage Input	350 to 460VAC (110V, 220V against Order)
2. Current Path	10mA to 5.00 Amp (Isolated) (1.00 Amp Against Order)
3. Frequency	45 to 65 Hz
4. Operating Temperature	-10 to 70°C
5. Display Size	0.56"
6. Stages	8
7. Target Power Factor Setting	0.90 lag to 0.90 lead (±) Dead band
8. Switching Time Delay a) On delay b) Off delay	 1 to 60 seconds 1 to 60 seconds
9. Dead band range	0.01 to 0.20
10. Ampere Sensitivity	1 to 20 Amp
11. Control Type	Binary
12. Programming Lock	Available
13. Manual Operation	Available
14. Display Parameters	PF, Volt, Amp.
15. Relay Contacts	7 Amp 230VAC
16. Dimensions	96mm (W)x96mm(H)x 100mm(D)
17. Bezel/Panel Cut Out	90mmx90mm

Note : Specification may change due to continuous development.

2. Display & Indications



1. Bright Red, 0.56", 7 Segment, 3digit Display.
2. Lead PF Indication.
3. LAG PF Indication.
4. Volt Indication.
5. Ampere Indication.
6. Auto Mode Indication.
7. Manual Mode Indication.

8 to 15. These Led's Indicate On Status of Contactors/Capacitors.

16. Scroll Key to Select Volt/Ampere (in display)
17. ON Delay Time key.
18. OFF Delay Time key.
19. Target PF Program Key.
20. Dead Band Program Key.
21. Navigation Key Upward/Increase.
22. Navigation Key Downward/Decrease.
23. Auto/Manual Select & Enter key.

3. Important Instructions (Must Read)

(i) Always Install CT On Phase With Maximum Load Current & Connect Rest of 2 Phase to 415VAC of Relay Through MCB (Max 6Amp.)

(ii) Install CT Before APFC Panel & Factory Load (As Shown in Wiring Diagram at page no. 7)

(iii) Choose CT 2 to 3 times of Load Current.

(iv) Always Set Ampere Sensitivity to Avoid Hunting of first capacitor At Low Current.

(v) Pay Special Attention For The Size of CT Wire (2.5mm Copper Conductor Wire is Recommended).

(vi) Always Install Capacitors in Increasing Order Capacitor Ratio 1-2-4-6-10.....
Or ratio Should Not Increase 2-4-8-15.....

(vii) Install Branded Capacitors (Preferably Epcos).

(viii) Do Not Use Coil Voltage Of Contactors Above 240V.

(ix) Fix Capacitors On LT Side of Transformer For Transformer PF Compensation (If Energy Meter Installed On HT Line).

4. System Installation

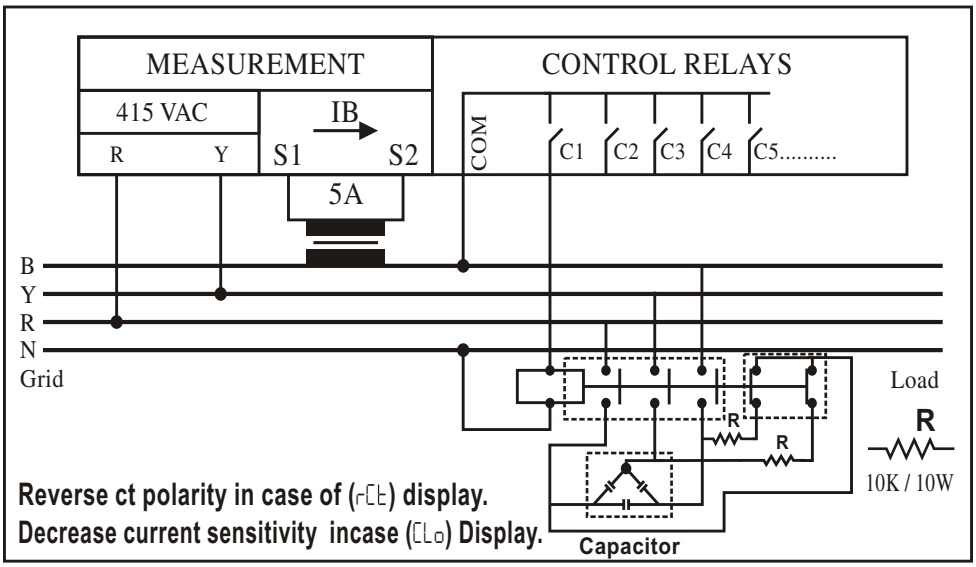
Appropriate Specifications must be followed while electrical installation, taking care following specifications.

a) Input voltage range 350V to 460V (250mA fuse).

b) Current transformer of 5 Amp. secondary (10A fuse)

c) Control circuit for 230V AC 5A. (use 5Amp. fuse / MCB externally).

4(a) Wiring Diagram



While using contactor always prefer to use contactor with 2 NC Auxiliary contacts use 10K / 10W resistance for capacitor discharge circuit as shown in the diagram or use capacitor duty contactors.

Must read important instructions (at page no. 7)

4(b) Manual Test

AUTO MANUAL SWITCHING

This switch is used to select the mode of operation

(i) **Auto mode** : The capacitor switch ON/OFF is automatically related to power factor in order to control the power factor with in the specified range.

(ii) **Manual mode** : Controller is by passed and the user can select the capacitor by pressing navigation keys ▲ / ▼

4(c) System Protection

i) Always Install 6 Amp. MCB On Common.

ii) Always use proper fuse (15mm glass fuse)
415 VAC ¯ 250 mA

iii) Do Not Use Coil Volt of Contactor Above 240Volt.

iv) Choose CT 2 to 3 times of Load Current
(Secondary CT 5Amp.)

v) Always install indoor.

5 System Programming

5a) SYSTEM LOCK :

At power on relay is in lock mode. Relay can be unlocked by setting Dead Band 004. During lock mode the set values of PF, Dead Band, delay on, delay off, sensitivity cannot be changed.

i) To unlock relay, press DEAD BAND key and set 004 on display & press AUTO MANUAL key. Now relay is unlocked.

ii) To lock relay press DEAD BAND key set any figure except 004 & press AUTO MANUAL key Switch off the relay now relay is locked.

5 System Programming

5b) DEFAULT/FACTORY SET PARAMETERS :

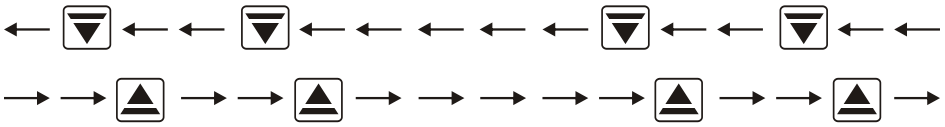
Target PF -- 1.00 ((unity PF)
Dead band 004
On Time Delay 005
Off Time Delay 005
sensitivity 004 amp.

5c) TO CHANGE TARGET POWER FACTOR :

Press SET PF key display shows present value of target power factor to change value of PF press ▲ / ▼ key, To store press AUTO MANUAL key.

.90.91.92.93.94.95.96.97.98.99 100 .99.98.97.96.95.94.93.92.91.90

Lag. PF UNITY PF Lead PF



5d) TO CHANGE ON DELAY TIME :

Press DELAY ON Key display shows stored value of On Delay Time to change press ▲ / ▼ key to store press AUTO MANUAL key.

5e) TO CHANGE OFF DELAY TIME :

Press DELAY OFF key display shows stored value of OFF Delay Time to change press ▲ / ▼ key to store press AUTO MANUAL key.

5f) TO SET AMPERE (I) SENSITIVITY :

when ever user switch on the relay display shows stored sensitivity no.

[Purpose of sensitivity is avoid hunting at low current

To change sensitivity No. first set dead band to same No. as required sensitivity No. Keep pressing VOLT AMPERE Key until LED's stop blinking.
Now sensitivity No. is equal to the dead band setting now set dead band to previous setting.
Sensitivity No. = sensitivity current x 500 / CT Ratio
sensitivity current is load current where user wants to switch on first capacitor.

For example : User requires 1st capacitor (say 1KVAr) On at 3Amp. of load current & CT Ratio is 100/5
Sensitivity No. =3 x 500/100 = 15 (15 is sensitivity no. to program in relay)

5 System Programming

Recommended current sensitivity at motor load.
For first capacitor of 1KVAr - 003 amp.
For first capacitor of 2KVAr - 005 amp.
For first capacitor of 3KVAr - 007 amp.
For first capacitor of 5KVAr - 010 amp.

5g) TO SET DEAD BAND :

Press DEAD BAND key display shows stored dead band. To change dead band press ▲ / ▼ key. To store press AUTO MANUAL key (always set dead band at the last in programming due to system lock mode).

90.91.92.93.94.95.96.97.98.99 1.00 .99.98.97.96 95.94.93.92.91.90

dead band 004 Target PF dead band 004

Always set dead band at the last in the program due to lock mode

6. Trouble Shooting

Before Trouble Shooting, Always Reset System

FAULT	REMEDIES
1. Display shows 'rCt'	Reverse CT polarity, interchange S1 to S2
2. Display shows 'CLo'	a) Set current sensitivity b) Check if load current is less than current sensitivity of relay.
3. Display shows lead PF but stages off	Check the wiring, as per wiring diagram. (See page no. 7)
4. Relay switches the capacitor On, but power factor does not improve.	a) Check if current of APFC panel & load current is passing out through CT. b) The capacitors are defective, the best way to find out is to measure the capacitor with capacitor meter. c) Current polarity of APFC panel through CT is reversed.
5. Relay doesn't hold	a) Increase the dead band setting, if problem persists even when the dead band setting is higher, it means that the size of capacitor is too large for load. The remedy is to change with the smaller one. b) check if capacitors are in increasing order.
6. Relay is dead	a) Check fuse 250mA on terminal block. b) Check Voltage at 415VAC terminal using multimeter (Do not check with a neon tester)
7. All capacitors on but relay shows lag PF (or below the desired PF)	At the extreme is the possibility the total installed KVAr is too low. Check if the capacitors are healthy Remedy is to add capacitors.
8) Relay shows on status of capacitor but no contactor is on.	Check common fuse (5Amp).

8-HOW TO CHOOSE THE SIZE OF CAPACITOR PANEL IN KVAr

Running Power Factor cos Ø	0.80	0.82	0.85	0.88	0.90	0.92	0.94	0.96	0.98	1.00
0.30	2.43	2.48	2.56	2.64	2.70	2.75	2.82	2.89	2.98	3.18
0.32	2.21	2.26	2.34	2.42	2.48	2.53	2.60	2.67	2.76	2.96
0.34	2.02	2.07	2.15	2.23	2.28	2.34	2.41	2.48	2.56	2.77
0.36	1.84	1.89	1.97	2.05	2.10	2.17	2.23	2.30	2.39	2.59
0.38	1.68	1.73	1.81	1.89	1.95	2.01	2.07	2.14	2.23	2.43
0.40	1.54	1.59	1.67	1.75	1.81	1.87	1.93	2.00	2.09	2.29
0.42	1.41	1.49	1.54	1.62	1.68	1.73	1.80	1.87	1.96	2.16
0.44	1.29	1.34	1.42	1.50	1.56	1.61	1.68	1.75	1.84	2.04
0.46	1.18	1.23	1.31	1.39	1.45	1.50	1.57	1.64	1.73	1.93
0.48	1.08	1.13	1.21	1.29	1.34	1.40	1.47	1.54	1.62	1.83
0.50	0.98	1.03	1.11	1.19	1.25	1.31	1.37	1.45	1.63	1.73
0.52	0.89	0.94	1.02	1.10	1.16	1.22	1.28	1.35	1.44	1.64
0.54	0.81	0.86	0.94	1.02	1.07	1.13	1.20	1.27	1.36	1.56
0.56	0.73	0.78	0.86	0.94	1.00	1.05	1.12	1.19	1.28	1.48
0.58	0.65	0.70	0.78	0.86	0.92	0.98	1.04	1.11	1.20	1.40
0.60	0.58	0.63	0.71	0.79	0.85	0.91	0.97	1.04	1.13	1.33
0.61	0.55	0.60	0.68	0.76	0.81	0.87	0.94	1.01	1.10	1.30
0.62	0.52	0.57	0.65	0.73	0.78	0.84	0.91	0.99	1.06	1.27
0.63	0.48	0.53	0.61	0.69	0.75	0.81	0.87	0.94	1.03	1.23
0.64	0.45	0.50	0.58	0.66	0.72	0.77	0.84	0.91	1.00	1.20
0.65	0.42	0.47	0.55	0.63	0.68	0.74	0.81	0.88	0.97	1.17
0.66	0.39	0.44	0.52	0.60	0.65	0.71	0.78	0.85	0.94	1.14
0.67	0.36	0.41	0.49	0.57	0.63	0.98	0.75	0.82	0.90	1.11
0.68	0.33	0.38	0.46	0.54	0.59	0.65	0.72	0.79	0.88	1.08
0.69	0.30	0.35	0.43	0.51	0.56	0.62	0.69	0.76	0.85	1.05
0.70	0.27	0.32	0.40	0.48	0.54	0.59	0.66	0.73	0.82	1.02
0.71	0.24	0.29	0.37	0.45	0.51	0.57	0.63	0.70	0.79	0.99
0.72	0.21	0.26	0.34	0.42	0.48	0.54	0.60	0.67	0.76	0.96
0.73	0.19	0.24	0.32	0.40	0.45	0.51	0.58	0.65	0.73	0.94
0.74	0.16	0.21	0.29	0.37	0.42	0.48	0.55	0.62	0.71	0.91
0.75	0.13	0.18	0.26	0.34	0.40	0.46	0.52	0.59	0.68	0.88
0.76	0.11	0.16	0.24	0.32	0.37	0.43	0.50	0.57	0.65	0.86
0.77	0.08	0.13	0.21	0.29	0.34	0.40	0.47	0.54	0.63	0.83
0.78	0.05	0.10	0.18	0.26	0.32	0.38	0.44	0.51	0.60	0.80
0.79	0.03	0.08	0.16	0.24	0.29	0.35	0.42	0.49	0.57	0.78
0.80		0.05	0.13	0.21	0.27	0.32	0.39	0.46	0.55	0.75
0.81			0.10	0.18	0.24	0.30	0.36	0.43	0.52	0.72
0.82			0.08	0.16	0.21	0.27	0.34	0.41	0.49	0.70
0.83			0.05	0.13	0.19	0.25	0.31	0.38	0.47	0.67
0.84			0.03	0.11	0.16	0.22	0.29	0.36	0.44	0.65
0.85				0.08	0.14	0.19	0.26	0.33	0.42	0.62
0.86				0.05	0.11	0.17	0.23	0.30	0.39	0.59
0.87					0.08	0.14	0.21	0.28	0.36	0.57
0.88					0.06	0.11	0.18	0.25	0.34	0.54
0.89					0.03	0.09	0.15	0.22	0.31	0.51
0.90						0.06	0.12	0.19	0.26	0.48
0.91						0.03	0.10	0.17	0.25	0.46
0.92							0.07	0.14	0.22	0.43
0.93							0.04	0.11	0.19	0.40
0.94								0.07	0.16	0.36
0.95									0.13	0.33

Example :

Running Load (KW) ———— 50.00
Running PF ———— 0.75
Desired PF ———— 0.94
Multiply Factor From Table ———— 0.52
Already connected Capacitor (KVAr) — 5.00
Required Panel KVAr =
Connected Capacitor + (KW x Multiply factor)

Required Panel KVAr = 5+(50 x 0.52) = 31