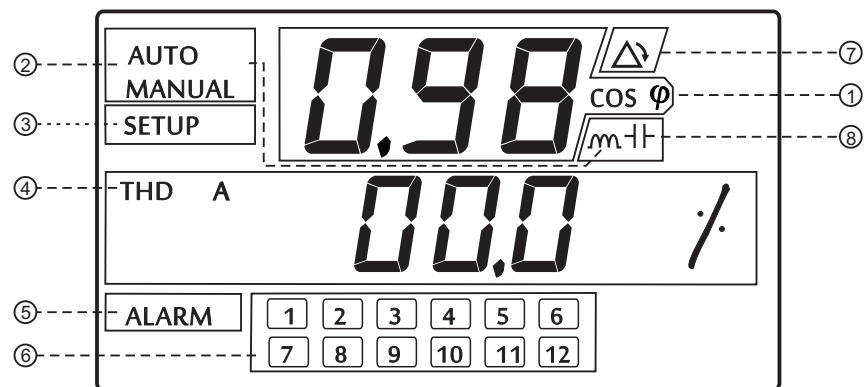


INSTRUCTION MANUAL

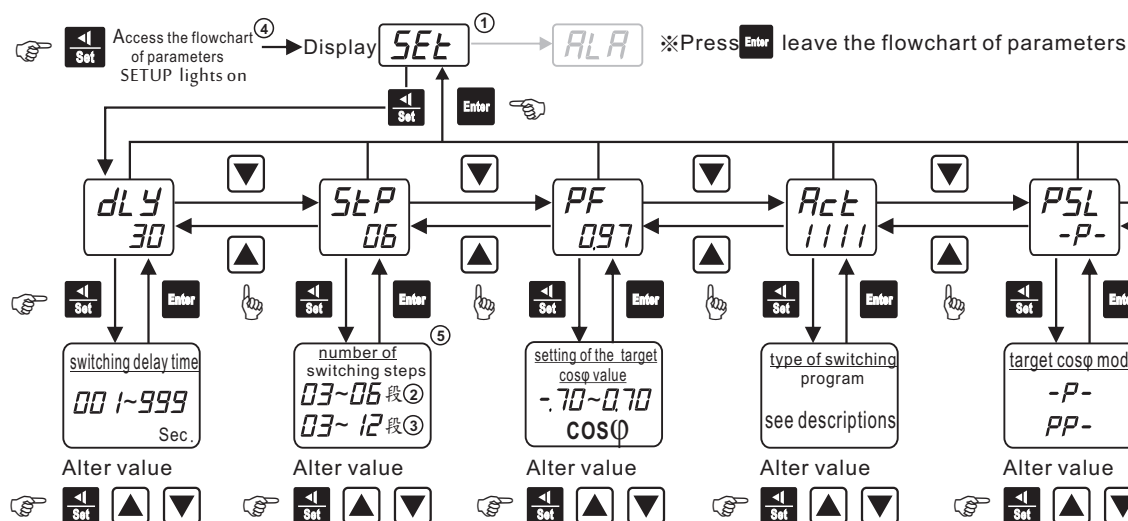
POWER FACTOR CONTROLLER T406D, T412D



Front View

- ① Power Factor value
Lower than the set value in LRS shows LL
- ② Auto/Manual indication is related to the status of mH
- ③ Setup functions SETUP
- ④ Value and unit indication
Display examples:
THDA 03.1 /
- ⑤ Fault Alarm
- ⑥ Switch-in steps
- ⑦ Fault phase sequence /correction indication
This legend keeps lighting up after correction
- ⑧ Switch-in status m
Switch-out status H

• FLOWCHART OF PARAMETERS



The second part display switching

P.1

Display value as ④ THD A

When ALARM appears means fault events happened (Please refer to alarm message part)

DESCRIPTION OF FAULT STATUS

When ALARM appears, press **Set** + **Up** for checking back the fault records

As ALARM flashes, press **Enter** to leave this part

※The activation setup assigned to the ALARM mode will indicate with the faulty records and related settings as the ALARM starts to be energized. And relatively, it indicates nothing without having the ALARM faults.

ELR	Under-current	EOR	Over-current
ELU	Under-voltage	Eou	Over-voltage
ERt	THD A ratio	ECn	Short of capacity after switching in

MANUAL MODE

- Up** + **Down**: Enter AUTO/MANUAL Mode. Selected AUTO or MANUAL flashes (Current mode)
- Up**: Alter Mode: Selected AUTO, MANUAL, MANUAL m , MANUAL H flashes in order
- Down**: Alter Mode: Selected AUTO, MANUAL, MANUAL m , MANUAL H flashes in order
- Enter**: Confirm: The flash will stop
- AUTO: Auto mode MANUAL: Manual Stop Mode
- MANUAL m : Manual Switch-in Mode MANUAL H : Manual Switch-out Mode
- When Manual Switch-in Mode switch to MANUAL could stop switching-in

5E Setting menus :

1. **dLY** : The switching delay time can be set from **001 ~ 999** seconds.
The setting of the switching delay time will be reset once switching-in/out condition changes
2. **SLP** : The number of switching steps can be set from **03 ~ 06 (12)** steps
This H.S.P (Fast switching-in Compensation) mode will be de-activated for proper operation if the setting of the number of switching steps is less than the switching step in circular sequence.
3. **PF** : The target power factor can be set in the range of **-0.70 ~ 0.70**
The target power factor has to be adjusted to reach a proper controlling program in accordance with the setting of the parameters
4. **Rct** : The type of switching program has to be set in compliance with the capacity of the installed capacitors on the network distribution.

1111 : 1.1.1 (switching in circular sequence)

1222 : 1→2.2. (SICS)

1244 : 1→2→4.4. (SICS)

1248 : 1→2→4→8.8. (SICS)

11222 : 11 (Alternate Switching)→2.2. (SICS)

11244 : 11 (AS)→2→4.4. (SICS)

11248 : 11 (AS)→2→4→8.8 (SICS)

11224 : 11 (AS)→22 (AS)→4.4. (SICS)

1-1 : 1.1.1 (switching in sequential sequence)

5. **PSL** : The precise setting of the target PF mode for a variety of applications has to be set in compliance with the measuring threshold of the actual power factor value.
(Furthermore, the detecting band of the set C/K value is mainly derived from the actual load variations.)
-P- : The target power factor can be permitted to set in the range of capacitive power factor.
Besides, this mode represents a fixed setting point.
PP- : This mode is the same as **-P-**, but the target PF can not be set to capacitive PF.

※ It is only limited to set to the inductive PF value in the desired mode of **-P-** because it is not allowed to set to capacitive PF value (-0.97) in the **PP-** mode.

6. **CRP** : Capacity/Kvar value setup **Auto** (auto-detection mode) **001 ~ 240** (manual mode)
In case of selecting the manual mode, the calculation of the C/K value has to be done in compliance with the capacity of the first capacitor :

$$Ck = \frac{IC}{k} \quad \text{Var : The first capacitor (Kvar)}$$

$$IC = \frac{\text{Var}}{\sqrt{3} \times U} \quad \begin{matrix} U : \text{Line-Volt (in the system)} \\ k : \text{C.T. transformation ratio} \end{matrix}$$

For example : Var = 10KVar , U = 380V , k = 400:5 = 80

$$Ck = 10K / (1.732 \times 380 \times 80) = 0.19$$

- ※ Please refer to page 3, table of C/K value
- ※ If the capacity cannot adapted to auto-decation mode, then have to use manual mode to set up **CRP**

7. **HSP** : Fast switching performance, **no ~ YES YES**: Start-up

1. The activation starts to be energized first based on the set SICS program if the is adapted to the SICS program. But, the rest shall follow up the activation mode set **Rct** mode for activation
2. Follow up the above, it proceeds with the same activation again, the set delay time **dLY** will be decreased half for activation. The legend of **cos φ** flashing represents that the delay time will be recovered if the same activation is not required again

※ This mode is de-energized if the **SLP** steps of the installed capacitors is less than of the set SICS program.

For example: **dLY** = 30 , **SLP** = 6 , **Rct** = **11244** (step 4 as circular sequence)

In case a compensation demand for the reactive power value (KVar) is 10 times of the CK value, the following explanations are as follows: The controller will directly switch on the capacitor (step 4) after 30 seconds because the reactive power value (KVar) is higher than 4 times of the C/K value, thus the Kvar value in the system should be derived from the designed formula as 10-4=6. This way, the derived value (10-4=6) in KVar is still higher than 4 times of the C/K value, a half of the preset switching delay time under the mode will be activated for switching on again (new default value has been automatically changed as 15s), and meanwhile, the decimal point of the unit place also flashes. Following up the designed formula, now the latest derived value (6-4=2) in KVar in the system is less than the step 4 in circular sequence so the H.S.P. mode should be de-activated.

※ Select the Manual mode, the H.S.P. mode is de-activated.

※ If **SLP** = 3, as three steps are 112, circular sequence in step 4

So HSP mode is de-energized, but half of the preset switching delay time under the mode still works

8. **RRU** : Auto-adjustment in inverted-phase shift **no ~ YES YES**: Start-up
The legend of **Δ** flashes around 3 secs for the phase angle in a reverse shift at 180 degree as the phase angle exceeds the normal requirements. Being altered as normal status then indicated with **Δ**, it represents the phase sequence has been altered
※ This mode is only limited to the input voltage in polarity and the input current in reverse flow direction (KL)

9. **rY6** : The last step relay contact activation **nor ~ on**
r 12 **nor** : Not assigned to other functions

on : Switch-in the capacitor forever (Energized after the delay time)

※ The added relay contact activation with specific functions doesn't relate with the **SLP** steps of relays for switching operation.

ALA Alarm menus : Fault status please check P.1

1. **oUS** : Setting of the over-voltage range **100 ~ 130 %** Default value: **120**
2. **oUR** : Over-voltage activation setup Default value: **ALA**
no : De-energized **nAc** : Stop switching-in the capacitor
trP : Switching-out according to **Rct** **ALA** : Being appeared with ALARM
nA_A : **nAc** + **ALA** **tr_A** : **trP** + **ALA**
3. **oUd** : Over-voltage delay time setup **00 ~ 99 (sec.)** Default value: **02**
4. **LUS** : Setting of the under-voltage range **60 ~ 99 %** Default value: **80**
5. **LUR** : Under-voltage activation setup Default value: **ALA**
no : De-energized **nAc** : Stop switching-in the capacitor
trP : Switching-out according to **Rct** **ALA** : Being appeared with ALARM, the relay contact is energized.
nA_A : **nAc** + **ALA** **tr_A** : **trP** + **ALA**
6. **LUd** : Under-voltage delay time setup **00 ~ 99 (sec.)** Default value: **02**
7. **oRS** : Over-current ratio setup **80 ~ 120 %** Default value: **110**
8. **oRR** : Over-current activation setup Default value: **no**
no : De-energized **YES** : Being appeared with ALARM, the relay contact is energized
9. **oRd** : Over-current ratio setup **00 ~ 99 (sec)** Default value: **02**
- a. **LRS** : Under-current activation setup **01 ~ 29 %** Default value: **10**
 Lower than default value will show **cc**
- b. **LRR** : Under-current activation setup Default value: **no**
no : De-energized **YES** : Being appeared with ALARM, the relay contact is energized
- c. **LAd** : Under-current delay time setup **00 ~ 99 (sec.)** Default value: **02**
- d. **RHS** : THD A ratio setup **00 ~ 99 %** Default value: **35**
- e. **RHR** : Activation setup/THD A exceeds the set ratio Default value: **nAc**
no : De-energized **nAc** : Stop switching-in the capacitor
trP : Switching-out all the energized capacitors base on **Rct** **ALA** : Being appeared with ALARM, the relay contact is energized.
nA_A : **nAc** + **ALA** **tr_A** : **trP** + **ALA**
- F. **RHd** : THD A delay time setup **00 ~ 99 (sec.)** Default value: **03**
- g. **CR** : Activation setup/Short of capacity after switching in the capacitor Default value: **no**
no : De-energized **YES** : Being appeared with ALARM, the relay contact is energized.

※ **trP** → **↑↑** flashes ※ **nAc** → **↑↑** flashes ※ **ALA** → ALARM lights on
 ※ **trP** → **↑↑** flashes, delay time after second step alter to seconds **cos φ** ↑↑ flashes

■ Table of the C/K values for 380V

CT 比	KV AR													
	2.5	5	7.5	10	15	20	25	30	37.5	40	50	60	80	100
150/5	0.13	0.25	0.38	0.51	0.76	1.01	1.27	1.52	1.90	2.03				
200/5	0.09	0.19	0.28	0.38	0.57	0.76	0.95	1.14	1.42	1.52	1.90	2.28		
250/5	0.08	0.15	0.23	0.30	0.46	0.61	0.76	0.91	1.14	1.22	1.52	1.82		
300/5	0.06	0.13	0.19	0.25	0.38	0.51	0.63	0.76	0.95	1.01	1.27	1.52	2.03	
400/5	0.05	0.09	0.14	0.19	0.28	0.38	0.47	0.57	0.71	0.76	0.95	1.14	1.52	1.90
500/5	0.04	0.08	0.11	0.15	0.23	0.30	0.38	0.46	0.57	0.61	0.76	0.91	1.22	1.52
600/5	0.03	0.06	0.09	0.13	0.19	0.25	0.32	0.38	0.47	0.51	0.63	0.76	1.01	1.27
800/5	0.02	0.05	0.07	0.09	0.14	0.19	0.24	0.28	0.36	0.38	0.47	0.57	0.76	0.95
1000/5	0.02	0.04	0.06	0.08	0.11	0.15	0.19	0.23	0.28	0.30	0.38	0.46	0.61	0.76
1500/5		0.03	0.04	0.05	0.08	0.10	0.13	0.15	0.19	0.20	0.25	0.30	0.41	0.51
2000/5		0.02	0.03	0.04	0.06	0.08	0.09	0.11	0.14	0.15	0.19	0.23	0.30	0.38
2500/5			0.02	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.15	0.18	0.24	0.30
3000/5				0.03	0.04	0.05	0.06	0.08	0.09	0.10	0.13	0.15	0.20	0.25
4000/5				0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.15	0.19
5000/5					0.02	0.03	0.04	0.05	0.06	0.06	0.08	0.09	0.12	0.15

■ Table of the C/K values for 220V

CT 比	KV AR												
	2.5	5	7.5	10	15	20	25	30	40	50	60	80	100
150/5	0.22	0.44	0.66	0.87	1.31	1.75	2.19						
200/5	0.16	0.33	0.49	0.66	0.98	1.31	1.64	1.97					
250/5	0.13	0.26	0.39	0.52	0.79	1.05	1.31	1.57	2.10				
300/5	0.11	0.22	0.33	0.44	0.66	0.87	1.09	1.31	1.75	2.19			
400/5	0.08	0.16	0.25	0.33	0.49	0.66	0.82	0.98	1.31	1.64	1.97		
500/5	0.07	0.13	0.20	0.26	0.39	0.52	0.66	0.79	1.05	1.31	1.57	2.10	
600/5	0.05	0.11	0.16	0.22	0.33	0.44	0.55	0.66	0.87	1.09	1.31	1.75	2.19
800/5	0.04	0.08	0.12	0.16	0.25	0.33	0.41	0.49	0.66	0.82	0.98	1.31	1.64
1000/5	0.03	0.07	0.10	0.13	0.20	0.26	0.33	0.39	0.52	0.66	0.79	1.05	1.31
1500/5	0.02	0.04	0.07	0.09	0.13	0.17	0.22	0.26	0.35	0.44	0.52	0.70	0.87
2000/5		0.03	0.05	0.07	0.10	0.13	0.16	0.20	0.26	0.33	0.39	0.52	0.66
2500/5		0.03	0.04	0.05	0.08	0.10	0.13	0.16	0.21	0.26	0.31	0.42	0.52
3000/5		0.02	0.03	0.04	0.07	0.09	0.11	0.13	0.17	0.22	0.26	0.35	0.44
4000/5			0.02	0.03	0.05	0.07	0.08	0.10	0.13	0.16	0.20	0.26	0.33
5000/5			0.02	0.03	0.04	0.05	0.07	0.08	0.10	0.13	0.16	0.21	0.26

■ TECHNICAL DATA

Voltage range : AC 220V $\pm 15\%$ & AC380V $\pm 15\%$
 Power consumption : $\leq 4\text{VA}$ (T460D), $\leq 6\text{VA}$ (T412D)
 Current range : AC 0.05 ~ 5A
 Current consumption : $\leq 0.5\text{VA}$
 LCD screen : LCD backlight display, 12mm high, 0.01 PF resolution

Power factor setting range : Cap. 0.70~ Ind. 0.70 PF.
 0.97 be set on delivery from factory

Power factor setting mode : Setting value to plus PF. or setting point mode

C/k value setting : Automatic self adjustment for C/k Value or
 Manual setting for C/k value.(0.01~2.40)

Switching delay time : 01 ~ 999 sec.
 delay time 30 sec. be set on delivery from factory

Number of steps : 3 ~ 6 steps for T406D, 3 ~ 12 steps for T412D

Relay contact capacity : Typical AC 250V 5A

Operating temperature : 0 ~ 60°C

Storage temperature : -10 ~ 70°C

Dielectric strength : AC 2KV, 60Hz, 1 minute, INPUT/OUTPUT/CASE

Surge immunity : IEC 61000-4-5 Level 4

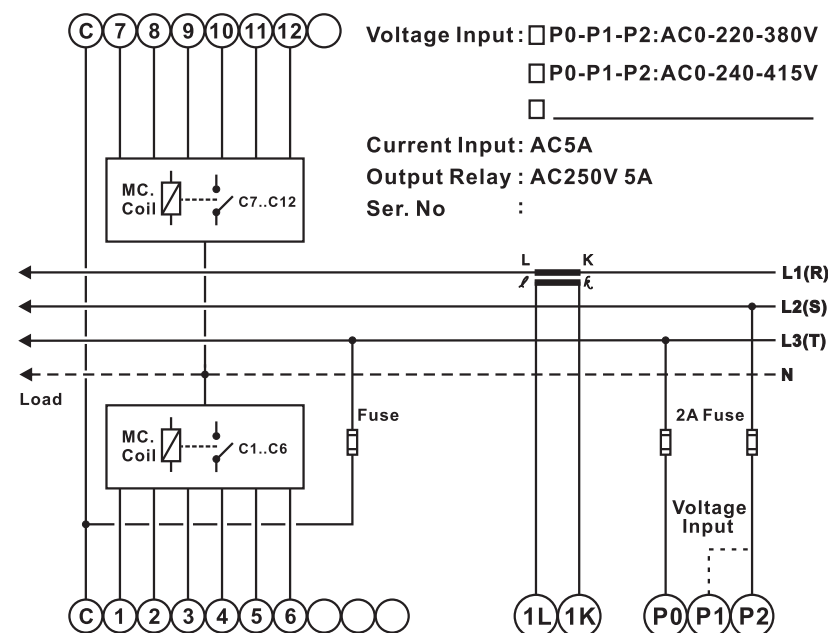
Electrical fast transient/burst : IEC 61000-4-4 Level 4

Short interruptions and voltage variation : IEC 61000-4-11 70%/10mS, 40%/100mS

Connection : Plug-in terminal block

Weight : About 0.7kg .

■ CONNECTION DIAGRAM



■ DIMENSIONS : mm

