

Capacitor-Duty Thyristor Switch

(PF Correction - Hybrid Technology)

THY-CON USER's MANUAL



TAS POWERTEK PVT. LTD.

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 factory.

The contents of this User Manual shall not become part of or modify any prior or existing agreement or relationship. Any statements contained herein do not create new warranties or modify the existing warranty.

The reproduction, transmission or use of this document or its contents is not permitted without express written authority. Offenders will be liable for damages. All rights are reserved.

CAUTIONS:

1. Please note the Circuit Connections and be careful where High Voltages are Present.
2. TAS Products are only to be used indoor or sheltered protected environments.
3. Make sure that the discharge time set in the APFC Units matches with the actual capacitor bank discharge time!
4. This User Manual corresponds to the THY-CON (Product Name), Firmware Version 1.0.0. Dated: 4th Dec. 2015.

Because of continuous improvements efforts by TAS PowerTek in their Product's Features and Specifications, Product Packaging etc., 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.

TAS PowerTek Pvt. Ltd. Reserves all rights to themselves, to change, upgrade, update, enhance, modify, discontinue, or make obsolete, any of their products, without any Prior Notice to the Customers / End-User.

Index

Sr	Content	Page No.
1	Ordering Information	4
2	Important Instructions	5
3	Introduction	6
4	Features & Specifications	7
5	Mechanical Dimensions	8
6	Operating Panels / Labels	9
7	Control Wiring Diagram	10
8	Field Installation Guidelines	11
9	Operation of THY-CON	12
10	Faults	17
11	General Notes	18
12	Warranty Conditions	19
13	Specific Warranty Conditions	20
14	TAS PowerTek Contact Details	23

1. Ordering Information:

Product Specific Information Number (PSIN)

THY-CON – XXA-YYCMTD

XX A: Continuous AC Fundamental Frequency Current Rating (Must be specified by TAS while Quoting, as well as by Purchaser, while sending Purchase Orders to TAS: Available in: 1) 25 Amp, OR 2) 40 Amp, OR 3) 80 Amp

XX = 25 or 40 or 80 Amps.

YYY CMD: Command Voltage (Must be specified in Quote & P.O.) Available in:

- 1) 230V AC, 50 Hz / 60 Hz (Standard), (if not specified) or
- 2) 110 V AC, 50 Hz / 60 Hz or
- 3) +12V DC or
- 4) +24V DC

YYY = 230 or 110 or +12 or +24

Reference table for deciding the appropriate THY-CON Model as per kVAr Basis.

Capacitive kVAr	Average Current @ 415Vac/3-ph	Suitable Model type no	Average Current @ 440Vac/3-ph	Suitable Model type no
5 kVAr	6.95A	THY-CON-25A-YYCMTD	6.56A	THY-CON-25A-YYCMTD
7.5 kVAr	10.43A	THY-CON-25A-YYCMTD	9.84A	THY-CON-25A-YYCMTD
10 kVAr	13.91A	THY-CON-25A-YYCMTD	13.12A	THY-CON-25A-YYCMTD
12.5 kVAr	17.39A	THY-CON-25A-YYCMTD	16.40A	THY-CON-25A-YYCMTD
15 kVAr	20.86A	THY-CON-25A-YYCMTD	19.68A	THY-CON-25A-YYCMTD
20 kVAr	27.82A	THY-CON-40A-YYCMTD	26.24A	THY-CON-40A-YYCMTD
25 kVAr	34.78A	THY-CON-40A-YYCMTD	32.80A	THY-CON-40A-YYCMTD
30 kVAr	41.73A	THY-CON-80A-YYCMTD	39.36A	THY-CON-40A-YYCMTD
40 kVAr	55.64A	THY-CON-80A-YYCMTD	52.49A	THY-CON-80A-YYCMTD
50 kVAr	69.56A	THY-CON-80A-YYCMTD	65.61A	THY-CON-80A-YYCMTD

2. Important Instructions:

- * Read the following instructions carefully before installing THY-CON-XXA-YYYCMD (the Product).
- * This User Manual covers typical, approved use of the Product.
- * In case, your application requirements are different than specifications & features of the Product, it is important to obtain prior approval of our company before installing for the specific application. Refer to the latest specifications as our company products undergo continuous improvements and upgrading of the Product features & specifications.
- * Technical Data given in the manual is accurate to the best of our company design know-how. However, in case of any doubts, ask our company specifically.
- * Human Safety & Product Safety is **IMPORTANT** at all times. If the guidelines of this User Manual are not strictly followed, there are **Hazards** to Human safety, Unit's Failure, Fire, and / or Bursting of Components. In case of doubts, ASK!!!
- * It is the User's Responsibility to select the Product of correct model type and ratings as required specific to their Application. In case of any doubts on this, our concerned company representatives must be contacted for any assistance in selection.
- * Use and / or Storage of the Product in Corrosive Atmosphere and conductive dust is **STRICTLY** Prohibited, particularly where Iron or Carbon dust, Chloride Gas, Sulphide Gas, Salt, Alkali, Acid or similar substance(s) are present in atmosphere. In such case, product should be used within appropriate enclosures so as to prevent this product from exposing to such unacceptable atmosphere.
- * It is **ESSENTIAL** to conduct routine and regular maintenance and clean the dust (conductive as well as non-conductive), to maintain the thermal efficiency and electrical safety of the Product.
- * In the Application Areas of the Product, use only Flame-Retardant and Self-Extinguishing type of materials. It is likely that there can be hot-spots / instantaneous high-temperature points in the Unit.
- * Important Caution: This Product should not be **INSTALLED** or **USED**, in case it is observed that any mechanical and / or component has been damaged in transit. It is to be checked before installation or commissioning. This Product should be installed and commissioned only by a qualified and experienced technical person with knowledge of electricity and uses.
- * Usage of this product is for Power Factor Improvement Capacitors (with detuning or spike suppression reactors). Any other usage other than PF improvement Capacitor switching is not recommended. Applications like Harmonic filter (tuned and partially tuned) switching, is not recommended with these Modules.

3.Introduction:

TAS PowerTek Pvt. Ltd. (TAS) has designed and manufactures THY-CON Unit which is an Intelligent, Micro-Controller based Unit, specifically suited for Capacitor Bank Switching in Automatic Power Factor Control Schemes, in a Three-Phase System.

THY-CON uses Hybrid technology for AC Power On/Off Control of Balanced 3-Phase Power Capacitors, for Capacitive Reactive Power Factor Correction.

Idea behind THY-CON is to replace traditional Capacitor-Duty Contactor with THY-CON Unit. Operation of Thy-Con is very much similar to a Power Contactor, but with added features and facilities. Simply, by applying AC or DC supply as an Input Command (just as Contactor Coil supply), Thy-Con switches ON/OFF the Delta-Connected Power Capacitor Bank.

In contrast with conventional Contactor based Capacitor Bank Switching, THY-CON allows switching ON without in-rush current (soft-switching), & also smooth disconnecting.

The Capacitor Bank is always switched-on at Zero Differential Voltage across the Switching Device and switched-off at Zero Current, thru' the Solid-State-Semiconductor Devices. Thus, the in-rush Current Stress is avoided for the Electro-Mechanical Contacts. This extends the life of the Electro-Mechanical Contacts considerably. The On-State Continuous Power-Loss is minimized due to electro-mechanical contacts and also improves the ability to withstand supply voltage transients.

The LEDs on the front panel of Thy-Con helps the user with quick diagnostic information.

4. Features & Specifications:

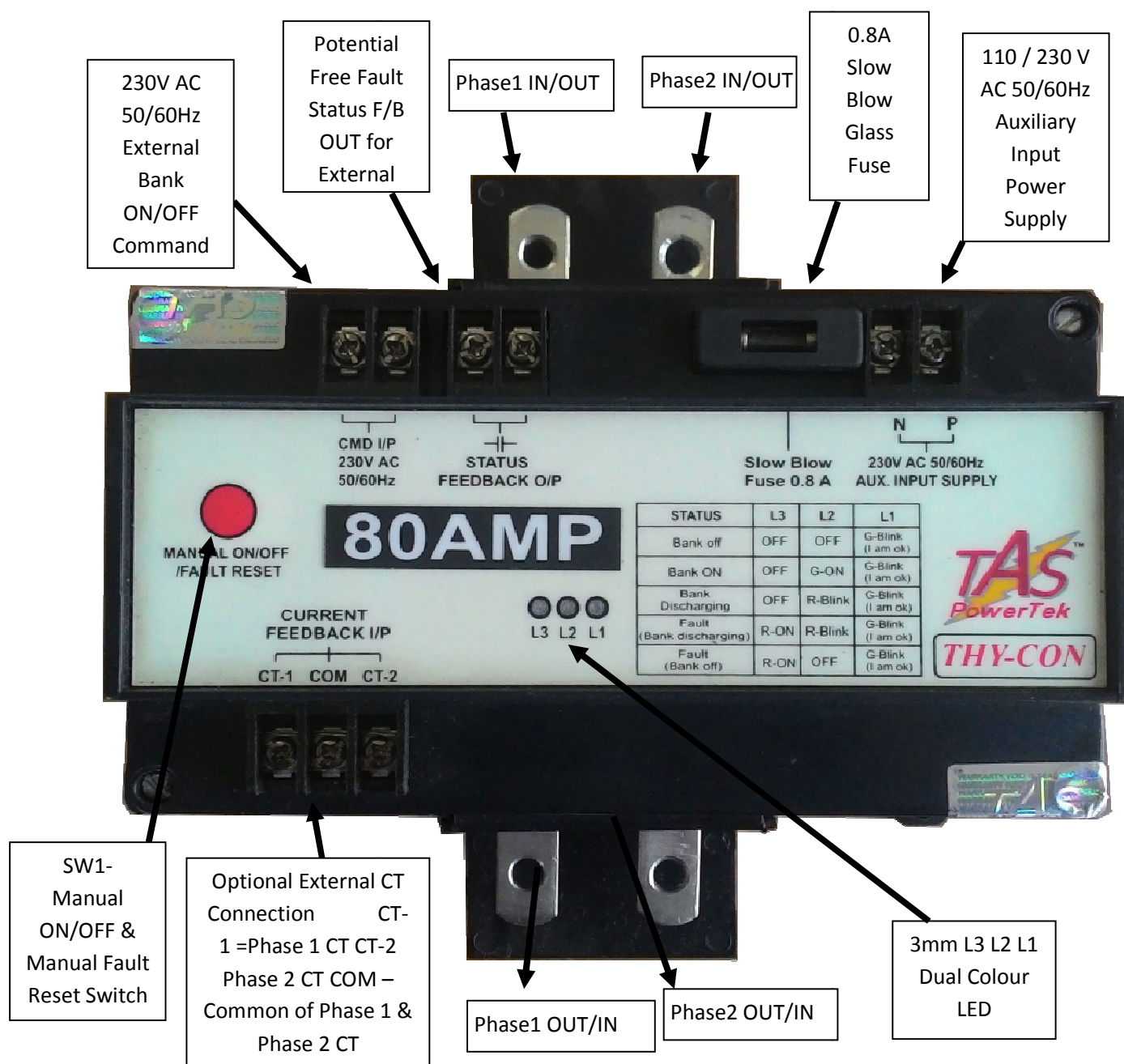
Features:

- Micro-Controlled based intelligent design.
- Only 2 Phases controlled for ON or OFF for Capacitor Bank, that is, the third wire is directly connected.
- Low Electrical Power Losses, along with Capacitor Current In-rush surge free switching.
- Suitable for Balanced, Delta-Connected AC Power Capacitors for LT Lines up to 500 Vac, 50 Hz +/- 3 Hz.
- Protected against Short Duration Over-Voltage Transients and Voltage Spikes.
- Electrically Isolated Command Input for ON / OFF.
- Potential Free, Normally Open, Relay Contact as Auxiliary Digital Output, for Fault Feedback to the Power Factor Controller or for annunciation.
- Wide Voltage Range, High-Efficiency, Single-Phase AC Supply as Aux. Power Supply Input, with externally replaceable Fuse Protection.
- Comprehensive Status Indication thru' 3 Dual-Colour LEDs on the Unit for various Operating and / or Faults States.
- Capacitor Over-Current Protection. (Only if External suitable rated CTs in two controlled phases are installed).
- De-tuned Harmonic Filter Inductors and Power Capacitor, Optional and separate Units.
- Auto / Manual (local mode for testing) Operation.
- Natural Cooled Operation. No Cooling Fans, no noise, no maintenance
- Can be mounted on Standard DIN-Rail or on Wall-Mount.
- Plastic Cabinet with Shrouding for the Bus-Bar Terminals.

Specifications:

- Aux. Power Input Supply: 230 V, 50 Hz +/- 3 Hz, with range as 170 Vac to 285 Vac
OR 220 V, DC with range as 120V to 350V (Ripple <5%pk-to-pk).
- PF Correction LT Capacitors for 3-phase line-to-line supply voltage of 110Vac to 484 Vac, 50 Hz, +/- 3 Hz.
- Switch Current Ratings suitable for 25Amp, or 40Amp, or 80Amp continuous AC Current at Fundamental Line Frequency of Operation.
- Command for ON/OFF (Options)
 - 1) 230V AC, 50 Hz: Voltage value (-20% to +20%) ---- (Standard Option)
 - 2) 110V AC, 50 Hz: Voltage value (-20% to +20%)
 - 3) +12V DC, Ripple <5% pk-to-pk: Voltage value (-20% to +20%)
 - 4) +24V DC, Ripple <5% pk-to-pk: Voltage value (-20% to +20%)
- Operating Temperature Range: +5°C to +50°C.
- Operating Relative Humidity Range: 10% to 90% (Non-Condensing)
- Altitude: Maximum of up to 2000 Meters above mean sea-level.

6. Operating Panel / Labels (Bus-Bar Protection covers removed, to show connection terminals):



Use Correct Size “U” Type, Insulated Fork Lugs for Field Wires Connections, suitable for 2.5 mm-Square wires. Suggested Make: Chetna Engg., F-57, Ambad MIDC, Nashik-422 010, India. Cat. No.: CCFM-937, Serial No.: 835, or Direct Equivalent.

8. Field Installation Guide-lines:

- 1) Connect Incoming 3-Phase AC Power Supply, to 3-Terminal Power Capacitor Bank (R, Y Phases) from any one side of THY-CON (Bus-Bars) & “B” Phase directly to the Capacitor Bank. This means, Connection of Incoming Supply and Capacitor Bank can be done in any direction, top-bottom or bottom-top. (Transparent – non- directional connections).
 - 2) Connect exactly opposite side Bus-bars, to 3 terminals Capacitor Bank through series reactors of appropriate rating.
 - 3) Auxiliary Input Supply (Power Supply input) is to be connected to THY-CON Unit.
 - 4) The Field Wiring between the Product and APFC Unit for Command, Fault Feedback etc, are as shown in Typical Wiring Diagram shown here above.
 - 5) It is mandatory to use the series reactors for capacitors that are switched through the Product. The value of series reactors is normally specified in term of % AC voltage drop. This is the voltage drop in one phase series element of reactor and is calculated as:
$$[(\text{voltage-drop across reactor}) / (\text{Nominal Supply voltage Phase-Neutral voltage})] \times 100.$$
- The minimum % AC voltage drop for the Product usage is 0.20%. Still, the exact value should be selected depending upon the various considerations to supply system harmonics and resonant condition avoidance.
- 6) The AC Power Connections Bus-Bars at the Input Side and the Output Side are provided with Plastic Covers as Shrouds to avoid the chances of accidental human touch or any metal object falling on the same. These need to be removed for making firm connections of the Field Cables. It is necessary to re-install these Covers after the Field Wiring is over. In case of Aluminium cable lugs terminations, it is recommended to use the Copper/Aluminium brazed plates between such lugs and terminations.

9. Operation of Thy-Con:

There are Three Modes in which Thy-Con can be operated.

- A) Auto Mode
- B) Manual Mode
- C) Fault Latch Mode

Auto Mode: (By Default, after power up, Thy-Con unit operate in Auto Mode):

- 1) Power up THY-CON unit with Auxiliary Input Supply.
- 2) Connect three terminals Capacitor in series with De-tuned/Suppression Reactor as shown in Connection Diagram.
- 3) Wire-up “External Command” for capacitor Bank ON/OFF control.
- 4) After Power-On with 3 phases supply (L1, L2 & L3), THY-CON goes into Power-up Discharging Mode for typically 1 Minute. Discharge Time may extend, depending upon Discharge Resistor Value connected across Capacitor.
- 5) During Power-ON Discharge Mode, THY-CON Unit shows below LED Status Indication.

Status	L3	L2	L1
Power ON Discharging Mode	OFF	Red Blink	Green Blink

Note: After power up, if Thy-Con Unit's LED Status is not as similar to above mentioned Status, then check faults Status Indications Table.

- 6) After Successful completion of Power-On Discharge Time, THY-CON unit is Ready for accepting external Command for Capacitor Bank for ON/OFF.
- 7) If, 3 Phase 3 terminals Power Capacitor is in fully Discharge State, with no System Fault & External Command voltage is available at Command Terminal of THY-CON, then THY-CON Unit will Turn ON Capacitor Bank and it will keep ON till External Command is Available.

Status	L3	L2	L1
Bank ON	OFF	Green ON	Green Blink
Bank OFF	OFF	OFF	Green Blink

- 8) Note that, during capacitor discharging time, Thy-Con unit will not accept external command.
- 9) If Thy-Con unit detects any fault (Refer Fault List), during capacitor bank ON, it immediately Disconnect capacitor Bank from supply lines & THY-CON Unit update its LED Display Status for respective Fault(s).

Status	L3	L2	L1
Fault Occur & ON Command Present & Capacitor is in Charged Condition	Red ON	Red Blink	Green Blink
Fault Occur & ON Command Present & Capacitor is in fully Discharged State	Red ON	OFF	Green Blink

- 10) Note that, if Thy-Con Unit detects Same Fault occurrence consecutively 3 times in a row then, it latches on that fault, & Disconnect capacitor Bank. During this state, Thy-Con unit would not accept any External Command.
- 11) To un-latch this Fault State, Thy-Con unit needs Manual Reset operation by pressing Manual Reset Key available on the Front Panel of Thy-Con.



Manual Mode: There are Three Sub-Modes in Manual mode, these are,

- 1) Manual Test Mode: Manual Bank ON/ OFF
- 2) Manual Parameter Display Mode: Display Phase Sequence, information About Last Fault Occur, Supply Frequency Detect by Thy-Con.
- 3) Manual Fault Reset Mode: Reset Fault Latch State of Thy-Con unit.



Manual Test Mode:

- 1) To put Thy-Con unit in Manual Test Mode from normal Auto mode, user has to ensure NO External Command voltage at command terminal (Capacitor Bank is in OFF/Disconnect state), during this condition, user can put unit into Manual Test Mode.
- 2) By Single pressing of Manual ON/OFF Key, Thy-Con Unit gets in Manual Test Mode & Turns ON the Capacitor Bank instantly.
- 3) Again by single press of manual ON/OFF Key, Thy-Con Unit Turns OFF Capacitor Bank & Comes out from Manual Test Mode to Auto mode.
- 4) Note That during Manual Test Mode, LED colour change to **amber** colour & unit in Manual Test Mode would not accept any External Command.
- 5) If Thy-Con unit detects any Fault during Manual Test Mode (ON Operation of Capacitor), it immediately disconnects capacitor bank by switching OFF & Displays respective fault on the Status LED. Such faults are latched by Thy-Con unit and it continues to show the respective Fault status. The latched Fault can be reset by pressing of Manual ON/OFF Key or unit would reset itself after the Manual Test Mode time-out* is over.
** Time-Out is 3 minutes with no key pressed by user. Timer is automatically started immediately after entering into manual mode and restarted thereafter by press of a Manual ON/OFF key.*
- 6) Note that, if Thy-Con is in Manual Test Mode (Capacitor Bank ON) and Time-out occurs (3 minutes), on occurrence of this situation, the Thy-Con unit turns OFF capacitor Bank automatically & Changes Mode From Manual Test Mode to Auto Mode. In such case if the External Command is present for ON status, can turn on the Thy-Con unit switch. User is advised to keep the APFC relay commands in OFF state when such Thy-Con units are tested in Manual Test Mode.

Bank ON/OFF Operation in MANUAL TEST MODE:

Action	Status	L3	L2	L1
Require State to Enter into Manual Test Mode	Bank OFF, Auto Mode	OFF	OFF	Green Blinking
		L3	L2	L1
Manual ON/OFF Key Press	Bank ON, Manual Test Mode	OFF	Amber ON	Amber Blink
		L3	L2	L1
Manual ON/OFF Key Press	Bank OFF, Exit from Manual Test Mode to Auto Mode	OFF	Red Blink/OFF (Depends Upon Capacitor Charge Status)	Green Blink

Fault Condition during MANUAL TEST MODE:

Action	Status	L3	L2	L1
Require State to enter into Manual Test mode	Bank OFF, Auto Mode	OFF	OFF	Green Blinking
		L3	L2	L1
Manual ON/OFF Key Press	Bank ON, Manual Test Mode	OFF	Amber ON	Amber Blink
	Fault Occur, Bank OFF	Amber Blink/OFF (Depend on Fault)	Amber Blink/OFF (Depend on Fault)	Amber Blink/OFF (Depend on Fault)
		L3	L2	L1
Manual ON/OFF Key Press	Reset Fault, Exit From Manual Test Mode to Auto Mode	OFF	Red Blink/OFF (Depend Upon Capacitor Charge Status)	Green Blink

Manual Parameter Display Mode:

- 1) If Thy-Con unit is in Auto mode & no External Command is present at command terminal (Capacitor Bank is in OFF/Disconnect state at this condition), Thy-Con Unit can be put into Manual Parameter Display mode by Long duration depressing of Manual ON/OFF key (More than 1 sec in pressed state).

- 2) As soon as unit goes in to Manual Parameter Display Mode, it indicates last Fault occurrence information.
- 3) By next long duration depressing Manual ON/OFF Key, unit shows information about Frequency & Phase sequence detection.

Status	L3	L2	L1
50Hz with RYB Sequence	OFF	OFF	Amber blink
60Hz with RYB Sequence	Amber blink	OFF	Amber blink
50Hz with RBY Sequence	OFF	Amber blink	OFF
60Hz with RBY Sequence	Amber blink	Amber blink	OFF

Note that, for nominal 50Hz frequency, frequency Band is 47Hz to 53Hz & for nominal 60Hz frequency, frequency Band is 57Hz to 63Hz.

- 4) Further next long duration depressing Manual ON/OFF Key, Thy-Con unit exits from Manual Parameter Display Mode to Auto Mode.

Also note that, in Manual Display Parameter mode, Thy-Con unit exits from manual parameter display mode to auto mode by single pressing Manual ON/OFF Key too.

Action	Status	L3	L2	L1
Require State to enter into Manual Display Parameter mode	Bank OFF, Auto Mode	OFF	OFF	Green Blinking
↓		L3	L2	L1
Long Duration Manual ON/OFF Key Press	Manual Display Parameter mode, Display First Parameter (Last Fault Occur)	Amber Blink/OFF (Depend on Last Fault Occur)	Amber Blink/OFF (Depend on Last Fault Occur)	Amber Blink/OFF (Depend on Last Fault Occur)
↓		L3	L2	L1
Single Manual ON/OFF Key Press	Exit From Manual Display Parameter mode to Auto Mode	OFF	Red Blink/OFF (Depend Upon Capacitor Charge Status)	Green Blink
OR				

Long Duration Manual ON/OFF Key Press	Display Second Parameter(Frequency & Phase Sequence Detect by Thy-Con)	Amber Blink/OFF (Depend on Frequency Detect)	Amber Blink/OFF (Depend on Phase Sequence Detect)	Amber Blink/OFF (Depend on Phase Sequence Detect)
↓		L3	L2	L1
Single Manual ON/OFF Key Press OR Long Duration Manual ON/OFF Key Press	Exit From Manual Display Parameter mode to Auto Mode	OFF	Red Blink/OFF (Depend Upon Capacitor Charge Status)	Green Blink

Fault Latch Mode:

- 1) If Thy-Con unit is in Fault Latched State (Same Fault Occurred 3 times in a row), at only this condition, Thy-Con Unit goes into Fault Latch Mode.
- 2) After Single Pressing Manual ON/OFF Key, Thy-Con Unit Clear / Exit Fault Latched State & again resume into Auto Mode.

10. Faults:

Fault Status Indication for THY-CON unit are as per below mention table

Fault	L3	L2	L1
3 Phase Power Failed	Red Blink	Red Blink	Red Blink
L1 Power Failed	Red Blink	OFF	Red Blink
L2 Power Failed	Red Blink	Red Blink	OFF
L1 Thyristor ON Failed	OFF	OFF	Red Blink
L2 Thyristor ON Failed	OFF	Red Blink	OFF
L1 & L2 Thyristor ON Failed	OFF	Red Blink	Red Blink
L1 ON Failed	Red ON	OFF	Red Blink
L2 ON Failed	OFF	Red Blink	Red ON
L1 & L2 ON Failed	Red Blink	Red Blink	Red ON
L1 OFF Failed	Red ON	Red Blink	Red ON
L2 OFF Failed	Red ON	Red ON	Red Blink
L1 & L2 OFF Failed	Red Blink	Red ON	Red ON
Over Current	Red Blink	Red ON	OFF

Note that, for any of the above Fault(s) situation(s), Fault Feedback Potential Free Relay Contact changes from “open-N.O.” State, to “close-N.C.” State.

11. General Notes:

- 1] The THY-CON unit should only be used according its intended application of Power Factor correction system capacitor switching requirements. Any other application usage like partially tuned or fully tuned harmonic filter switching applications that can cause permanent damage to the Thy-Con unit, in which case the units would not be covered under company warranty terms.
- 2] The THY-CON unit must only be used in coordination with appropriately rated Safety devices such as HRC Fuses, MCB/MCCB.
- 3] The THY-CON must be installed in such a way that no excessive high Currents and / or voltages can appear in case of any faults on supply line. User should take note that even though Thy-Con unit has some protection features against faults, it is not intended to be used as protection relay. The functionality of this unit is intended for switching ON and switching OFF of the 3-terminal capacitors used for Power Factor correction.
- 4] The THY-CON unit can be used for switching the capacitors along with series reactors. Still, the series reactors values are normally quite critical based upon the applications. Wrong selection of such reactors or putting of capacitors without reactors in parallel with capacitors with reactors can cause the system resonant conditions. This can exceed the Thy-Con unit's maximum permissible limits of Voltage and Currents. User is strongly advised to use the right engineering practices and prevent the Thy-Con unit to be subjected beyond the absolute maximum limit as mentioned in Specifications. Failures in unit due to such wrong practices of usage are not covered under the unit warranty.

Special Notes:

- 1] The maximum DC Voltage at switched-off Capacitor can be up to 150% of Peak of Mains AC Voltage. Appropriate human safety standards should be applied for human working on these units.
- 2] Continuous DC Voltage across disconnected Capacitors can appear across the power terminals of Thy-Con unit. Therefore, suitable discharge resistors are recommended across the three terminals of the capacitors used. Normally, human safety standards define such resistor values so that DC voltage is less than 48Vdc peak within 1 minute interval, from power disconnection.
- 3] The Discharging Resistors values are even selected for a permanent connection to the Power Capacitors based upon the Voltage, Current, Wattage loss and the switch response time for reconnection. Therefore, such resistances should be suitably chosen to meet the required design criteria.
- 4] Install clearly visible “**WARNING SIGNS**”, to show the possibility of residual voltage at the disconnected Capacitor Banks.

12. Warranty Conditions:

General Warranty Conditions for TAS Product Range:

- 1) The product/system is warranted against any manufacturing and design defects. Any other defects in the product/system due to wrong handling, transportation damages, usages of product beyond the specified electrical supply conditions, wrong application, wrong working conditions etc. are not covered under the warranty clause.
- 2) TAS PowerTek Private Limited will not accept any liabilities, liquidated damages claims due to improper usage of this equipment. The proper usage of these products/systems would be sole responsibility of the purchaser and / or the end-user of these products, and TAS would only give the guidelines for the proper usage.
- 3) Product is warranted against failure of any component as specified in clause No.1 and TAS PowerTek Private Limited would be replacing any faulty components free of cost which would be including the cost of the component and the direct engineering services that are involved with the repair of the said product/system.
- 4) The warranty services, within the valid warranty period, offered would be only applicable in the specified territory of our service centres. Any services required outside the specified territory would be on chargeable basis.
- 5) Some of the products can only be serviced at our Manufacturing works at Nasik. With such products, the transportation cost of faulty product to and from Nasik would be to the end-user and / or the purchaser's account.
- 6) Normally, the products offered are warranted for a period of 12 months from the product invoice date or 12 months from the first usage date, whichever is earlier. This is valid unless extended term of warranty is explicitly agreed between TAS and the purchaser, at the additional cost to the purchaser / end-user.
- 7) The warranty is applicable only for rectification of the defective product/system and would not be applicable for the entire product/system replacement.
- 8) The "General Notes" here above are considered as part of warranty conditions.

13. Specific Warranty Conditions:

(THY-CON Unit specific)

The said product is intended to be used as a part of the electrical system with specific purpose. Therefore, the said product is designed with intention to work with the system which is appropriately designed. Inappropriate application or design of the other components in the system can cause some of the design specification parameters to exceed the product specification design rating and can cause damage to them. Thus, user of this product is strongly advised to follow the guidelines given in this document so as to avoid damage to this product and in turn failures of the systems wherein this product is used.

If the said technical guidelines in this document are not totally followed, the product warranty terms would not be applicable, and user would be solely responsible for such failures in the purchased product/s.

The mandatory requirements to be followed for usage of this product are:

- I. This product is intended to be used for switching ON and switching OFF the three terminal Connected Power Capacitors to be used with Power Factor Improvement Capacitor switching system. Usage of this product is restricted to the application of “Power Factor Improvement” capacitors only and not for any other application usage like “Tuned or Partially tuned passive harmonic filters”. For such application, there is a separate product model available from TAS PowerTek Pvt. Ltd. and should be used in case of such specialized application/s.
- II. The product is to be used with 3 phase 50 Hz/60 Hz supply system with extreme AC RMS line to line voltage range as 200Vac to 500Vac.
- III. It is mandatory to use the series reactors with minimum rating of 0.25% and maximum rating not exceeding 16.5% voltage drop at capacitor rated current. These reactors should be placed in series with the capacitors that are required to be switched. User is advised to restrict the usage of reactors with % voltage drops of 11.11%, 4%, 2.04%, 1.23%, 0.83%, 0.59%, 0.44%, 0.35%, 0.28%, 0.23%, 0.19% values as these would tend to match with the harmonic frequencies and can cause undesirable effects.
- IV. In case, the supply system is with “Electrical Power Quality Problems”, user is advised to take adequate measures to improve such conditions before usage of this product. The major listed Power Quality Issues can be:
 - a) Harmonics on supply lines exceeding limits and causing over-current in capacitor banks. The harmonic current in capacitor should be restricted to less than 18% THD-F. (THD – Total Harmonic Distortion)
 - b) Voltage sags and swells beyond the permitted supply voltage levels.
 - c) Loss of supply mains cycles. (½ cycle to 60 cycles)
 - d) Supply voltage glitches and transients where peak amplitude of voltage not exceeding 1.25 times the rated supply voltage peak value. I.e. for 500 Vac maximum line voltage supply system, the peak voltage is $500 \times \sqrt{2} = 707$ Volts peak. Then the supply voltage glitch or transient peak should never be beyond $707 \times 1.25 = 884$ Volts.
 - e) Sustained high dV/dt voltage components that are deviating instantaneous values of sinusoidal voltages more than 1.2 times its rated instantaneous values (Normally produced by Thyristor / Diode rectifiers used in AC/DC variable speed drives, UPS/Inverters,

welding machines, Induction furnaces, Arc furnaces). Normally, usage of series reactors (commutation reactors) with such equipment is mandatory, but if such applications are used without the series reactors, it can cause such disturbances in supply voltage lines.

- V. If capacitors are used in presence of harmonic prone supply system environment, user is advised to use the appropriate de-tuned series reactors of correct rating and values. The capacitor and reactor (inductor) series tuned frequency should be minimum 25% away from the specific major harmonic components and should be offering inductive impedance to the specific harmonic frequency component on supply system. i.e. in presence of 5th, 7th, 11th, 13th, 17th, 19th etc. harmonics, user is advised to use the detuned reactors in series with power capacitors with resonance frequency of 187 Hz for 50 Hz supply system and 225Hz for 60Hz supply system. Additionally, in presence of triplen harmonics like 3rd, 9th, 15th, 21st etc, user is advised to use the de-tuned reactors in series with power capacitors with resonance frequency of 134 Hz for 50Hz supply system and 160 Hz for 60 Hz supply system. It should also be noted that in case of supply source impedance is higher value (Generators or special transformers), even in absence of triplen harmonics, it is advised to use the reactors with resonance frequency of 134 Hz for 50 Hz supply system and 160 Hz for 60 Hz supply system.
- VI. Due to deterioration of capacitor μ F (micro-Farad) values over time period (longer usage of capacitors), the resonance frequency is likely to be shifted from the recommended values to higher values and can be close to harmonic frequency. In such case, user of the system is advised to correct the capacitor values (by adding parallel capacitors) or by correcting the reactors mH (milli-Henry) values, so that right resonance frequency is achieved.
- VII. Wrong selection of capacitor and reactors (inductors) values can cause the L-C (inductor-capacitor) series resonance values to come near the harmonic frequency and instead of blocking the harmonics passing through capacitors, it would start filtering the harmonics. This can cause over-voltages and can be detrimental to the thyristor switches causing the MOV (Metal Oxide Varistor) put across the thyristors to fail. Thus, user is strongly advised to take note of this application usage point.
- VIII. Usage of Detuned reactor with Capacitors on the same Electrical supply system bus that has Capacitors without any reactors can cause the system resonance condition. This is to be avoided by user under any circumstances. Such usage can cause the permanent damage to the unit and warranty to the product is discontinued with such error prone application usage.
- IX. When switch is powered-up (Power terminals are given the supply), the control supply to the switch (if not taken from the internal Power terminals) should never be switched ON or OFF. User is advised such supply to be normally taken from the switch Power terminals itself, but if taken from other supply points, the stated additional care is to be taken.
- X. The said product switch is recommended to be mounted in the panel on a 35mm Wide DIN-Rail or directly on the Rear-Wall of the Panel. There is NO fan built in any of the Thy-Con Models. If the Automatic Power Factor Controller Panel already has any fan, the direction of the Panel Fan(s) should be such as to force the Hot-Air to flow in the up-word direction, to effectively cool the APFC Panel.
- XI. In panel mechanical design, the unit surrounding ambient temperature should be restricted in the operating range of +5°C to +50°C.

- XII. In cold climatic condition, the units mounted in the cabinet should not be powered up unless the ambient temperature inside the cabinet is minimum $+5^{\circ}$ Celsius. In cold climatic condition, it is advisable to use the “Space-Heaters” within the cabinet to achieve the specified ambient temperature before the units are powered up. Note that thyristors are likely to misbehave during very cold conditions causing wrong operations and can cause electrical accidents and can cause human safety issues. With space heaters usage in panel, ensure that desired temperature range is maintained for minimum 30min period before the unit can be put in operation.
- XIII. In case of usage of the product in dust prone environment, heavy accumulation of the dust or dust with moisture can cause the flashovers between the Power conductors used within the unit. User is advised to make appropriate arrangement in the system so as to avoid the ingress of dust. In such environments, even with usage of appropriate enclosures, it is advisable the regular cleaning of dust by usage of air-blower in dust-suction mode or Vacuum Cleaner, to collect the dust. It should not be blown all over, inside the Panel.
- XIV. In case the supplied system is subjected to HT insulation test, the control supply terminals should be kept isolated if the HT supply test voltage value is exceeding 1.5 kV-ac. The said product then can be subjected to HT insulation test with HT supply test voltage not exceeding 2.5 kV-ac.
- XV. The External Command for Thy-Con (for ON/OFF of Capacitor bank) should never exceed the specified nominal operating voltage within the tolerance of $\pm 20\%$. In case of DC Voltage as the Command Input, the ripple content on such control supply should be restricted to maximum 5% Vpeak-to-peak of nominal voltage value.
- XVI. In case of dead short in capacitors or reactors, there is a strong possibility of damage to the said product (thyristors used in the product may get shorted). User is therefore advised to use the good quality capacitors and reactors so as to avoid such situation.
- XVII. The control supply and the Capacitor Bank On/Off Command wiring (as per the Product Ordering Code) in the system is advised to be made to run in separate channels than the 200 Vac to 500 Vac range Power supply voltage (line-to-line). The distance of about 25 cm should be maintained between these two channels (control and power wiring) if made to run parallel to each other. Putting the control and power wiring in same vicinity can cause the undue noise level in electronics used for control in the said product and can cause mal-function or damage to the product.
- XVIII. The product is designed to be used with the relative humidity levels of 10% to 90% R.H. (Non-Condensing) and elevation of 0 to 2000Meters above mean-sea-level. User is advised to restrict the usage of this product within the stipulated environment.
- XIX. Product is fitted with Tamper Proof sticker. Any attempt by the user to tamper with the internal parts (electronics or power or any other part) of the product, is not permitted and would mean that warranty stands cancelled.

14. Contact Details:

The Sales & Marketing / The Customer Support & Service Dept.,

TAS PowerTek Pvt. Ltd., W-61, MIDC, Ambad Industrial Area,

Nasik – 422 010, Maharashtra State, India.

Land-Line Phones: +91-253-6694 956 (Sales & Marketing).

+91-253-6694 955 (Customer Support & Service).

Fax: +91-253-6694 955.

E-mail: sales@taspowertek.com

Web: www.taspowertek.com

Working Hours: 9:30 AM to 6:30 PM. Weekly Off: Saturdays.

This Product is completely Designed, Developed, Manufactured, Assembled, Tested, and Calibrated in India by TAS PowerTek Pvt. Ltd., Nasik – 422 010, India.



Would you like to learn in-depth on the subject of Reactive Power Compensation on LV supply system?, then, buy e-Book on-line from Amazon.com

Book Title: Reactive Power Compensation on LV Supply.

Author: Mr. Tushar P. Mogre, CEO, Director, TAS PowerTek Pvt. Ltd.

e-Book Published by: Amazon.com

Web-link: <http://www.amazon.com/gp/aw/d/B00o7YLLYY>