

USER'S MANUAL  
Rev. 12/2004

# PT3000 S -1PH THYRISTOR UNIT

*From 125A to 700A*



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# PT3000S-1PH Thyristor Unit from 125A to 700A

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## **CAUTION**



Thyristor units are used in power industrial equipment. When the thyristor unit is working, there are on the unit the following voltages

- Maximum main supply voltage on power terminals up to 600V.
- Auxiliary supply 230-460Vac.
- Fan voltage 230Vac 50/60Hz Power consumption 14W.

Don't remove the plastic cover which provides adequate protection against electric shock.

Don't use this thyristor in aerospace and nuclear application.

### **Electric Shock Hazard (Risque the choque électrique)**

When thyristor unit has been connected to main supply voltage and is switched off, before to touch it be secure that the unit is isolated and wait at least one minute to permit to discharge internal capacitors. Thus be secure that:

- access to thyristor unit is only permitted to specialized personnel;
- the authorised personnel must read this manual before to have access to the unit;
- the access to the units must be denied to unauthorized personnel.

### **Important warnings(attention)**

- Local regulations regarding electrical installation should be rigidly observed.
- Safety regulations must be rigidly observed.
- Don't bend components to maintain insulation distances.
- Protect the units from high temperature, humidity and vibrations.
- Don't touch components to prevent electrostatic discharges on them.
- Verify that all ratings are in line with real needs.
- If authorized personnel must measure voltage, current etc. on units, take away rings and other jewels from fingers and hands.
- Authorized personnel working on thyristor unit under power supply voltage must work on insulated board. Be secure that board is not connected to earth.

This listing does not represent a complete enumeration of all necessary safety cautions.

**Protection(Protection)**

PT3000 thyristor family has a polymeric plastic cover in compliance to International specification IP20. To understand if IP20 protection is sufficient should be evaluated the installation place where the units are installed.

Open Type Equipment(équipement de type ouvert).

Maximum surrounding air temperature 40°C(Temperature de l'air environnante maximum 40°C).

**Earth(terre)**

PT3000 family has isolated heatsink. For safety connect the heatsink to earth to avoid shocks in case that circuit board or thyristors lost insulation. Earth impedance should be correspondent to local earth regulation. Periodically the earth efficiency should be inspected.

**Electronic Supply(alimentation électronique)**

PT3000 family electronic circuit should be supplied by dedicated voltage supply for all electronic circuit but not in parallel with contactor's coil, solenoids and other inductive or capacitive loads. It's recommended to use a shielded transformer.

**Electromagnetic compatibility (compatibilité électromagnétique)**

Our thyristor unit has an excellent immunity to electromagnetic interferences if all suggestions contained in this manual are respected. In respect to a good Engineering practise, all inductive loads like solenoids contactor coils should have a filter in parallel.

**Emissions (émission)**

All thyristor switching at high speed generate some radiofrequency disturbance. PT3000 serie complies with EMC rules for CE mark. In many installations near electronic devices has not been noted problems. If radiofrequency device at low frequency are used near the thyristor unit, some precautions should be taken like line filters and shielded cables for input signal and for load cables.

**NOTE**

We reserves the right to apply modifications to the our products without any advice.

# 1. Glossary



## 1.1 Terminology

- V:** voltage power supply.  
**I:** the full circulating current in thyristor unit.  
**P:** total load power.

## 1.2 Input signal

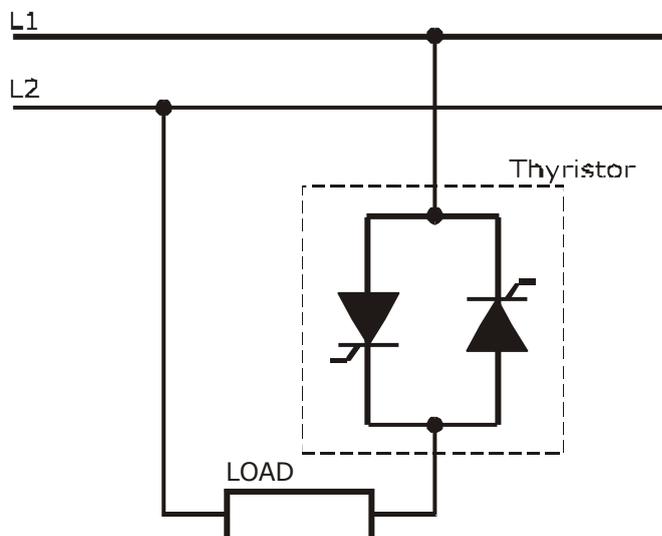
- SSR:** This input type is a square waveform generated by a temperature controller.  
**AN:** Analog input.  
**IRS:** Communication command.

## 1.3 Power feed back

**Feedback:** supply voltage fluctuation changes the power to the load. To overcome this effect the voltage supplied to the load is measured and compared with power demand from controller, the error signal is used to automatically hold the power at demanded level.

## 1.4 What is a thyristor unit

A thyristor unit is semiconductor device which acts as a switch formed by two thyristors in antiparallel. To switch on the alternating current the input signal will be on and the thyristor will switch off at first zero crossing voltage with no input signal. The benefits of thyristor units compared with electromechanical contactors are numerous: no moving parts, no maintenance and capacity to switch very fast. Thyristors are the only solution to control transformers and special loads that change resistance with temperature and with age.



## 2. Technical specifications

### 2.1 General Features

Operating temperature	0-45°C for higher temperature see derating curve
Voltage power supply	24V minimum, 480V max and 600V on request
Input signal	SSR
Firing mode	Zero Crossing (ZC)
Auxiliary voltage supply	230 → 200-230V ±15%; 10 VA power consumption 460 → 300-460V ±15%; 10 VA power consumption
Fan voltage supply	230V ±15%; 110V ±15% on request
Fuses	Internal
Mounting	Bulk head mounting
Protection	IP20

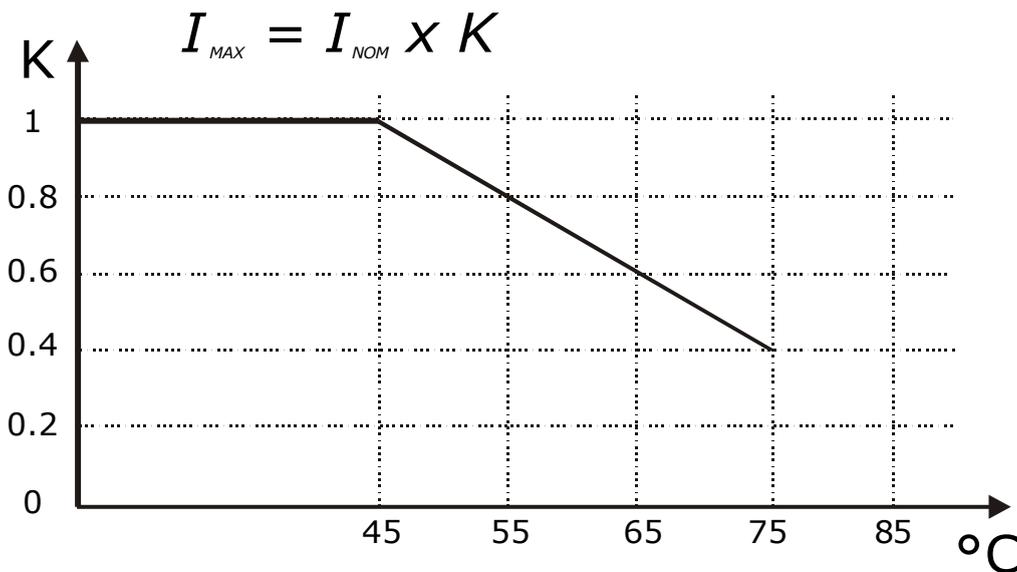
### 2.2 Input features

Input signal	Maximum current drain	ON condition	OFF condition
SSR	12mA constant current	≥4V- max 30V	≤1V

### 2.3 Output features

Current (A)	Voltage range (V)	Ripetitive peak reverse voltage		Latching current (mAeff)	Max peak one cycle (10msec.) (A)	Leakage current (mAeff)	I <sup>2</sup> T value for fusing tp=10msec	Frequency range (Hz)	Power loss I=Inom (W)	Isolation Voltage Vac
		(480V)	(600V)							
125	24-600	1200	1600	450	1540	15	11300	47-70	146	2500
150	24-600	1200	1600	450	2000	15	19100	47-70	162	2500
200	24-600	1200	1600	300	4800	15	108000	47-70	204	2500
300	24-600	1200	1600	300	5250	15	128000	47-70	320	2500
400	24-600	1200	1600	200	7800	15	300000	47-70	397	2500
500	24-600	1200	1600	200	8000	15	306000	47-70	530	2500
600	24-600	1200	1600	1000	17800	15	1027000	47-70	589	2500
700	24-600	1200	1600	1000	17800	15	1027000	47-70	712	2500

### 2.4 Derating curve



### 2.5 Fans

The thyristor units are equipped with a fan. The fan supply must be protected with a fuse. Fan voltage supply is standard 230VAC ± 15% 50/60Hz or optional 110VAC ± 15% 50/60Hz. The power consumption is given in the table below.

Size	CE Number of fans	UL LISTED US Number of fans
125A up to 200A	One Fan - 14W	One Fan - 14W
300A up to 600A	One Fan - 14W	Two Fans - 30W
700A	Two Fans - 30W	Two Fans - 30W

### 3. Ordering information

Model PT3000S 1PH

	1	2	3	4	5	6	7
<b>PT3000S-1PH</b>							
Ex: PT3000S 1PH/	150A/	400V/	480V/	460V/	SSR/	ZC/	UL

1   <b>Nominal CURRENT of PT3000S</b>			
125A	300A	600A	
150A	400A	700A	
200A	500A		

2   <b>Operating Load Voltage (incoming voltage supply)</b>	
Specify the value of the line supply.	

3   <b>Max VOLTAGE of PT3000S</b>	
480V	
600V	
The voltage on the identification label must be equal or more than operating voltage. The minimum voltage supply to the load is 24V.	

4   <b>Auxiliary Voltage</b>	
230V	200-230V ±15%; 10VA
460V	300-460V ±15%; 10VA
600V	600V ±15%; 10VA (on request)

5   <b>Input</b>	
SSR	4-30VDC

6   <b>Firing</b>	
ZC	Zero Crossing

7   <b>Options</b>	
FAN110	Fan voltage supply 110VAC ± 15% (std 230VAC ± 15%) 14W 50/60Hz
UL	UL Certification

## 4. Installation and wiring information

### 4.1 Identification of the unit



Before to install the PT3000S unit examine for damages or deficiencies. Check that the product features shown on PT3000S identification label corresponds to that ordered.

An identification label provide all the informations regarding the factory settings of the unit. This label is on the board inside the unit, as represented below:



Identification label

PHASES	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
AMPS	125 <input type="checkbox"/>	300 <input type="checkbox"/>	650 <input type="checkbox"/>
	150 <input type="checkbox"/>	350 <input type="checkbox"/>	700 <input type="checkbox"/>
	200 <input type="checkbox"/>	400 <input type="checkbox"/>	<input type="checkbox"/>
	225 <input type="checkbox"/>	450 <input type="checkbox"/>	<input type="checkbox"/>
	275 <input type="checkbox"/>	600 <input type="checkbox"/>	<input type="checkbox"/>
MAX V	480 <input type="checkbox"/>	600 <input type="checkbox"/>	<input type="checkbox"/>
OPERATING V			
AUX V	230 <input type="checkbox"/>	460 <input type="checkbox"/>	800 <input type="checkbox"/>
INP.	SSR <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FIR.	ZC <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OPT.	F3 <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

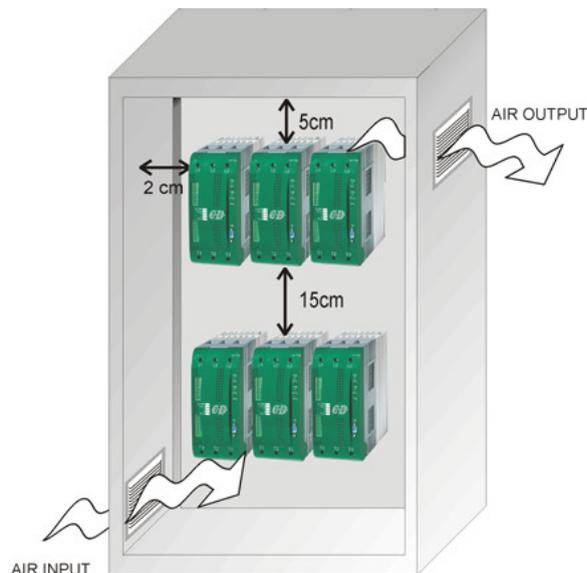


### 4.2 Installation

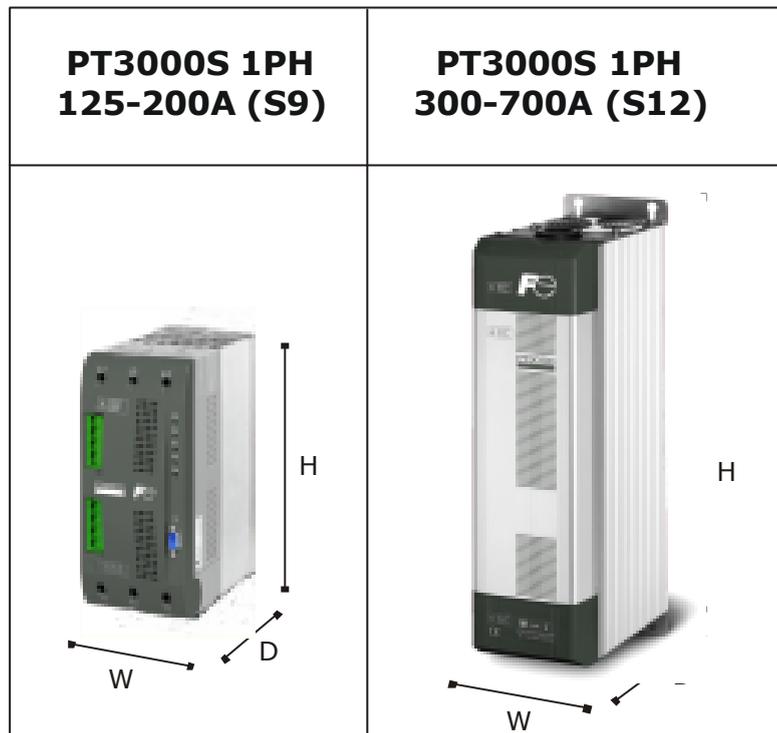


PT3000S unit should be always mounted in vertical position to improve air cooling on heatsink. Maintain minimum distances in vertical and in horizontal as below represented. Don't install in proximity of hot elements and near units generating electromagnetic interferences.

When more units are mounted inside a cubicle provide air circulation as below represented. Sometimes it is necessary to provide a fan to have better air circulation.

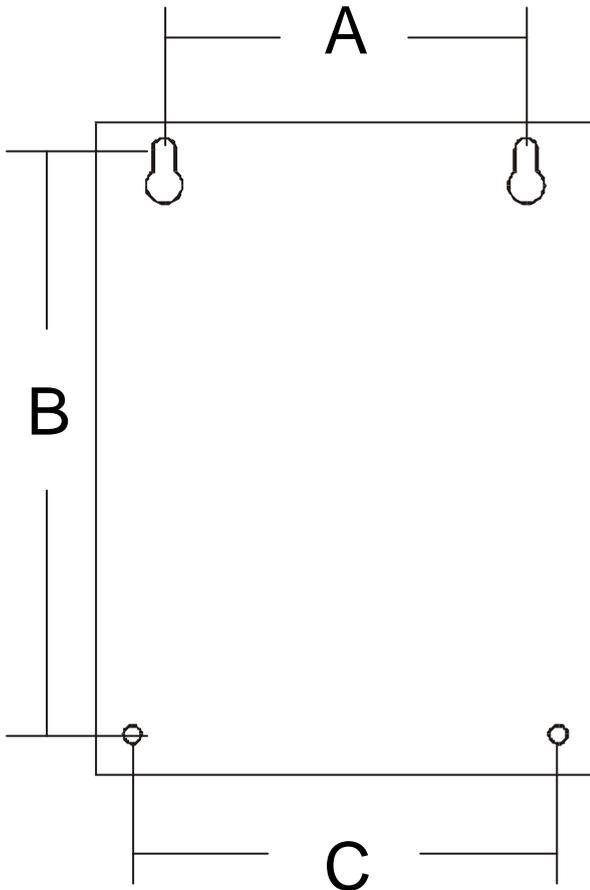


## 4.3 Dimensions



Size	W(mm)	H(mm)	D(mm)
125A (S9)	116	316	187
150A (S9)	116	316	187
200A (S9)	116	316	187
300A (S12)	137	520	270
400A (S12)	137	520	270
500A (S12)	137	520	270
600A (S12)	137	520	270
700A (S12)	137	520	270

## 4.4 Fixing Holes



Size	A(mm)	B(mm)	C(mm)
125A (S9)	96	290	104
150A (S9)	96	290	104
200A (S9)	96	290	104
300A (S12)	97	495	97
400A (S12)	97	495	97
500A (S12)	97	495	97
600A (S12)	97	495	97
700A (S12)	97	495	97

## 5. Wiring Instructions

### 5.1 Removing the cover

To open the unit apply as follow.

For S12 size, you must open the cover to cable, to configure the unit and to view the fuses



For S9 size, you must open the cover to configure the unit and to view the fuses



**Warning:** this procedure can be done just by specialized personnel

*PT3000S unit has isolated heatsink. For safety connect the heatsink to hearth using its terminal with hearth symbol.*

PT3000S can be susceptible to airborne interferences from near equipment or from interferences on main supply, so a number of precautions must be taken.

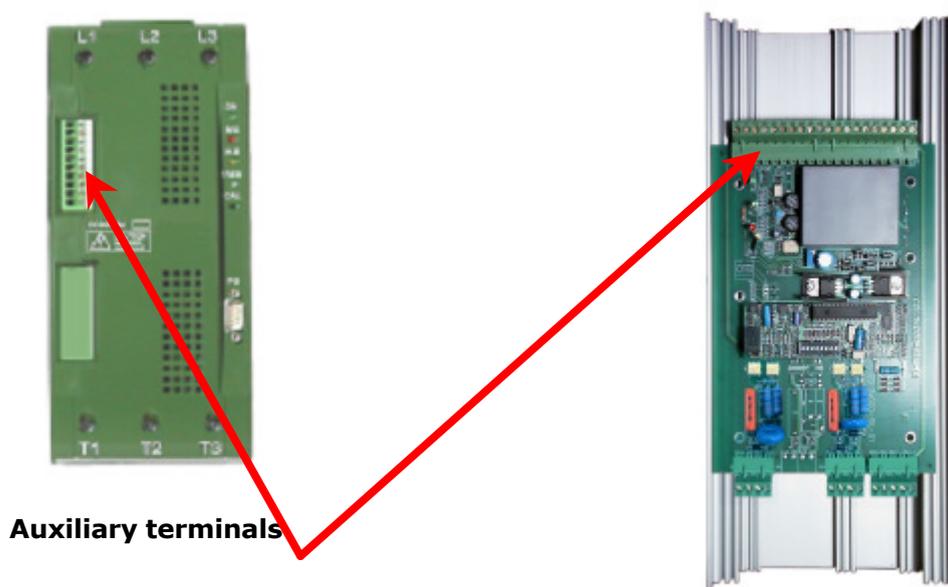
- Contactors coils and chokes must have in parallel a RC filter and must be supplied with a different voltage line.
- All input/output signal must use screened bifilar wires.
- Signal input and output must not routing in same cable tray and must not be parallel.
- Local regulations regarding electrical installation should be rigidly observed.

5.1.1 Auxiliary Terminals



Before connect or disconnect, make sure that the power, control cables and wires are insulated from the voltage

Terminal	Description
1	Auxiliary supply voltage 230-460Vac (600V opt.)
2	N.C. not connected
3	Auxiliary supply voltage 230-460Vac (600V opt.)
4	N.C. not connected
5	Fan supply 230V (110V opt.)
6	Fan supply 230V (110V opt.)
7	Reset
8	Reset
9	+ Input command signal SSR
10	- Input command signal SSR
11	∅ Volt GND (only on S12 size)
12	Output + 8Vdc stabilized, 1mA max (only on S12 size)
13	+Output command signal to PT3000 slave (only on S12 size)
14	- Output command signal to PT3000 slave (only on S12 size)
15	Not used
16	Not used
17	Not used
18	Not used
19	Not used
20	Not used



### 5.1.2 Power Terminals



Before connect or disconnect, make sure that the power, control cables and wires are insulated from the voltage

Terminal	Description
L2	Line Input
T2	Load Output

**S9 power connection**



**S12 power connection**



## 5.2 Cabling detail

Use 75°C copper (CU) conductor only, provided with the terminal type indicated below.

<b>Current/courant</b>	<b>Torque/couple Lb-in (N-m)</b>	<b>Wire Range/cable</b>	<b>Wire Terminal/terminal</b>
125A, 150A, 200A,	265 (30)	1 3/0	Polymeric Terminal Block M8
300A, 400A 500A 600A, 700A	505 (57.0)	Bus Bar	Bus Bar Adapter M10

Power terminals: wire details:

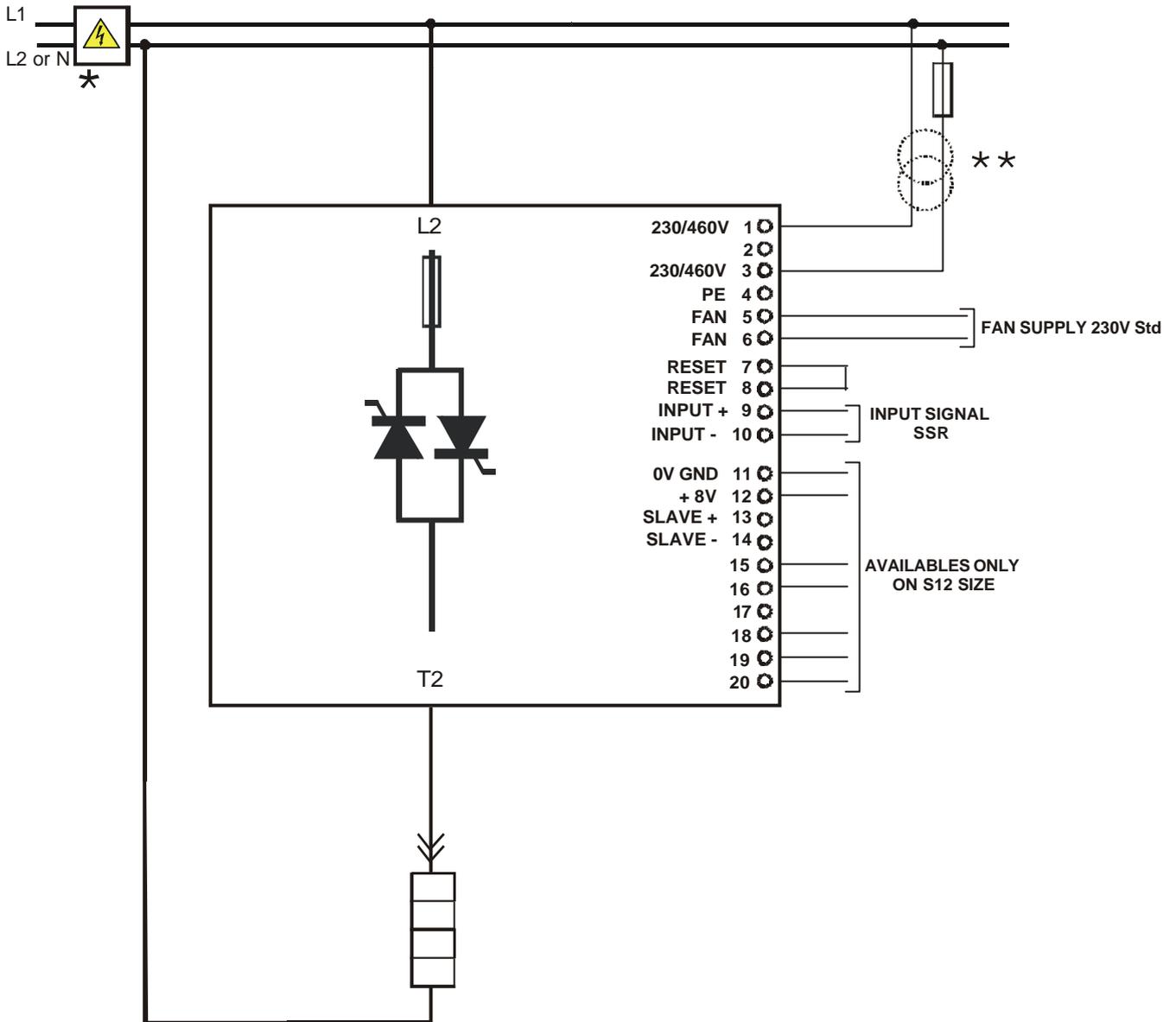
Current	Supply L1, L2 and L3			Load T1, T2 and T3		
	Cable		Screw  M	Cable		Screw  M
	mm <sup>2</sup>	AWG		mm <sup>2</sup>	AWG	
125A	50	1	M8	50	1	M8
150A	70	1/0	M8	70	1/0	M8
200A	95	3/0	M8	95	3/0	M8
300A	2 x 70	2 x 1/0	M10	2 x 70	2 x 1/0	M10
400A	2 x 95	2 x 3/0	M10	2 x 95	2 x 3/0	M10
500A	Bus Bar		60 x 4 mm	Bus Bar		60 x 4 mm
600A	Bus Bar		60 x 5 mm	Bus Bar		60 x 5 mm
700A	Bus Bar		60 x 6 mm	Bus Bar		60 x 6 mm

Auxiliary connectors and earth:

Current	Auxiliary Supply			Earth		
	Cable			Cable		Screw  M
	mm <sup>2</sup>	AWG		mm <sup>2</sup>	AWG	
125A	0,50	18		16	6	M6
150A	0,50	18		16	6	M6
200A	0,50	18		25	4	M8
300A	0,50	18		50	1	M8
400A	0,50	18		50	1	M8
500A	0,50	18		70	1/0	M8
600A	0,50	18		70	1/0	M8
700A	0,50	18		70	1/0	M8

### 5.3 Wiring connection

#### 5.3.1 PT3000 125-700A



NOTE: IMPORTANT

\* The user installation must be protected by electromagnetic circuit breaker or by fuse isalator.

\*\* If the auxiliary voltage (written on the identification label) is different from supply voltage (to the load), use an external transformer, as reported above.



To work terminals 7-8 must be linked.

Fan voltage supply is standard 230VAC ±15% 50/60Hz or optional 110VAC ±15% 50/60Hz. For power consumption see fan paragraph.

## 5.4 LED Status Table

LED	STATUS	DESCRIPTION
PW (green led)	○	Auxiliary supply is not connect
	●	Auxiliary supply is connect
ON (green led)	○	OFF Condition (Load IS NOT Powered)
	●	ON Condition (Load IS Powered)

○	= Light OFF	●	= Light ON
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## 6. Start up

Before to supply the thyristor unit:

- verify that load current equal or less than nominal;

$$\begin{array}{ll} \text{For resistive load} & \text{For inductive load} \\ I = \frac{P_{\text{tot}}}{V} & I = \frac{P_{\text{tot}}}{V \cos \phi} \end{array}$$

- verify that there is no short circuit on load;
- verify that main voltage equal or less than nominal;
- verify that all auxiliary connections are right;
- fan voltage equal than nominal (230V std , 110V optional)

After which supply thyristor unit giving the maximum input signal and verify that load current is equal or less than thyristor unit nominal current.



**Warning:** *this procedure can be done just by specialized personnel.*



*The thyristor unit is delivered configured and tuned in line with customer requirements. If it's necessary to change on site the configuration, procede as below specified.*

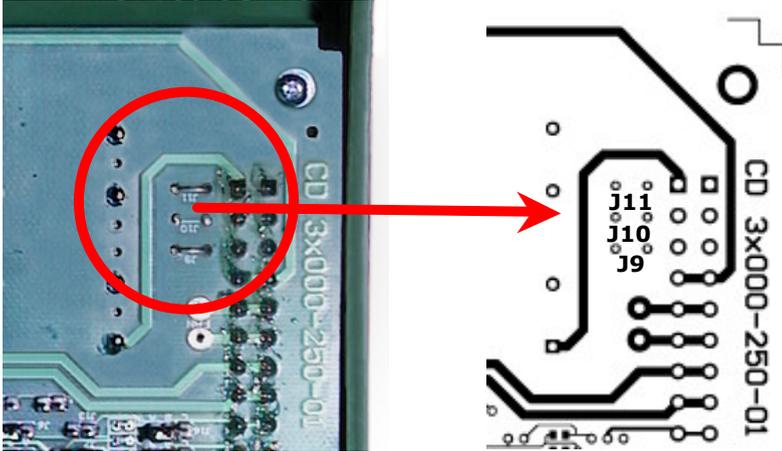
## 6.1 Auxiliary supply



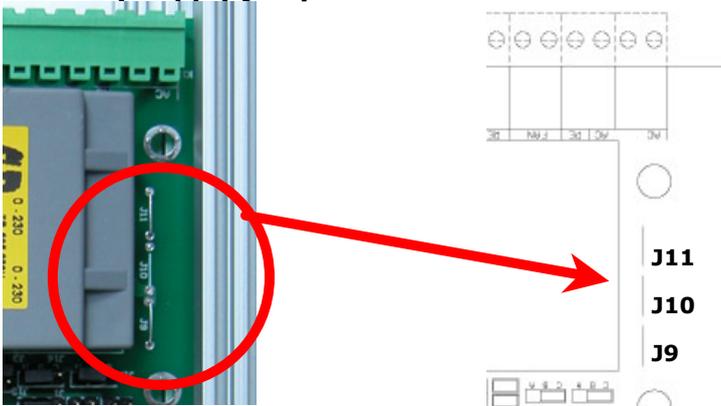
**Warning:** this procedure can be done just by specialized personnel.

To change auxiliary supply voltage sold the correct link-jumper on main PCB.

### Auxiliary supply jumpers for S9 size

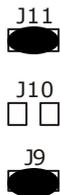


### Auxiliary supply jumpers for S12 size



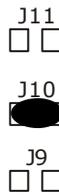
#### 230V Auxiliary supply

To set the auxiliary power supply to 230V, close J9 and J11 and open J10 as shown below.



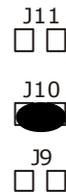
#### 460V Auxiliary supply

To set the auxiliary power supply to 460V, close J10 and open J9 and J11 as shown below.



#### 600V Auxiliary supply

This is a special version on request. In this case the unit is supplied already configured.

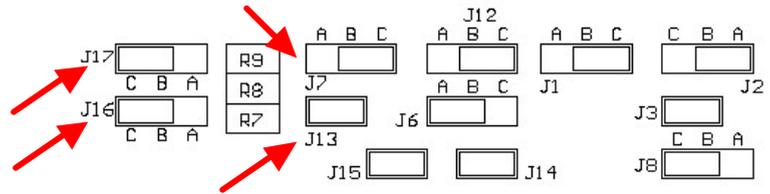
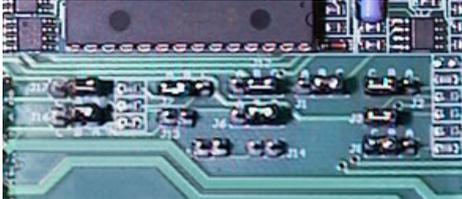


## 6.2 Input configuration

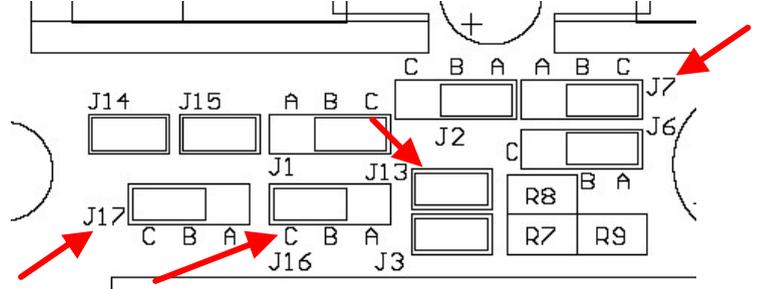
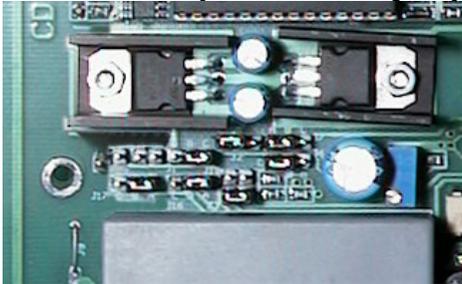


**Warning:** this procedure can be done just by specialized personnel.

### Location of input selection jumpers for S9 size

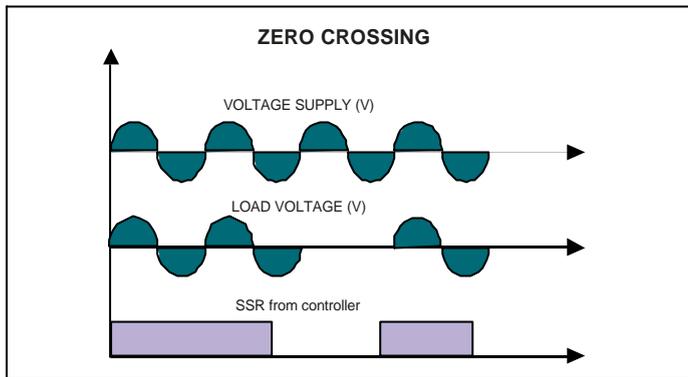


### Location of input selection jumpers for S12 size



Jumpers Configuration				
MAIN PCB				
Input	J7	J16	J17	J13
SSR	A B C ■ ■ ■	C B A ■ ■ ■	C B A ■ ■ ■	FITTED ■ ■ ■

## 7. Thyristor firing mode



### 7.1 Zero Crossing(ZC)

ZC firing mode is used with Logic Output from temperature controllers and the Thyristor operate like a contactor. The Cycle time is performed by temperature controller. ZC minimize interferences because the Thyristor unit switch ON-OFF at zero voltage.

## 8. Fuses and fuseholder

### 8.1 Fuses and Fuse Code

PT3000S unit must be protected by fuses against short circuit selecting the proper  $I^2t$  that must be lower than thyristor one. The same caution must be taken if Circuit Breaker is used. Remember that is very difficult to protect the thyristor if this choice is done.



**WARNING!!** Equipment short circuit protected by Semiconductor Fuse type with proper  $I^2t$

Sizes	Bussmann Div - Cooper (UK) Ltd (200 kA <sub>RMS</sub> Symmetrical A.I.C.)				Ferraz Shawmut SA (200 kA <sub>RMS</sub> Symmetrical A.I.C.)			
	Fuse Mod. No. /modèle fusible	Current (A <sub>RMS</sub> )	I <sup>2</sup> t (A <sup>2</sup> sec)	V ac	Fuse Mod. No. /modèle fusible	Current (A <sub>RMS</sub> )	I <sup>2</sup> t (A <sup>2</sup> sec)	Vac
125A	200 FEE	200	11400	660	6,6 URY 000 BS88/200	200	16000	660
150A	200 FEE	200	11400	660	6,6 URY 000 BS88/200	200	16000	660
300A	350 FM	350	105000	660	6,6 URZ 000 BS88 Z 350	350	85000	660
400A	550 FMM	550	215000	660	6,6 URZ 000 BS88 Z 550	550	208000	660
500A	700 FMM	700	420000	660	6,6 URZ 000 BS88 Z 700	700	340000	660
600A	2x 450 FMM	450	105000	660	6,6 URZ 2x000 BS88 Z 450	2X450	208000	660
700A	2x 450 FMM	450	105000	660	6,6 URZ 2x000 BS88 Z 700	2X450	208000	660



High speed fuses are only used for the thyristor protection and can not be used to protect the installation.



The user installation must be protect by electromagnetic circuit breaker or by fuse isolator.



The warranty of thyristor is null if no proper fuses are used. See tab above.

## 9. Maintenance

### 9.1 Trouble Shooting

Small problems sometimes can be solved locally with the help of the below tab of trouble shooting. If you don't succeed, contact us or your nearest distributor.

Symptom	LED Indication	Possible reasons of the symptom	Actions
Thyristor unit doesn't go in conduction with input signal.	Green LED (PWR) is always light off.	No voltage auxiliary power supply to terminals 1-3 (see wiring diagram).	Give auxiliary voltage supply to terminals 1-3.
	Green LED (PWR) light on and green LED (ON) in off condition.	No input signal. Reversed polarities of input signal. Reset contact in open condition (see wiring diagram).	Provide to give input signal. Reverse the input signal polarity. Make link on reset terminals.
Load current flows also with no input signal.	Green LED (ON) always in off condition.	Short circuit on thyristor. Wrong connection.	Substitute the thyristor. Check that load is not in short circuit.

## **9.2 Repairing procedure**

- Phone to us.
- Explain to Service Engineer the problem because sometimes it can be solved with a phone call.
- If this is not possible ship the unit to us or to your distributor.
- Write a fault description and give the name of your personnel to which refer.
- Use a rugged packaging to ship the unit.

## **9.3 Fans**

The thyristor unit with forced ventilation uses fans that rotate permanently when the unit is supplied. In case of accidental fan failure, there is an over heating temperature on heatsink. In this case to give protection to thyristor there is a thermal switch properly setted. The function of this switch is to open the input signal until the heatsink temperature falls below the setted value. This means that also with input signal in ON condition the unit is switched OFF and the system can not work at full power. For these reason is important to control periodically the fan status checking that is rotating.

## **9.4 Servicing**

In order to have correct cooling, the user must clean the heatsink and the protective grill of fan. The frequency of this servicing depends on environmental pollution. Check periodically also if the screw for the power cables and safety earth are tightened correctly

## **9.5 Warranty conditions**

We gives a 12 months warranty to its products. The warranty is limited to repairing and parts substitution in our factory and does exclude products not properly used and fuses. Warranty does not includes products with serial numbers deleted. The faulty product should be shipped to us at your cost and our Service will evaluate if product is under warranty terms. Substituted parts remains our property.