

USER'S MANUAL  
Rev. 11/2009

# REVO *S*

## SOLID-STATE RELAY

### 60 TO 210 A

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## 1 Important warning for safety



The Thyristor unit are integral part of industrial equipments.

When it is supply, the Thyristor unit is subject to dangerous tensions. Don't remove the plastic cover. Don't use this unit in aerospace and nuclear application.

### **Electric Shock Hazard (Rischi di scosse elettriche, Risque de 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 allow discharging internal capacitors.

Thus be secure that:

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

### **Important warnings (Avvertenze importanti, attention)**

During the operations with units under tension, local regulations regarding electrical installation should be rigidly observed:

- Respect the internal safety rules.
- 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 the size is in line with real needs.
- To measure voltage current etc. on unit, remove rings and other jewels from fingers and hands.
- Authorized personnel that work on thyristor unit under power supply voltage must be on insulated board

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

### **Protection (Protezione, Protection)**

The unit have IP20 protection rating as defined by the specific international. Is necessary consider the place of installation.

### **Earth (Messa a terra, Terre)**

For safety, the Thyristor unit with isolated heat-sink must be connected to earth.

Earth impedance should be correspondent to local earth regulation. Periodically the earth efficiency should be inspected.

### **Electromagnetic compatibility (Compatibilità elettromagnetica, Compatibilité électromag.)**

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

### **Emissions (Emissioni, Emission)**

All solid-state power controllers emit a certain amount of radio-frequency energy because of the fast switching of the power devices. The CD Automation's Thyristor unit are in accord with the EMC norms, CE mark.

In most installations, near by electronic systems will experience no difficulty with interference. If very sensitive electronic measuring equipment or low-frequency radio receivers are to be used near the unit, some special precautions may be required. These may include the installation of a line supply filter and the use of screened (shielded) output cable to the load.



## 2 Basic Connections

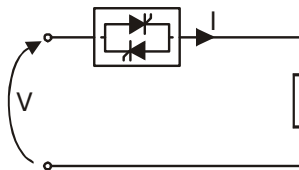
### Single phase wiring with resistive load

$$I = \frac{P}{V}$$

V = Nominal voltage of the load

I = Nominal current of the load

P = Nominal power of the load



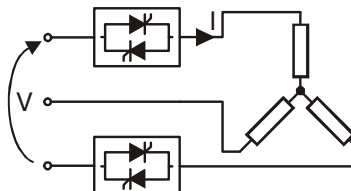
### Star wiring with resistive load (control on two phases)

$$I = \frac{P}{1,73V}$$

V = Nominal voltage of the load

I = Nominal current of the load

P = Nominal power of the load



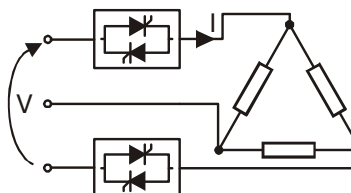
### Delta wiring with resistive load (control on two phases)

$$I = \frac{P}{1,73V}$$

V = Nominal voltage of the load

I = Nominal current of the load

P = Nominal power of the load



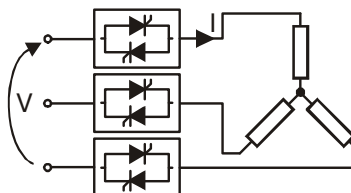
### Star wiring with resistive load (control on three phases)

$$I = \frac{P}{1,73V}$$

V = Nominal voltage of the load

I = Nominal current of the load

P = Nominal power of the load



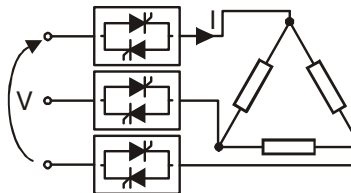
### Delta wiring with resistive load (control on three phases)

$$I = \frac{P}{1,73V}$$

V = Nominal voltage of the load

I = Nominal current of the load

P = Nominal power of the load



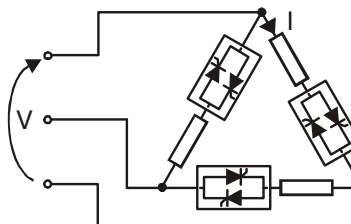
### Open Delta wiring with resistive load

$$I = \frac{P}{3V}$$

V = Nominal voltage of the load

I = Nominal current of the load

P = Nominal power of the load



## 3 Identification and Order Code

### 3.1 Identification of the unit



**Caution:** Before to install, make sure that the Thyristor unit have not damages. If the product has a fault, please contact the dealer from which you purchased the product.

The identification's label give all the information regarding the factory settings of the Thyristor unit, this label is on the unit, like represented in figure.

Verify that the product is the same thing as ordered .



### 3.2 Order Code

|   | 1        | 2        | 3 | 4 | 5 | 6 | - | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16       |
|---|----------|----------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----------|
| <b>CODE</b>                                       | <b>R</b> | <b>S</b> | - | - | - | - | - | - | - | - | -  | -  | -  | -  | -  | -  | <b>1</b> |
| <b>PHASES CONTROLLED</b>                          |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| 1PH   |          |          | 1 |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| 2PH   |          |          | 2 |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| 3PH   |          |          | 3 |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| <b>TYPE</b>                                       |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| 60A   |          |          |   | 0 | 6 | 0 |   |   |   |   |    |    |    |    |    |    |          |
| 90A   |          |          |   | 0 | 9 | 0 |   |   |   |   |    |    |    |    |    |    |          |
| 120A  |          |          |   | 1 | 2 | 0 |   |   |   |   |    |    |    |    |    |    |          |
| 150A  |          |          |   | 1 | 5 | 0 |   |   |   |   |    |    |    |    |    |    |          |
| 180A  |          |          |   | 1 | 8 | 0 |   |   |   |   |    |    |    |    |    |    |          |
| 210A  |          |          |   | 2 | 1 | 0 |   |   |   |   |    |    |    |    |    |    |          |
| <b>MAX VOLTAGE</b>                                |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| 480V  |          |          |   |   |   |   |   | 4 |   |   |    |    |    |    |    |    |          |
| 600V  |          |          |   |   |   |   |   | 6 |   |   |    |    |    |    |    |    |          |
| <b>AUXILIARY VOLTAGE</b>                          |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| None  |          |          |   |   |   |   |   | 0 |   |   |    |    |    |    |    |    |          |
| 12-24V ac/dc with HB Option or analog input       |          |          |   |   |   |   |   | 4 |   |   |    |    |    |    |    |    |          |
| <b>INPUT / FIRING</b>                             |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| SSR / Zero Crossing                               |          |          |   |   |   |   |   |   |   | S |    |    |    |    |    |    |          |
| 0-10V dc  |          |          |   |   |   |   |   |   |   | V |    |    |    |    |    |    |          |
| 4-20 mA   |          |          |   |   |   |   |   |   |   | A |    |    |    |    |    |    |          |
| <b>FIRING</b>                                     |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| SSR / Zero Crossing                               |          |          |   |   |   |   |   |   |   | Z |    |    |    |    |    |    |          |
| BF Burst Firing 4 Cycles (only for Analog Input)  |          |          |   |   |   |   |   |   |   | 4 |    |    |    |    |    |    |          |
| BF Burst Firing 8 Cycles (only for Analog Input)  |          |          |   |   |   |   |   |   |   | 8 |    |    |    |    |    |    |          |
| BF Burst Firing 16 Cycles (only for Analog Input) |          |          |   |   |   |   |   |   |   | 6 |    |    |    |    |    |    |          |
| <b>OPTION</b>                                     |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| None  |          |          |   |   |   |   |   |   |   |   |    |    | 0  |    |    |    |          |
| IF  |          |          |   |   |   |   |   |   |   |   |    |    | F  |    |    |    |          |
| IF + CT   |          |          |   |   |   |   |   |   |   |   |    |    | Y  |    |    |    |          |
| IF + CT + HB                                      |          |          |   |   |   |   |   |   |   |   |    |    | H  |    |    |    |          |
| <b>110V FAN OPTION</b>                            |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| None (standard 230V fan $\geq 120A$ )             |          |          |   |   |   |   |   |   |   |   |    |    | 0  |    |    |    |          |
| With 110V Fan option $\geq 120A$                  |          |          |   |   |   |   |   |   |   |   |    |    | 1  |    |    |    |          |
| <b>UL CERTIFICATION</b>                           |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| None  |          |          |   |   |   |   |   |   |   |   |    |    |    |    | 0  |    |          |
| cUL us (soon available)                           |          |          |   |   |   |   |   |   |   |   |    |    |    |    | L  |    |          |
| <b>MANUAL</b>                                     |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| None  |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    | 0  |          |
| Italian   |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    | 1  |          |
| English   |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    | 2  |          |
| German  |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    | 3  |          |
| <b>VERSION</b>                                    |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    |          |
| Version 1   |          |          |   |   |   |   |   |   |   |   |    |    |    |    |    |    | 1        |

## 4 Internal Fuse

The thyristor unit have internal fuse extrarapid at low  $I^2t$  for the thyristor protection of against the short-circuits. The Fuses must have  $I^2t$  20% less than thyristor's  $I^2t$ .  
The warranty of thyristor is null if no proper fuses are used.

### 4.1 Internal Fuse

| Type | Fuse Code<br>Spare Part | Current<br>(ARMS) | $I^2T$<br>(A <sup>2</sup> sec.) | Vac |
|------|-------------------------|-------------------|---------------------------------|-----|
| 060  | 100FE                   | 100               | 2800                            | 660 |
| 090  | FEE200                  | 200               | 11400                           | 660 |
| 120  | FEE200                  | 200               | 11400                           | 660 |
| 150  | FEE200                  | 200               | 11400                           | 660 |
| 180  | URB315                  | 315               | 82000                           | 660 |
| 210  | URB315                  | 315               | 82000                           | 660 |



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



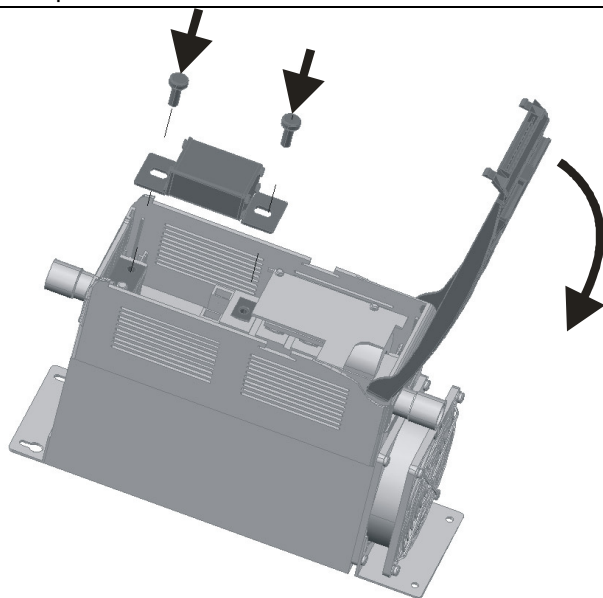
**Caution:** The warranty of thyristor is null if no proper fuses are used. See tab.



**Warning:** When it is supply, the Thyristor unit is subject to dangerous voltage, don't open the Fuse-holder module and don't touch the electric equipments.

### 4.2 Fuses Replacement

Open the cover and remove the screws



## 5 Installation

Before to install, make sure that the Thyristor unit have not damages.

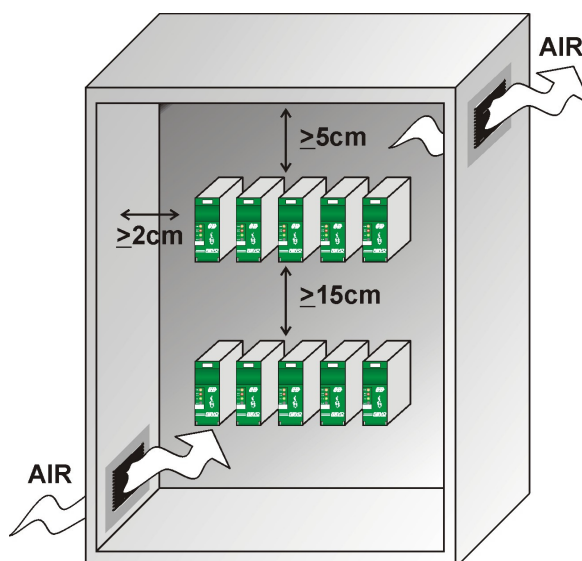
If the product has a fault, please contact the dealer from which you purchased the product. Verify that the product is the same thing as ordered.

The Thyristor unit must be always mounted in vertical position to improve air cooling on heat-sink.

Maintain the minimum distances in vertical and in horizontal as represented.

When more unit has mounted inside the cabinet maintain the air circulation like represented in figure.

Sometimes is necessary installing a fan to have better air circulation.

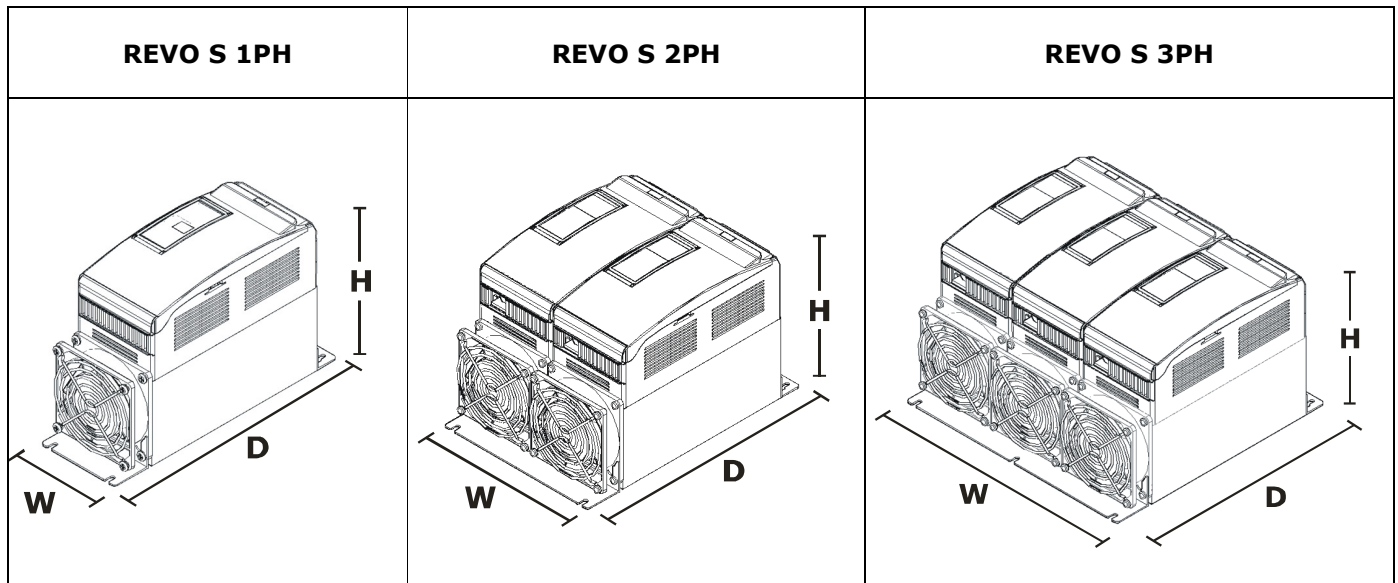


### 5.1 Environmental installation conditions

|                     |  |
|---------------------|--|
| Ambient temperature | 0-40°C at nominal current. Over 40°C use the derating curve.   |
| Storage temperature | -25°C a 70°C   |
| Installation place  | Don't install at direct sun light, where there are conductive dust, corrosive gas, vibration or water and also in salty environmental. |
| Altitude            | Up to 1000 meter over sea level. For higher altitude reduce the nominal current of 2% for each 100m over 1000m                         |
| Humidity            | From 5 to 95% without condense and ice   |

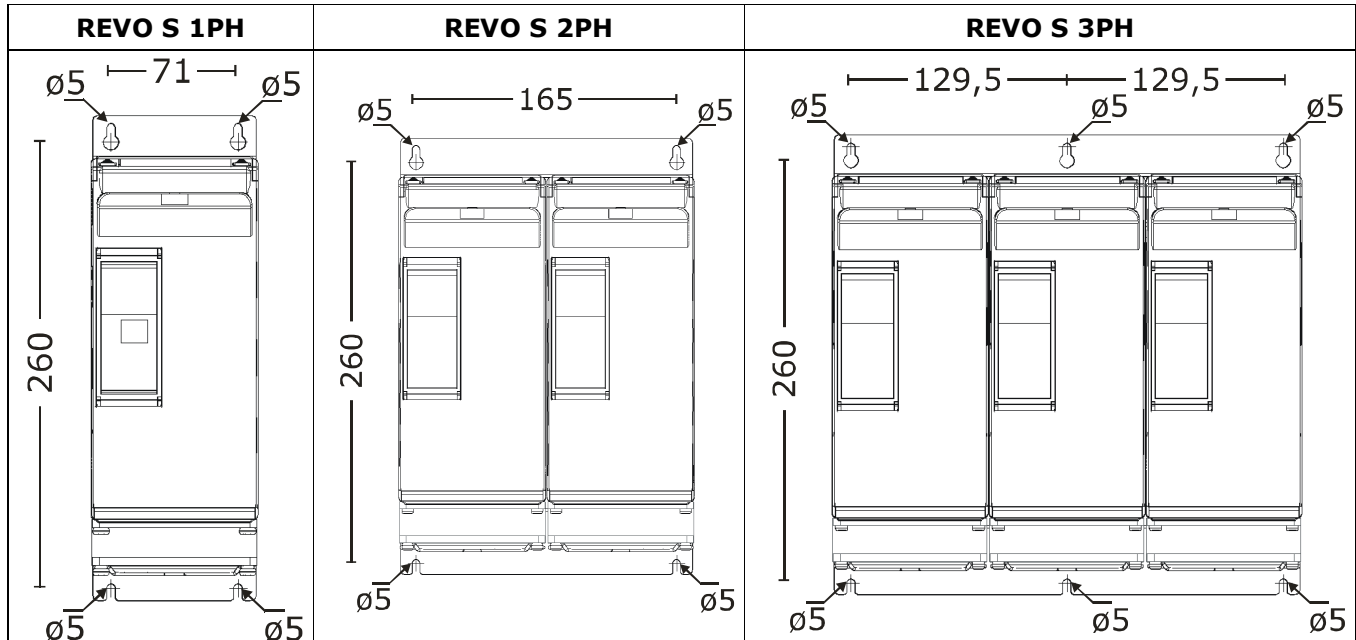


## 5.2 Dimensions and Weight



| Size | W(mm) | H(mm) | D(mm) | Weight (kg) |
|------|-------|-------|-------|-------------|
| 1PH  | 93    | 170   | 274   | 3,4         |
| 2PH  | 187   | 170   | 274   | 6,8         |
| 3PH  | 281   | 170   | 274   | 10,2        |

## 5.3 Fixing holes



## 6 Wiring instructions

The Thyristor unit could be susceptible to interferences lost by near equipments or by the power supply, for this reason in accord to the fundamental practices rules is opportune take some precautions:

- The coil contactor, the relays and other inductive loads must be equipped with opportune RC filter.
- Use shielded bipolar cables for all the input and output signals.
- The signal cables must not be near and parallel to the power cables.
- Local regulations regarding electrical installation should be rigidly observed.

Use copper cables and wires rated for use at 75°C only.

### Power cable torque (suggested)

| Type              | Connector Type | Torque Lb-in (N-m) | Wire Range mm <sup>2</sup> (AWG ) | MAX Current Terminals | Wire Terminals UL Listed (ZMVV)              |
|-------------------|----------------|--------------------|-----------------------------------|-----------------------|--|
| 060<br>090<br>120 | Screw M6       | 70.8 (8.0)         | 1                                 | 150                   | Fork/Spade Terminal<br>Copper Tube Crimp.Lug |
| 150<br>180<br>210 | Screw M8       | 265 (30.0)         | 1<br>3/0                          | 250                   | Copper wire<br>Compact (Solid)<br>Stranded   |

### Cable dimensions of the Command Terminals

0.5mm<sup>2</sup> (AWG 18)

### Cable dimensions of the Earth (suggested)

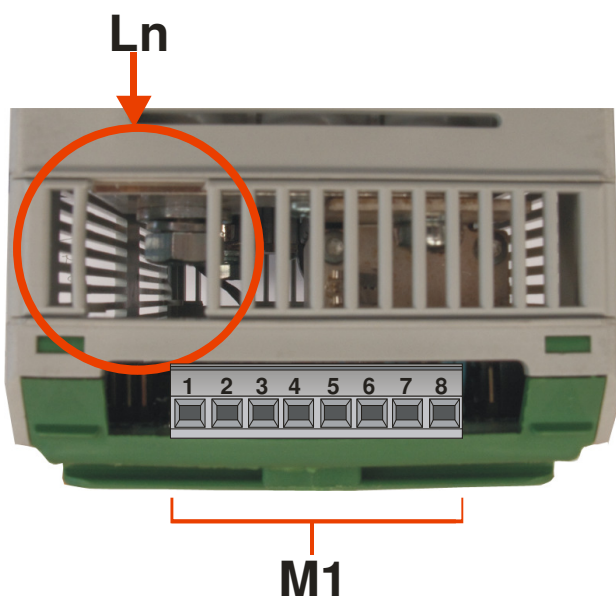
16 mm<sup>2</sup> (AWG 6) up to 120A

25 mm<sup>2</sup> (AWG 4) up to 210A

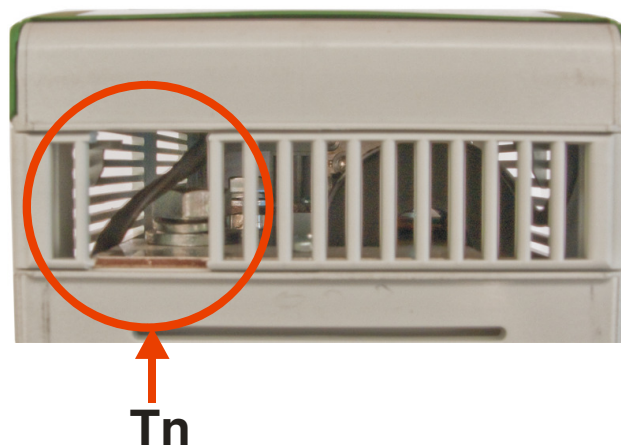


**Warning:** Before connecting or disconnecting the unit check that power and control cables are isolated from voltage sources.

### TOP VIEW



### DOWN VIEW



## 6.1 Power Terminals

| Terminal | Description                                |
|----------|--|
| L1       | Line Input Phase 1                         |
| T1       | Load Output Phase 1                        |
| L2       | Line Input Phase 2 (only for 3pH)          |
| T2       | Load Output Phase 2 (only for 3pH)         |
| L3       | Line Input Phase 3 (only for 2Ph and 3Ph)  |
| T3       | Load Output Phase 3 (only for 2Ph and 3Ph) |

### Command Terminals



**Warning:** Before connecting or disconnecting the unit check that power and control cables are isolated from voltage sources.

#### 6.1.1 SSR Input only terminal blocks for each phase (2PH and 3PH)

| Terminal | Description   |
|----------|---------------|
| 1        | Not connected |
| 2        | Not connected |
| 3        | Not connected |
| 4        | Not connected |
| 5        | Not connected |
| 6        | Not connected |
| 7        | - SSR Input   |
| 8        | + SSR Input   |

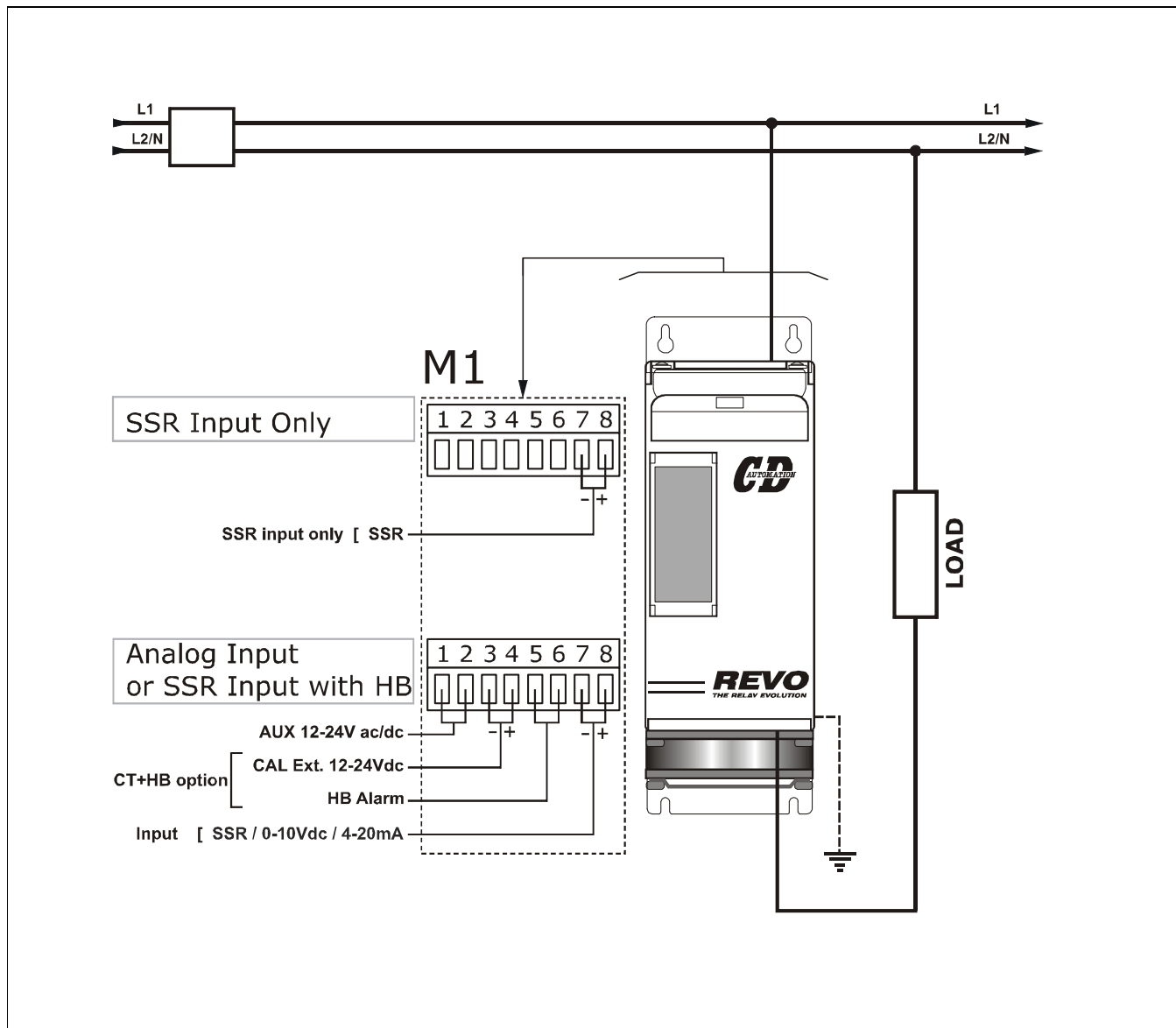
#### 6.1.2 Terminal block M1 for Analog Input or SSR input with HB

| Terminal | Description                  |
|----------|------------------------------|
| 1        | Aux 12-24V AC/DC             |
| 2        | Aux 12-24V AC/DC             |
| 3        | - Cal Ext. 12/24Vdc          |
| 4        | + Cal Ext. 12/24Vdc          |
| 5        | HB Alarm                     |
| 6        | HB Alarm                     |
| 7        | - SSR Input/0-10 Vdc/4-20 mA |
| 8        | + SSR Input/0-10 Vdc/4-20 mA |



**Caution:** this procedure must be performed only by qualified persons.

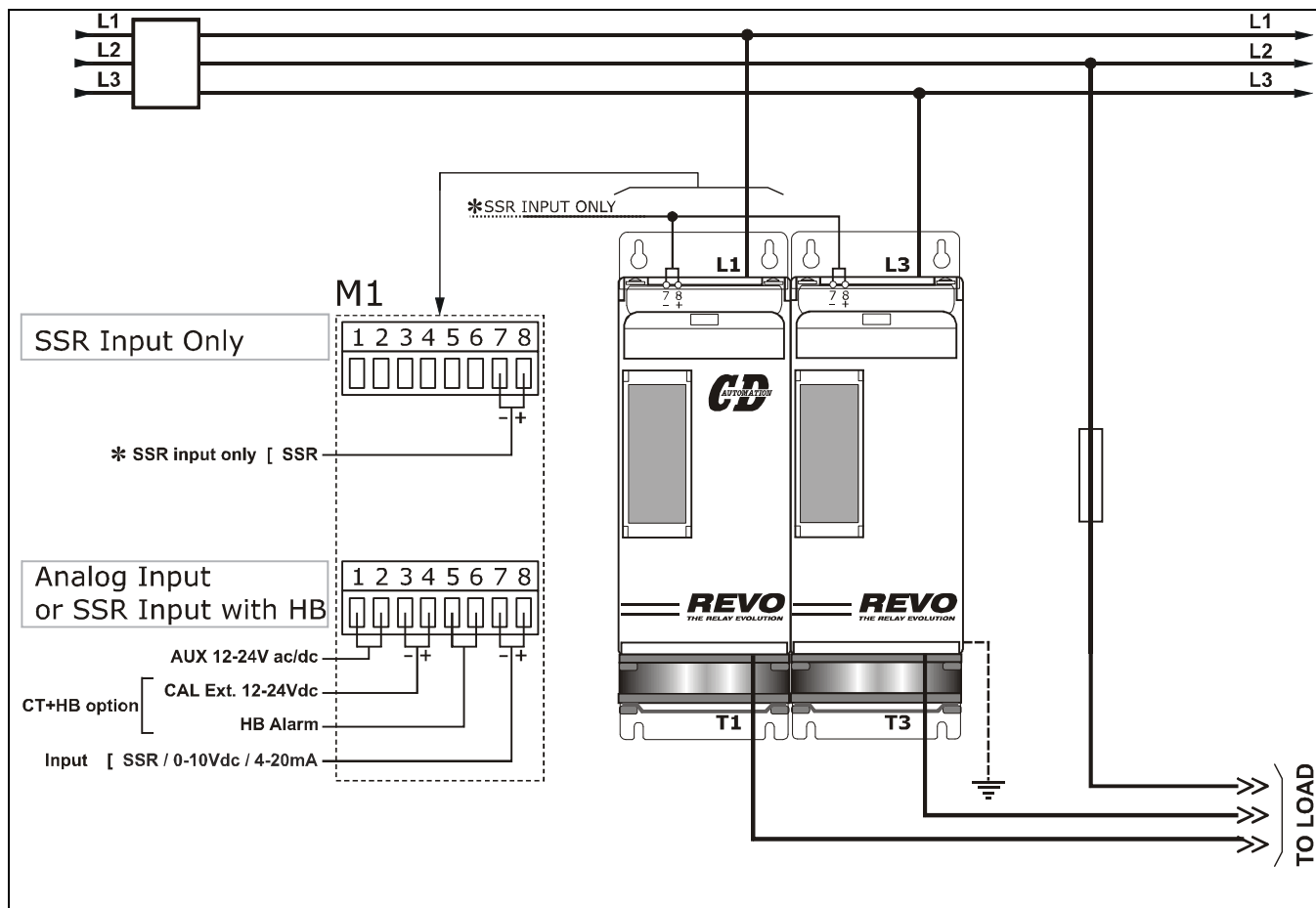
## 6.2 Connection Diagram for Single-phase



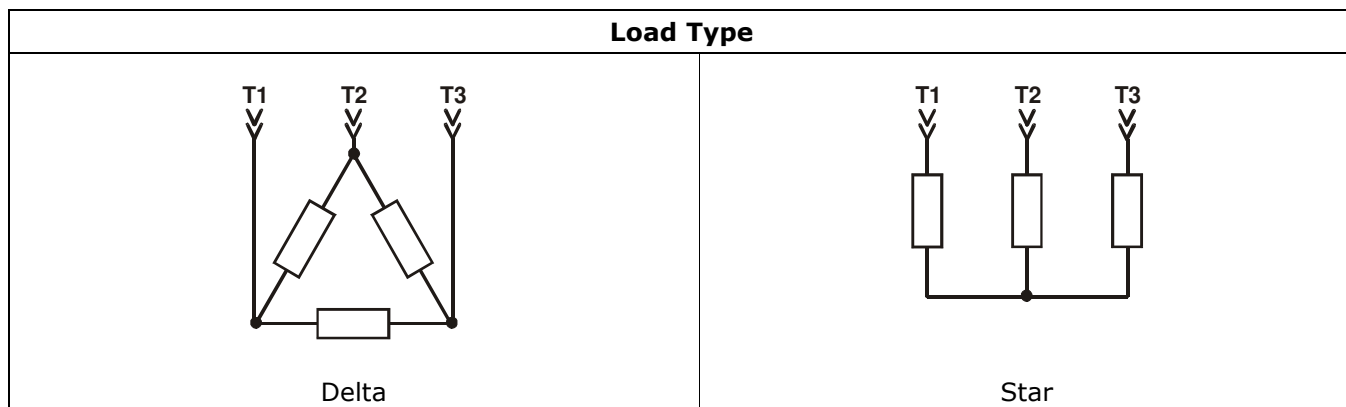
### 6.3 Connection Diagram for 3 phases (control on 2 phases)



**Caution:** this procedure must be performed only by qualified persons.



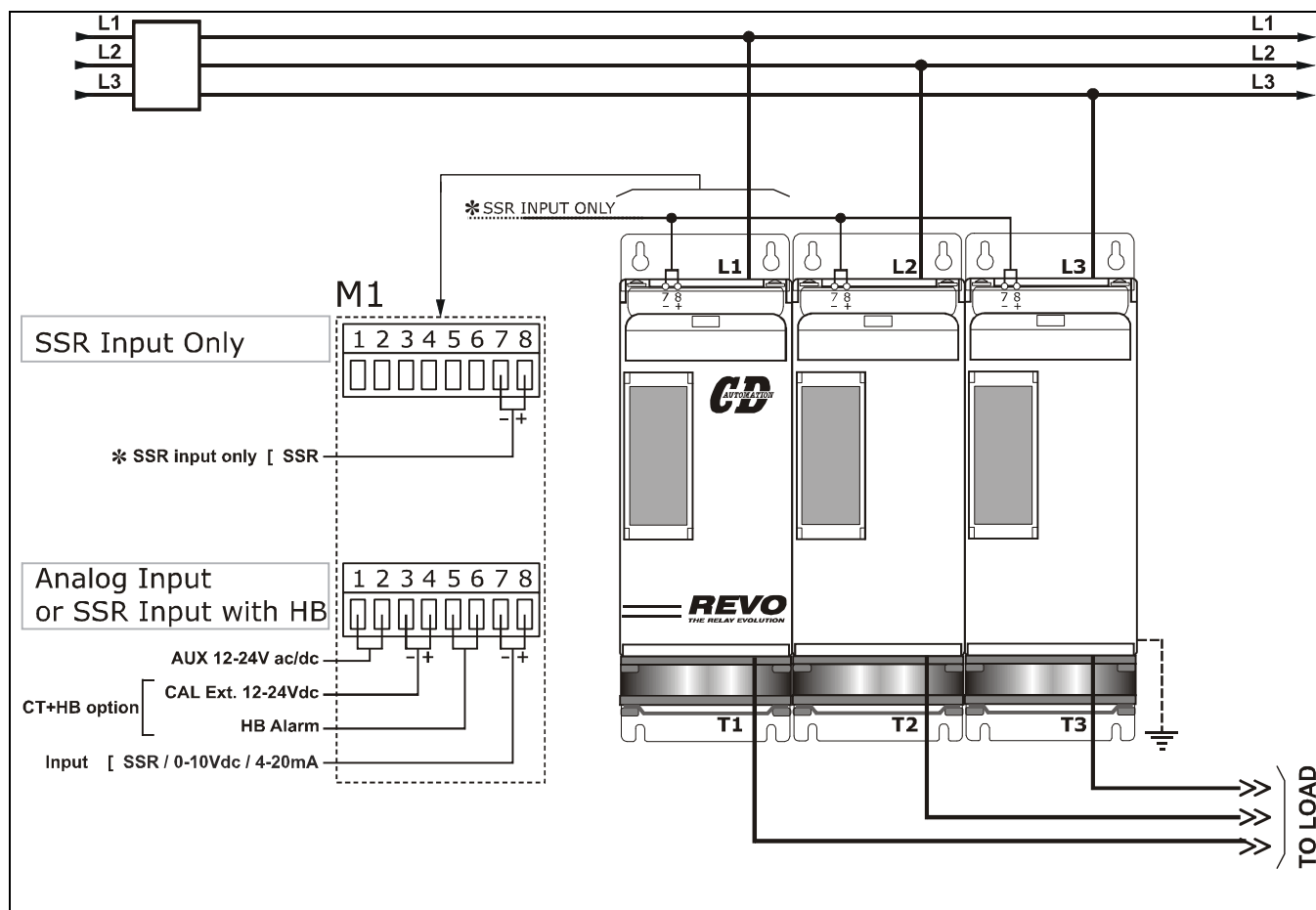
\* **NOTE:** SSR input without HB on terminals 7-8 must be connected on every terminal block M1 of every phase



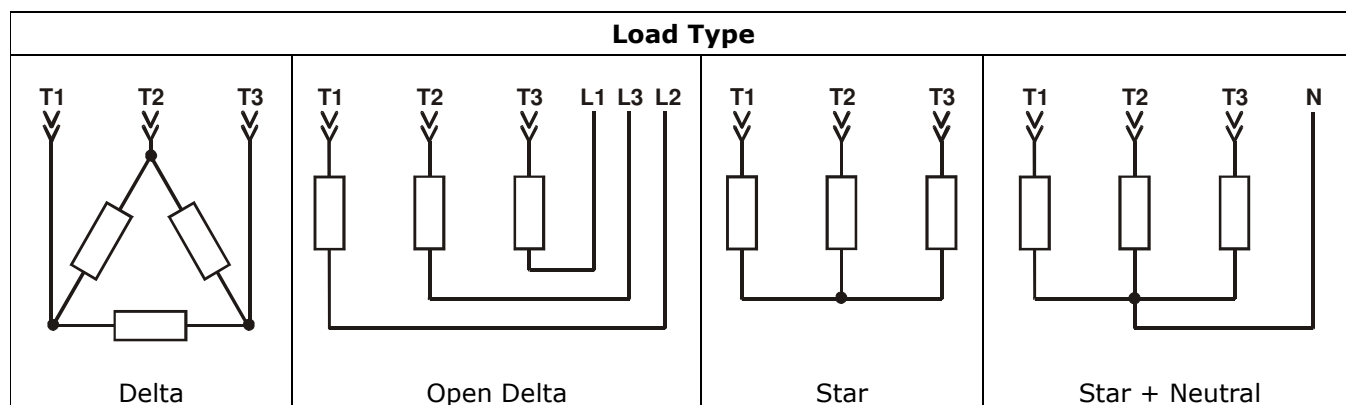
## 6.4 Connection Diagram for 3 phases (control on 3 phases)



**Caution:** this procedure must be performed only by qualified persons.



\* **NOTE:** SSR input without HB on terminals 7-8 must be connected on every terminal block M1 of every phase



## 7 Led status and Alarms

| LED          | STATUS          | DESCRIPTION                             |
|--------------|-----------------|---|
| H.B.<br>S.C. | LED OFF         | Load OK                                 |
|              | LED ON (Yellow) | Load Fault (only with HB option)        |
|              | LED ON (Red)    | SCR short circuit (only with HB option) |
| ON           | LED OFF         | Load is NOT powered                     |
|              | LED ON (Green)  | Load is powered                         |

## 8 Heater Break alarm and SCR short circuit (HB Option)



**Caution:** to work properly the load must be powered at least about 160msec.

The Heater Break circuit read the load current with an Internal current transformer (C.T.). Minimum current is 10% of the current transformer size.  
If load current is below this value the Heater Break Alarm doesn't work properly.

### Heater break Calibration procedure

An automatic function sets the Heater Break Alarm.  
The auto setting function can be activated using the "CAL" button on front unit, or supply with 12-24Vdc the digital input "Cal Ext." (See Connection Diagram).  
The Heater Break calibration procedure is performed in this way:

- The Unit gives the maximum voltage output
- all LEDS are on, this means that calibration procedure is active
- The current value is stored in memory
- After about 15 second the unit comes back to the initial situation

If load current decreases for partial or total load failure (sensitivity 20%) the yellow LED HB become ON and alarm relay change status.

If the unit is still in conduction with no input signal (LED green OFF) it means that there is a short circuit on thyristors and red LED (SC) become ON.

If the load has been changed the Heater Break calibration procedure must be done again

## 8.1 HB Alarm contact

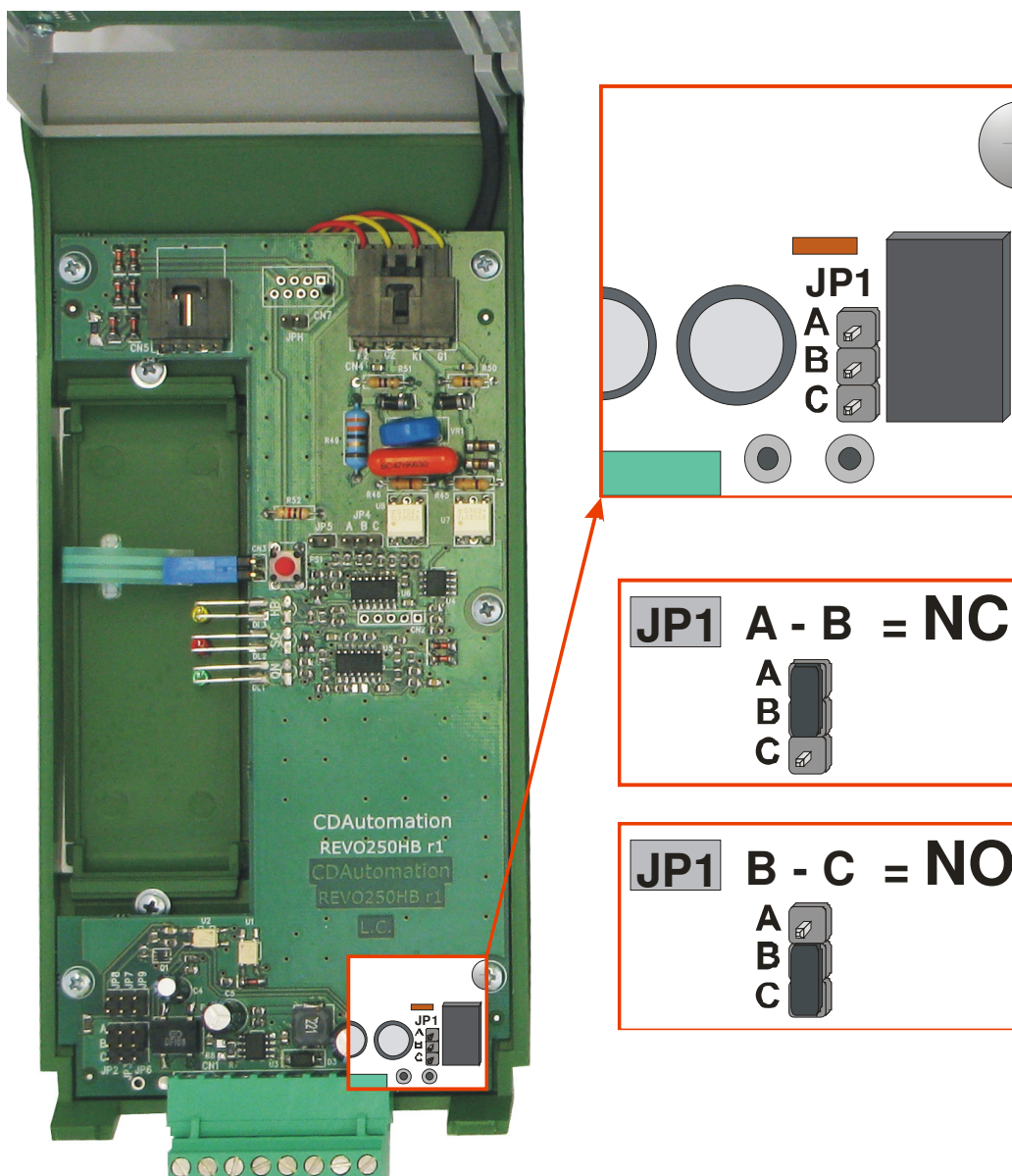
The Revo unit with HB option, is supplied with Heater Break alarm contact normally opened (NO):

- In normal conditions (without alarm) and with auxiliary power supply, the contact to the terminals has opened (relay coil energized).
- In alarm condition or without auxiliary power supply the contact to the terminals is closed (relay coil not energized).

if you wish to change the alarm contact open the cover of the module and set the jumper as shown in the next page .



**Warning:** Before operate, be sure that power and control cables are isolated from voltage sources



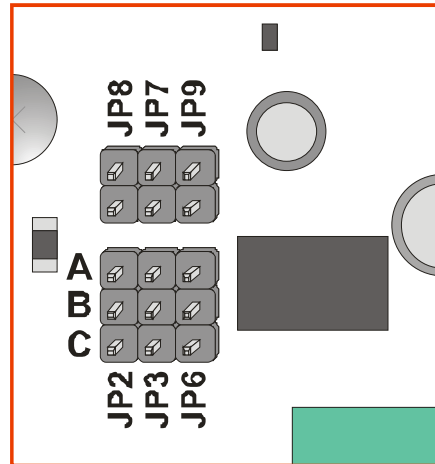
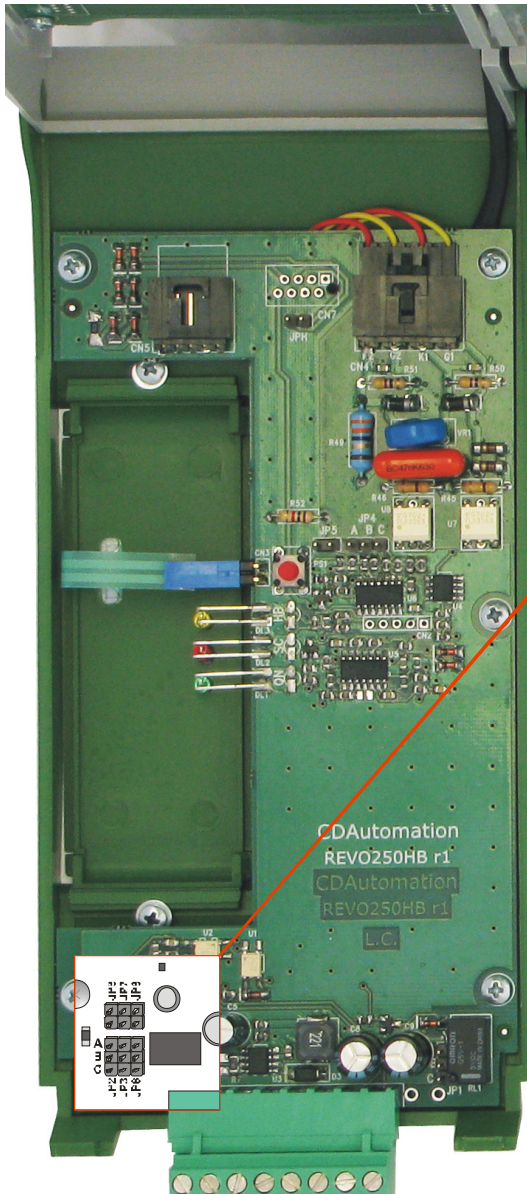


## 9 Input setting

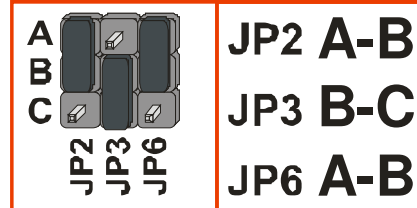
The input type is already configured in line with customer requirements that are defined in the Order Code. However, verify that the jumper are set as below represented:



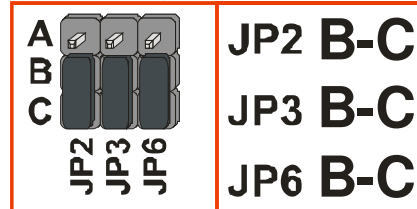
**Warning:** Before operate, be sure that power and control cables are isolated from voltage sources



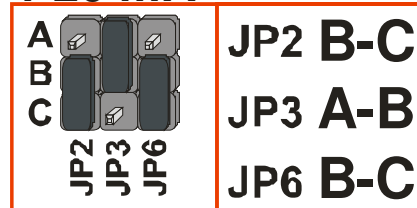
### SSR



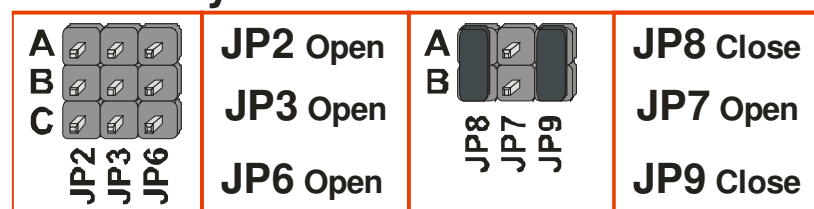
### 0-10 Vdc



### 4-20 mA



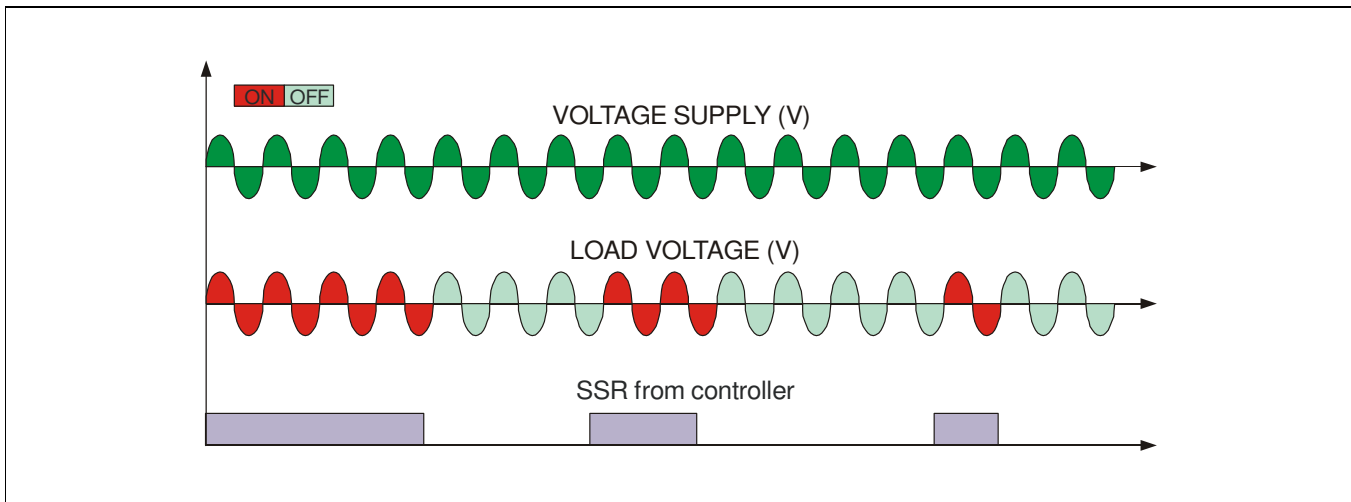
### SSR Only



## 10 Firing type

ZC firing mode is used with Logic Output from temperature controllers and the Thyristor operates like a contactor.

The Cycle time is performed by temperature controller. ZC minimizes interferences because the Thyristor unit switches ON-OFF at zero voltage.

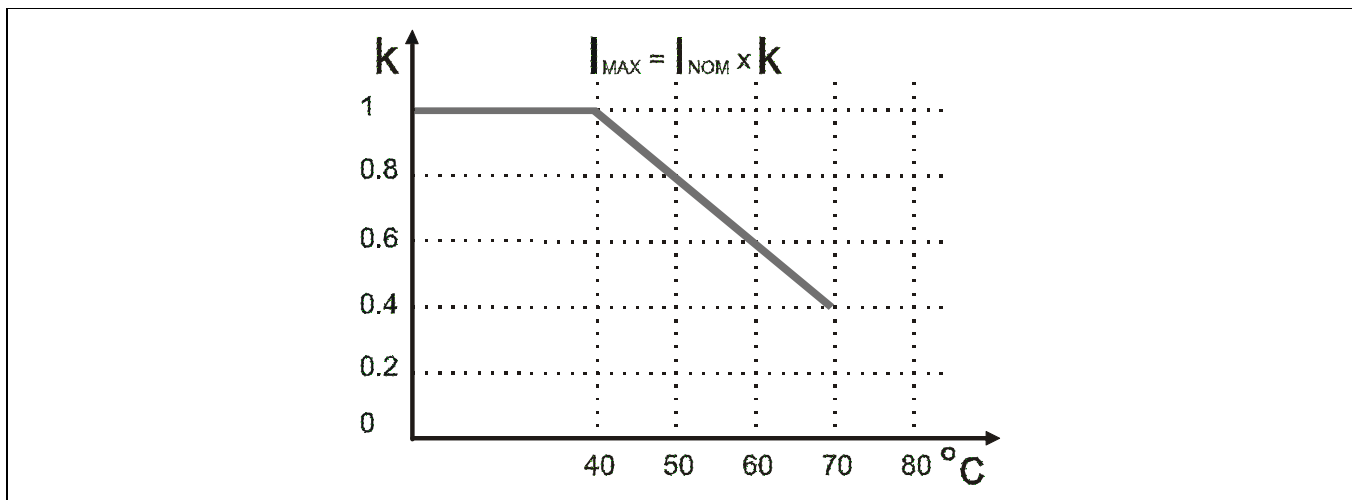


## 11 Technical Specifications

| General features:  |  |
|--|--|
| Cover and Socket material:                                 | PolymericV2                              |
| Auxiliary voltage:   | 12:24V AC/DC If requested                |
| Relay output for Heater Break Alarm (only with HB option): | 0.5A a 125VAC                            |
| Input features:  |  |
| Logic input SSR:   | 4 ÷ 30Vdc 5mA Max (ON ≥ 4Vdc OFF < 1Vdc) |
| Analogic input   | 0 ÷ 10Vdc impedance 15 K ohm             |
| Analogic input   | 4 ÷ 20mA impedance 100 ohm               |
| Digital Input  | 4 ÷ 24Vdc 5mA Max (ON ≥ 4Vdc OFF < 1Vdc) |
| Output features(power device):                             |  |

| Current | Voltage range | Repetitive peak reverse voltage |        | Latching current | Max peak one cycle | Leakage current | I <sup>2</sup> T value max | Frequency range | Power loss    | Isolation Voltage |
|---------|---------------|---------------------------------|--------|------------------|--------------------|-----------------|----------------------------|-----------------|---------------|-------------------|
| (A)     | (V)           | (480V)                          | (600V) | (mAeff)          | (10msec.) (A)      | (mAeff)         | tp=10mse<br>c              | (Hz)            | I=Inom<br>(W) | Vac               |
| 60      | 24÷600        | 1200                            | 1600   | 450              | 100                | 15              | 4750                       | 47÷70           | 216           | 2500              |
| 90      | 24÷600        | 1200                            | 1600   | 450              | 2000               | 15              | 19100                      | 47÷70           | 324           | 2500              |
| 120     | 24÷600        | 1200                            | 1600   | 450              | 1540               | 15              | 11300                      | 47÷70           | 270           | 2500              |
| 150     | 24÷600        | 1200                            | 1600   | 450              | 2000               | 15              | 19100                      | 47÷70           | 324           | 2500              |
| 180     | 24÷600        | 1200                            | 1600   | 300              | 4800               | 15              | 108000                     | 47÷70           | 810           | 2500              |
| 210     | 24÷600        | 1200                            | 1600   | 300              | 5250               | 15              | 128000                     | 47÷70           | 1080          | 2500              |

### 11.1 Derating Curve



## 12 Maintenance

In order to have a corrected cooling, the user must clean the heat-sink and the protective grill of the fans. The frequency of this servicing depends on environmental pollution.

Also check periodically if the screw for the power cables and safety earth are tightened correctly (See Connection Diagram)

### 12.1 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   | Indication on front unit                                      | Possible reasons of the symptom  | Actions   |
|---|---|--|---|
| Load current doesn't flow   | Green LED (ON)<br>light OFF                                   | <ul style="list-style-type: none"> <li>No Auxiliary Voltage</li> <li>No input signal</li> <li>Reversed polarities of input signal</li> </ul>   | <ul style="list-style-type: none"> <li>Give auxiliary voltage supply (See Connection Diagram)</li> <li>Provide to give input signal</li> <li>Reverse the input signal polarity</li> </ul> |
|   | Green LED (ON)<br>light ON                                    | <ul style="list-style-type: none"> <li>Fuse failure</li> <li>Load connection interruption</li> <li>Load failure: The yellow led (HB) is light on (with HB option)</li> <li>Thyristor fault: The red led (SC) is light on (with HB option)</li> </ul> | <ul style="list-style-type: none"> <li>Change the fuse</li> <li>Check the wiring</li> <li>Check the load</li> <li>Change the thyristor module</li> </ul>                                  |
| Load current flow also without input signal                       | Red LED (SC)<br>light on                                      | <ul style="list-style-type: none"> <li>Wrong wiring</li> <li>SCR short circuit</li> </ul>  | <ul style="list-style-type: none"> <li>Check the wiring</li> <li>Change the thyristor module</li> </ul>   |
| Current flows at nominal value but Yellow LED (HB/SC) is light on | Yellow LED (HB)<br>light on<br>or<br>Red LED (SC)<br>light on | <ul style="list-style-type: none"> <li>HB circuit not tuned</li> <li>Current transformers not properly wired</li> </ul>  | <ul style="list-style-type: none"> <li>Make HB calibration procedure</li> <li>Check current transformers wiring</li> </ul>  |
| Thyristor unit doesn't work properly                              |   | <ul style="list-style-type: none"> <li>Auxiliary voltage supply out of limits</li> <li>Wrong input signal selection.</li> <li>Wrong input signal calibration (out of range)</li> </ul>   | <ul style="list-style-type: none"> <li>Verify the auxiliary voltage supply</li> <li>Control input signal setting.</li> <li>Check input setting</li> </ul>                                 |

### 12.2 Warranty condition

CD Automation 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 include products with serial numbers deleted. The faulty product should be shipped to CD Automation at customer's cost and our Service will evaluate if product is under warranty terms.  
 Substituted parts remain of CD Automation property.

