USER'S MANUAL

Rev. 05/2022

REVO TH

MULTIZONE POWER CONTROLLER

from 35A to 90A

003

M-TH-35-90

CD Automation S.r.l.
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Declaration of conformity

Declaration of conformity - Dichiarazione di Conformità CE

PRODUCT MANUFACTURER / PRODUTTORE:

CD Automation S.R.L.
Controllers, Drives & Automation

Via Picasso, 34/36 - 20025 Legnano (MI)- Italy
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Dichiara che il prodotto / Declare that the product:

REVO TH 35A-50A-75A-90A

PRODUCT DESCRIPTION: Electric power control
SCOPE OF APPLICATION: Thermal control process
DESCRIZIONE DEL PRODOTTO: Unità di controllo potenza elettrica
UTILIZZO: Controllo processi termici

FULFILS THE REQUIREMENTS OF THE STANDARD:

Electrical safety Standard	EN60947-1:	2007 + A1 2011, A2 2014
	EN60947-4-3:	2014
Generic Emission standard	EN60947-4-3:	2014 Group 1 Class A emissions
Generic Immunity standard	EN60947-4-3:	2014 Industrial Immunity

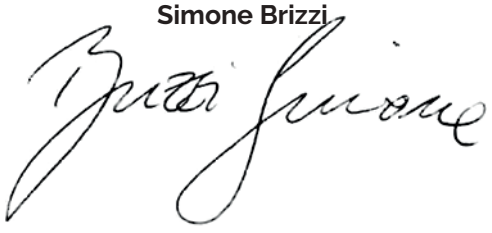
SODDISFA I REQUISITI DELLA NORMA:

Specifica di sicurezza	EN60947-1:	2007 + A1 2011, A2 2014
	EN60947-4-3:	2014
Specifica sulle emissioni	EN60947-4-3:	2014 gruppo 1 emissioni classe A
Specifica sulle Immunità	EN60947-4-3:	2014 Immunità industriale

CDAutomation declares that the products above mentioned are conforming to the directive
Low Voltage Directive updated 2014/35/EU
CDAutomation dichiara che i prodotti sopra menzionati sono conformi alla direttiva
Alla direttiva Bassa Tensione (low Voltage) EMC directive updated 2014/30/EU

Issued on: 20/03/2017
Data di emissione: 20/03/2017

Amministratore Unico e
Legale Rappresentante
Simone Brizzi



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Important warnings for safety

This chapter contains important information for the safety. The not observance of these instructions may result in serious personal injury or death and can cause serious damages to the Thyristor unit and to the components system included.
The installation should be performed by qualified persons.
In the manual are used symbols to give more evidence at the notes of safety and operativity for the attention for the user:

	This icon is present in all the operational procedures where the Improper operation may result in serious personal injury or death by Electrical Shock Hazard Symbol (a lightning bolt in a triangle) precedes an electric shock hazard CAUTION or WARNING safety statement.
	Warning or Hazard that needs further explanation than the label on unit can provide. Consult User's Guide for further information.
	Unit is compliant with European Union directives. See Declaration of Conformity for further details on Directives and Standards used for Compliance.
	If available, unit is a Listed device per Underwriters Laboratories. It has been investigated to ANSI/UL® 508 standards for Industrial Control Switches and equivalent to CSA C22.2 #14. For more detail search for File E231578 on www.ul.com
	ESD Sensitive product, use proper grounding and handling techniques when installing or servicing product.
	Do not throw in trash, use proper recycling techniques or consult manufacturer for proper disposal.

A **"NOTE"** marks a short message to alert you to an important detail.

A **"CAUTION"** safety alert appears with information that is important for protecting your equipment and performance. Be especially careful to read and follow all cautions that apply to your application.

A **"WARNING"** safety alert appears with information that is important for protecting you, others and equipment from damage. Pay very close attention to all warnings that apply to your application.

Safety notes

WARNING! To avoid damage to property and equipment, injury and loss of life, adhere to applicable electrical codes and standard wiring practices when installing and operating this product. Failure to do so could result in damage, injury and death.

AVERTISSEMENT! Pour éviter d'endommager la propriété et l'équipement, les blessures et la perte de vie, respecter les codes électriques en vigueur et les pratiques de câblage standard au moment de l'installation et de l'utilisation de ce produit. Dans le cas contraire, cela peut entraîner la mort, des blessures graves ou des dommages.

WARNING! All service including inspection, installation, wiring, maintenance, troubleshooting, fuse or other user serviceable component replacement must be performed only by properly qualified personnel. Service personnel must read this manual before proceeding with work. While service is being performed unqualified personnel should not work on the unit or be allowed in the immediate vicinity.

AVERTISSEMENT! Tous les services, y compris l'inspection, l'installation, le câblage, l'entretien, le dépannage, le remplacement de fusibles ou d'autres composants pouvant être réparés par l'utilisateur, doivent être effectués uniquement par un personnel diment qualifié. Le personnel de service doit lire ce manuel avant d'effectuer tout travail. Pendant que l'entretien est exécuté, tout personnel non qualifié ne doit effectuer de travail sur l'appareil ni se trouver a proximité.

WARNING! When in use the power controller is connected to dangerous voltages. Do not remove the protective covers without first disconnecting and preventing power from being restored while servicing the unit.

AVERTISSEMENT! Au moment de l'utilisation, le régulateur de puissance est connecté a des tensions dangereuses. Ne retirer aucun couvercle de protection sans d'abord débrancher l'appareil et ainsi empêcher l'alimentation d'être rétablie pendant l'entretien.

WARNING! Do not use in aerospace or nuclear applications.

AVERTISSEMENT! Ne pas utiliser pour les applications aérospatiales ou nucléaires.

WARNING! The units are not developed to manage capacitive loads.

AVERTISSEMENT! Les unités ne sont pas développées pour la conduite de charges capacitives.

WARNING! The power controller's protection rating is IP20 with all covers installed and closed. It must be installed in an enclosure that provides all the necessary additional protections appropriate for the environment and application.

AVERTISSEMENT! L'indice de protection du régulateur de puissance est de IP20 lorsque les couvercles sont installés et fermés. L'appareil doit être installé dans une enceinte qui assure toute la protection supplémentaire nécessaire pour l'environnement et l'application.

WARNING! Ground the power controller via the provided protective earth grounding terminal. Verify ground is within impedance specifications. This should be verified periodically.

AVERTISSEMENT! Mise a la terre du régulateur de puissance par le biais de la borne de prise de terre de protection fournie. Vérifier que la prise de terre est conforme aux spécifications de l'impédance. Cela doit être vérifié périodiquement.

WARNING! Electric Shock Hazard: when the power controller has been energized, after shutting off the power, wait at least one minute for internal capacitors to discharge before commencing work that brings you in to contact with power connections or internal components.

AVERTISSEMENT! Risque de décharges électriques: lorsque le régulateur de puissance est mis sous tension, après avoir été éteint, attendre au moins une minute pour que les condensateurs internes se déchargent avant de commencer tout travail incluant le contact avec les connexions électriques ou les composants internes.

WARNING! The installation must be protected by electromagnetic circuit breakers or by fuses. The semiconductor fuses located inside the power controller are classified for UL as supplementary protection for semiconductor devices. They are not approved for branch circuit protection.

AVERTISSEMENT! L'installation doit être protégée par des disjoncteurs électromagnétiques ou des fusibles. Les fusibles pour semi-conducteurs situés a l'intérieur du régulateur de puissance sont classés UL comme protection supplémentaire pour les dispositifs pour semi-conducteurs. Ils ne sont pas approuvés pour la protection des circuits de dérivation.

WARNING! When making live voltage or current measurements, use proper personal protective equipment for the voltages and arc-flash potentials involved.

AVERTISSEMENT! Au moment de relever des mesures de tension ou de courant en direct, utiliser un équipement de protection individuelle approprié pour les tensions et les potentiels d'arc électrique concernés.

WARNING! Verify the voltage and current ratings of the power controller are correct for the application.

AVERTISSEMENT! Vérifier que les valeurs de tension et de courant du régulateur de puissance sont correctes pour l'application.

CAUTION: To avoid compromising the insulation, do not bend wire or other components beyond their bend radius specifications.

ATTENTION: Pour éviter de compromettre l'isolation, ne pas plier le fil ou tout autre composant au-delà de ses spécifications en matière de rayon de courbure.

CAUTION: Protect the power controller from high temperature, humidity and vibrations.

ATTENTION: Protéger le régulateur de puissance contre les températures élevées, l'humidité et les vibrations.

CAUTION: The power controller warranty is void if the tested and approved fuses are not used.

ATTENTION: La garantie du régulateur de puissance est nulle si aucun fusible testé et approuvé n'est utilisé.

CAUTION: Only trained and authorized personnel should access and handle the internal electronics and they must follow proper electro-static prevention procedures.

ATTENTION: Seul le personnel formé et autorisé peut accéder aux composants électroniques internes et les gérer, et il doit se conformer a des procédures de prévention électrostatique appropriées.

CAUTION: Install an appropriately sized RC filter across contactor coils, relays and other inductive loads.

ATTENTION: Installer un filtre RC de dimensions appropriées sur les bobines du contacteur, les relais et autres charges par induction.

CAUTION: The thyristor units here described have been designed for use with sinusoidal networks with nominal frequency 50-60 Hz. Any application with NON-SINUSOIDAL, distorted or disturbed networks could compromise the correct operation of the unit.

ATTENTION: Les unités de thyristors décrites ici ont été conçues pour être utilisées avec des réseaux sinusoïdaux d'une fréquence nominale de 50 à 60 Hz. Toute application utilisant des réseaux NON SINUSOÏDAUX, déformés ou perturbés peut compromettre le bon fonctionnement de l'appareil.

NOTE: Provide a local disconnect to isolate the power controller for servicing.

REMARQUE: Fournir une déconnexion locale afin d'isoler le régulateur de puissance pour l'entretien.

NOTE: The nominal current is specified for ambient temperatures at or below 40° C. Ensure the application design allows for adequate cooling of each power controller. The power controller must be mounted vertically. The cooling design must prevent air heated by one power controller from causing power controllers mounted above to exceed the ambient operating temperature limit. When power controllers are mounted side by side allow a minimum spacing of 15mm between them.

REMARQUE: Le courant nominal est précisé pour des températures ambiantes égales ou inférieures a 40°C. S'assurer que la conception de l'application permette le refroidissement adéquat de chaque régulateur de puissance. Le régulateur de puissance doit être monté verticalement. La conception de refroidissement doit empêcher l'air chauffé par le régulateur de puissance de dépasser la limite de température de fonctionnement ambiante de la part des régulateurs de puissance montés au-dessus. Lorsque les régulateurs de puissance sont montés côte a côte, il faut conserver un espacement minimal de 15 mm entre les deux.

NOTE: Use only copper cables and wires rated for use at 90°C or greater.

REMARQUE: N'utiliser que des cables et des fils en cuivre pour l'utilisation a 90°C ou plus.

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).

Warranty condition

Producer 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 Producer at customer's cost and our Service will evaluate if product is under warranty terms.

Substituted parts remain of Producer property.

CE

CD Automation srl assumes no liability for any damage to persons or property deriving from tampering, from incorrect or improper use, or from any use not conforming to the characteristics of the controller and to the instructions in this User Manual.

Return Material Authorization (RMA)

Customers wishing to return any items, whether they are incorrectly supplied, faulty or damaged in transit, must first complete a Return Material Authorisation (RMA) form to obtain an RMA number from the Service Department.
A full repair service is available for customers. Prior to submitting the RMA form and returning products, customers are recommended to contact the technical support team to determine whether the issue can be resolved with telephone support.

How the RMA service works

The RMA form and details are available on our web sites:

https://www.cdautomation.com/rma-english-version/

When completing the RMA form, please be as specific as possible about the problem, including any pertinent application details. The more information given, the more quickly and more thoroughly the problem can be solved. The minimum information required is:

1. The Full Model Number
2. Quantity of units being returned
3. The units Serial Number(s)
4. A description of the problem ("faulty" or "unknown" is not sufficient).

Summary

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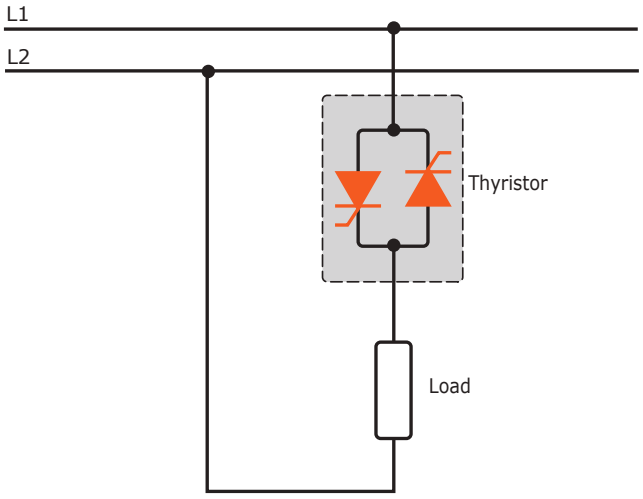
1 Introduction

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 elettromechanical contactors are numerouses: 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.



1.1 Overview

Current transformer and user interface
- Saves installation time and eases setup and commissioning.
- Delivers a user-friendly, intuitive interface.

Industry-leading design and serviceability
- Offers a robust SCR design to meet a rugged industrial environment's high quality and reliability needs.
- Provides quick and easy access to maintain and service fuses and individual legs in minimal time.
- Enables fast troubleshooting by providing helpful thermal system diagnostics.

Comprehensive power controller range
- Provides wide range of options from simple single phase to complex three-phase loads to 600V.

100kA short circuit current rating (SCCR) (Not reviewed by UL®)
- Enables greater protection in the event of a short circuit.

c-UL® 508 Listed - PRELIMINARY, to be tested
- Shortens project schedules, agency testing and expenses.

Control modes: contactor, voltage, current or power
- Satisfies a wide range of demanding thermal applications.

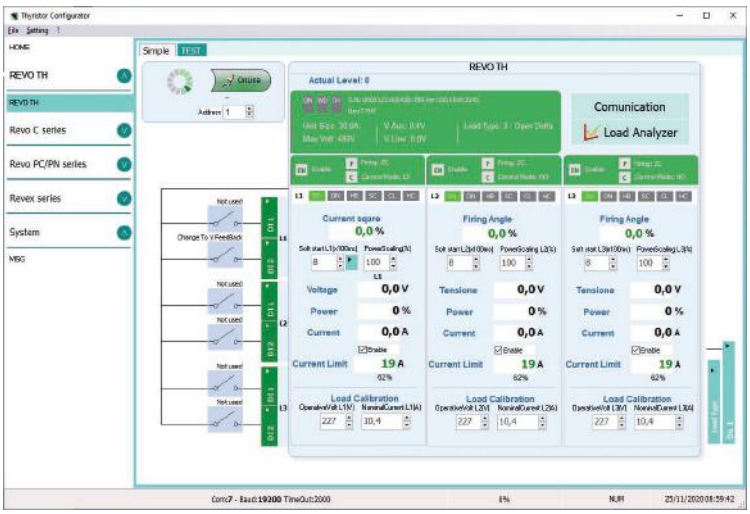
Load firing modes: zero-cross, burst fire
- Handles a wide range of load types including nichrome, medium and long waveform infrared lamps, moly, transformers, silicon carbide, UV lamps and tungsten.
- Protects and extends the life of connected loads.

Wide range of communication protocols
- Enable factory and process automation with connectivity to process and equipment data via Modbus® RTU. Modbus® TCP, Profibus, Profinet (available with external master communication module).

Open heater and shorted SCR indication
- Minimizes production downtime with easy to understand, intelligent, troubleshooting diagnostics.

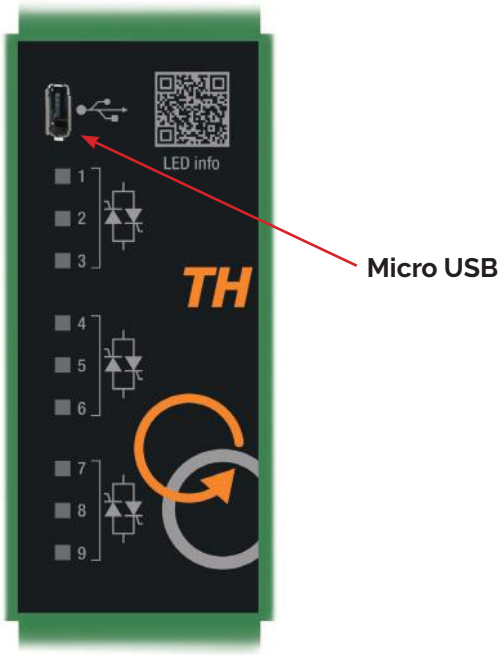
Integrated USB and user interface for configuration
- Easily and safely program configuration settings as the user interface can be powered through USB connection.
- Eliminates need to work in a high voltage hazard environment. High voltage to the power controller and system panel can be shut off and locked out for safety while configuring controller.

2 Software Configurator



Thyristor configurator software is free and is possible download it from our site.
If the Order Code is in line with requirement, then unit has been already configured in Factory and it's ready to use.
You need the software only to modify the ordered configuration. Anyway we suggest to check the unit on the machine with the "Test unit" section.
For install the software, launch the program and follow the instructions on the screen.
Run the software configurator and set the correct serial port number by menu setting-serial com – port number.

Software Configurator download link:
https://www.cdautomation.com/download/cd-automation/software/ThyristorConfigurator_ver6.exe



To connect the unit at the PC, it's necessary to use the micro USB 2.0 Modbus RTU cable.
USB connection need a driver to work properly, you can find it from our site.

However the configuration software installer will install as default the correct driver.

3 Quick Start

Attention: this procedure must be carried out by skilled people only.

If your REVO code is in line with what you really need, then the main configuration is already done by Producer and you just need to do the following steps:

1. Verify REVO current sizing. Be sure that:
   - the load current is equal or less than the nominal one of REVO
   - the main voltage is equal or less than the nominal voltage of REVO
2. Verify the Installation
3. Verify the Wiring:
   - all auxiliary connections must be done in line with wirings on this manual
   - verify that there isn't a short circuit on the load
4. Supply the Unit
5. Set the parameters **Operative Load Voltage** and **Nominal Current of the load** by configurator software

   The Unit is ready to work

The auxiliary voltage supply of the REVO unit must be synchronized with load voltage power supply.
If the Auxiliary Voltage (written on the identification label) is different from Supply Voltage (to the load), use an external transformer.

IMPORTANT
Starting Strategy (Enable):
1: Feed the unit with L1-L2-L3 power voltage supply
2: Feed the auxiliary supply
3: Close the Enable contact to start with the regulation

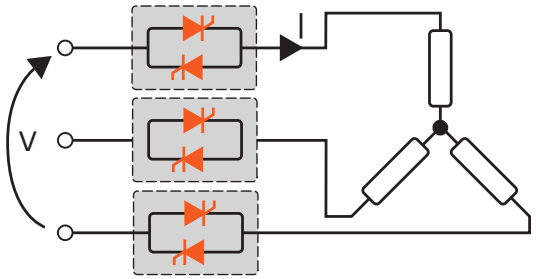
If your REVO code is NOT in line with what you really need, use the configurator software tool to set-up the unit. Install the software on your PC, select REVO and click on test unit changing what you need.

4 Basic Connections and sizing

Star wiring with resistive load

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

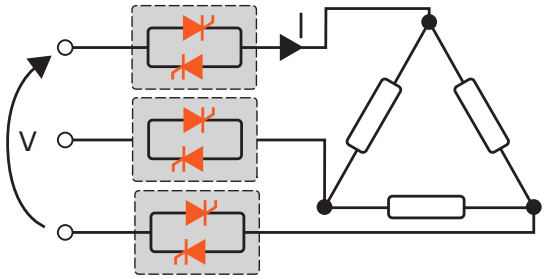
V = Nominal voltage of the load
I = Nominal current of the load
P = Nominal power of the load



Delta wiring with resistive load

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

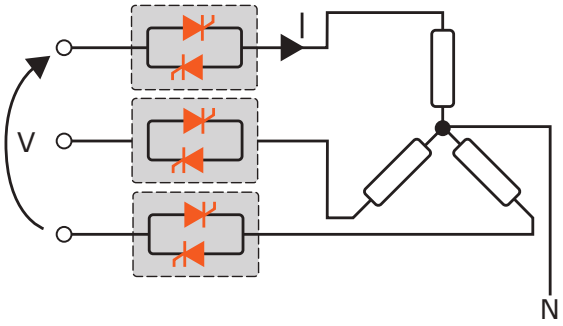
V = Nominal voltage of the load
I = Nominal current of the load
P = Nominal power of the load



Star + neutral wiring

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

V = Nominal voltage of the load
I = Nominal current of the load
P = Nominal power of the load

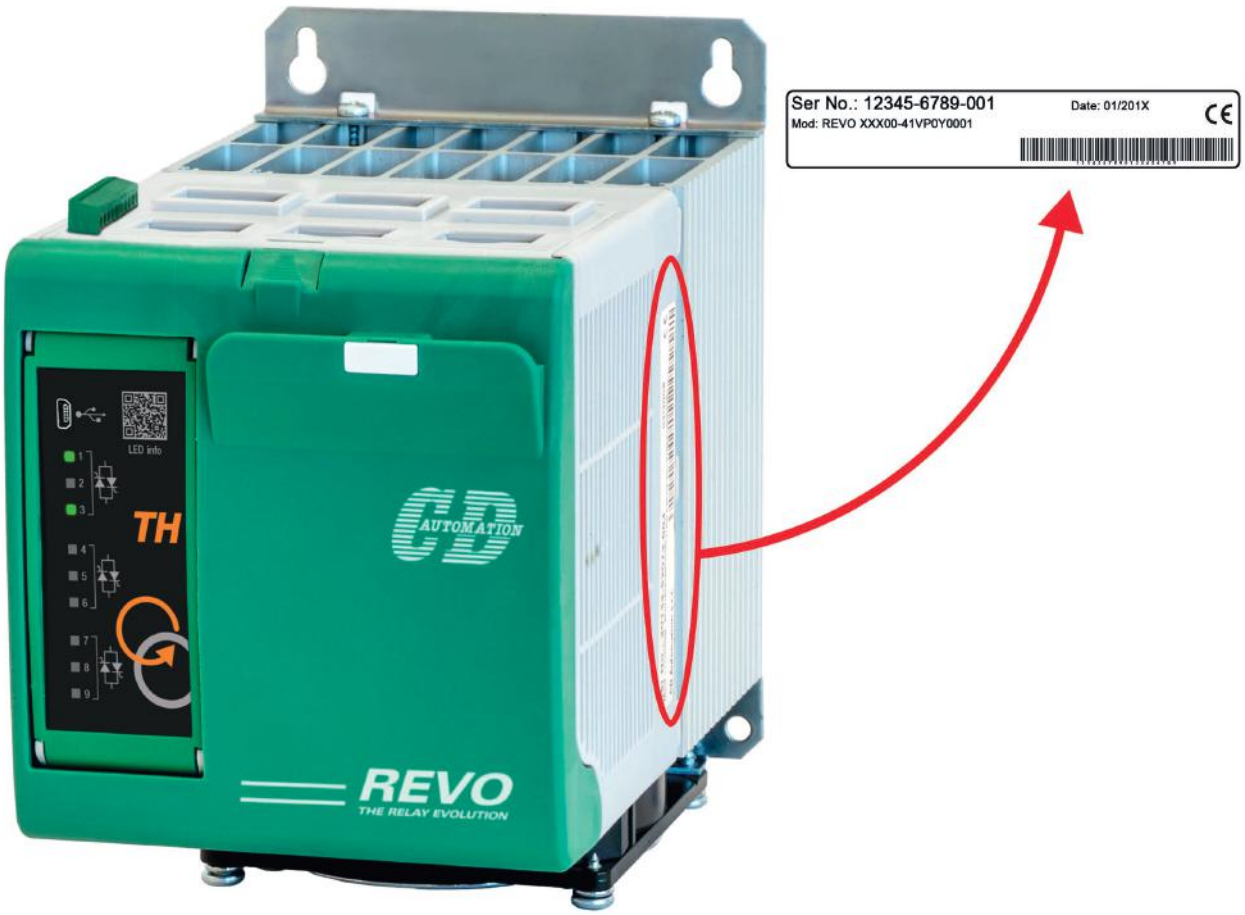


5 Identification and Order Code

5.1 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 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.



5.2 Order Code

	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15	16
ORDER CODE	T	H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CURRENT RATING	4	5	6	
description	code			note
35A	0	3	5	
50A	0	5	0	
75A	0	7	5	
90A	0	9	0	

MAX VOLTAGE	7	
description	code	note
480V	4	
600V	6	

AUXILIARY VOLTAGE	8	
description	code	note
24Vdc	4	

INPUT	9	
description	code	note
RS485 Modbus RTU Communication and DI	0	

FIRING	START OPTION	10	
description	description	code	note
Single Cycle	No Soft Start	C	
	Linear Soft Starter	S	
Half Cycle	No Soft Start	H	
	Linear Soft Starter	L	
	Soft Start for short wave infrared lamp	I	
Burst Firing	No Soft Start	B	
	Linear Soft Starter	J	
Phase Angle	No Soft Start	P	
	Linear Soft Starter	E	
Delayed Triggering	No Soft Start	D	
	Linear Soft Starter	T	
Zero Crossing	No Soft Start	Z	
	Linear Soft Starter	R	

CONTROL MODE	11	
description	code	note
Open Loop	0	
Voltage	U	
Voltage Square	Q	
Current	I	
Current Square	A	
Power VxI	W	
OPTION	12	
description	code	note
Option code - See table below	...	

FAN VOLTAGE	13	
description	code	note
24Vdc Fan	3	

APPROVALS	14	
description	code	note
CE EMC For European Market	0	

LOAD TYPE	15	
description	code	note
1 PH Normal Resistance	0	
1 PH IRSW Infrared Short Wave	1	
1 PH MoSi2 Heaters	2	2
1 PH SiC Heaters	3	
1 PH Transformer coupled with Normal Resistance	4	1
1 PH Transformer coupled with MoSi2 Heaters	5	1
1 PH Transformer coupled with SiC Heaters	6	1
1 PH Transformer coupled with UV Lamp	7	1

VERSION	16	
description	code	note
Standard Version	0	

Note (1): This configuration is possible only with Delayed Triggering or Phase Angle Firing
Note (2): This configuration is possible only with Phase Angle Firing

Option Code Table (digit 12)

Current Limit	HB Alarm	Option Code (digit 12)
Y	Y	2
Y	N	3
N	N	4
N	Y	D

N Option you want removed
Y It serves my project

6 Technical Specifications

6.1 General features

Cover and Socket material:	Polymeric V2
Utilization Category:	AC-51 AC-55b AC-56A
IP code:	20
Method of Connecting:	Delta / Star wiring
Auxiliary voltage Order code TH3___-_4:	24Vdc 1A
Relay output for Heater Break Alarm (only with HB option)	0.5A a 24Vac/dc

6.2 Input features

Digital input:	4 ÷ 30Vdc 5mA Max (ON ≥4Vdc OFF <1Vdc) 5Hz max
Logic input SSR (Fast Enable):	4 ÷ 30Vdc 5mA Max (ON ≥4Vdc OFF <1Vdc) 3Hz Max duty cycle min. 100 ms

6.3 Output features (power device)

Current	Nominal Voltage range (Ue)	Repetitive peak reverse voltage (Uimp)	Latching current	Max peak one cycle	Leakage current	Fuse I^2T value Suggested A2s (a 500V)	Frequency range	Power loss Thyristor + Fuse	Isolation Voltage (Ui)
(A)	(V)	(600V)	(mAeff)	(10 msec.) (A)	(mAeff)	tp= 10msec	(Hz)	I =Inom (W)	(Vac)
35	24÷600	1600	600	520	15	546	47÷70	42	3000
50	24÷600	1600	600	1500	15	1750	47÷70	60	3000
75	24÷600	1600	600	1900	15	4305	47÷70	90	3000
90	24÷600	1600	600	1900	15	4305	47÷70	108	3000

6.4 Environmental installation conditions

Ambient temperature	0-40°C (32-104°F) at nominal current. Over 40°C-104°F use the derating curve (max 50°C).
Storage temperature	-25°C to 70°C -13°F to 158°F
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
Pollution Level	Up to 2nd Level ref. IEC 60947-1 6.1.3.2

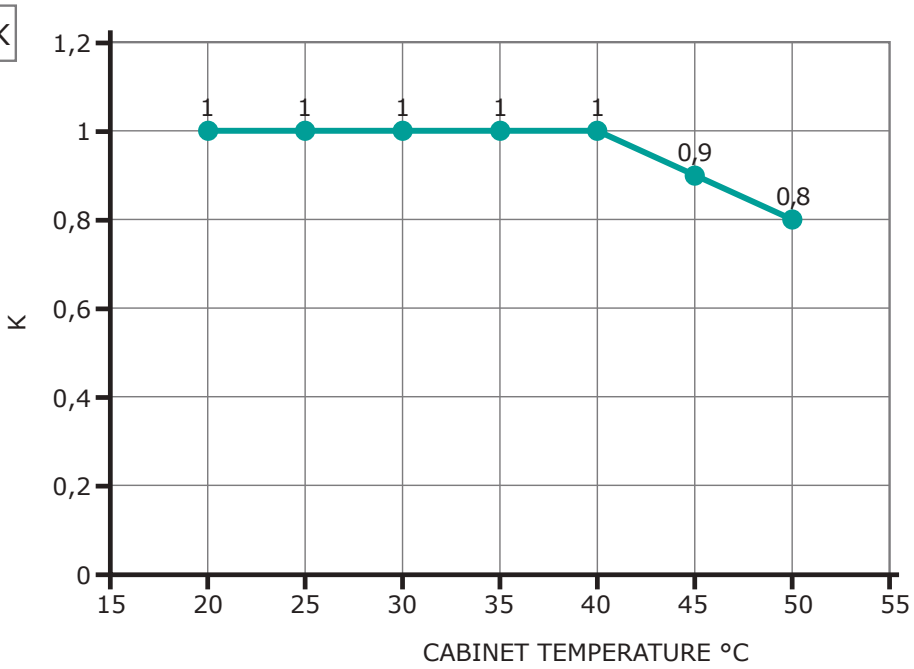
6.5 Fan Specification

Supply: 24 Vdc	Power 7W (1 Fan)

6.6 Derating Curve

The nominal current of the units in specification are referred to continuous service at 40°C ambient temperature. For higher temperature multiply the nominal current times derating coefficient K below represented:

I max = I nominal x K



For higher cabinet temperature (more than 50°C) contact the producer of the unit

6.7 Calculating flow capacity of the fan

All the thyristor units when are in conduction produces power loss that is dissipated inside cubicle in terms of heating. Due to this fact the internal temperature of cubicle is higher than ambient temperature. To be cooled the thyristor need of fresh air cooling and to do it is normally used a fan mounted on the front door or on the roof of the cabinet.

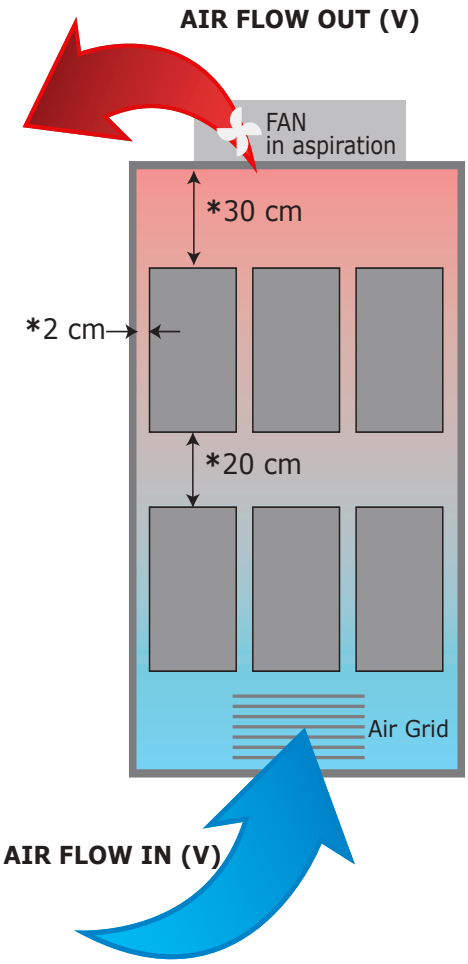
Procedure to size **Fan air mass flow (V)**: *see power loss for each thyristor and fuse mounted indicated in the manual related to the current (Output feature and Internal fuse Chapter).*

$V = f * \frac{Qv}{tc-ta}$	**Qv** = total power losses (w) (thyristor + fuse power loss) **ta** = ambient temperature (°C) **tc** = cabinet temperature (°C) **V** = fan air mass flow (m3/h) **f** = altitude coefficient (see table on right)	**Altitude** 0:100 meters f = 3.1 m3k/Wh 100:250 meters f = 3.2 m3k/Wh 250:500 meters f = 3.3 m3k/Wh 500:750 meters f = 3.4 m3k/Wh

The formulas used are for information only and is not a substitute for a proper thermal rating done by a qualified person.

7 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, *this area must be free from obstacle* (wire, copper bar, plastic channel).
When more unit has mounted inside the cabinet maintain the air circulation like represented in figure without obstacle for the air flow.
Is necessary to install a fan to have better air circulation as calculated previously.

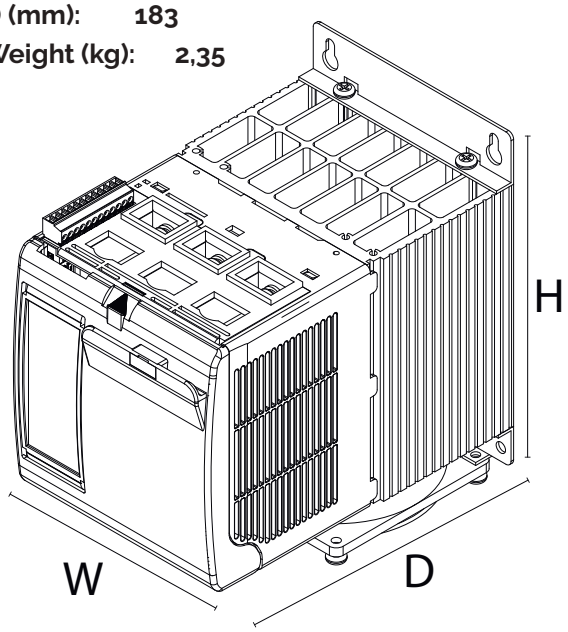


The V Air flow must be equal or more than the value calculated.

If the cabinet fan mounted by the customer have an air flow lower than the correct value the warranty will decay.

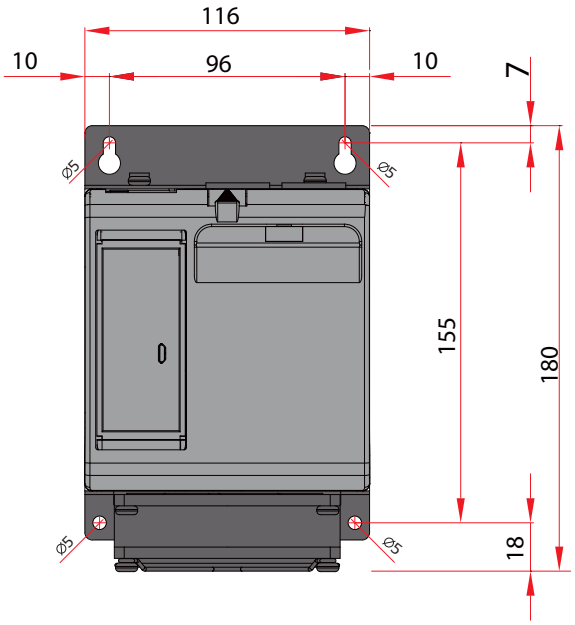
7.1 Dimensions and weight

Size: SR25
W (mm): 116
H (mm): 180
D (mm): 183
Weight (kg): 2,35



7.2 Fixing holes

Size: SR25



8 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 90°C copper (CU) conductor only, wire ranges (AWG), wire terminal type (ZMVV), terminal tightening torque in the table below

Power cable torque (suggested):

Type	Connector Type	Torque Lb-in (N-m)	Wire Range mm^2 (AWG)	MAX Current Terminals	Wire Terminals UL Listed (ZMVV)
035 050 075 090	Vite M6	44.2 (5.0)	18 (5) 25 (3)	90A	Terminali a Forcella Capicorda ad occhiello Listato UL (ZMVV)

Cable dimensions of the Command Terminals	0.5 mm^2 (AWG 18)
Cable dimensions of the Earth (suggested)	6 mm^2 (AWG 10)

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

Terminal	Description
L1	Line Input Phase 1
L2	Line Input Phase 2
L3	Line Input Phase 3
T1	Load Output Phase 1
T2	Load Output Phase 2
T3	Load Output Phase 3

8.1 Command Terminals

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

8.1.1 Terminal block M1

Terminal	Description
1	DI1-1
2	DI1-2
3	DI2-1
4	DI2-2
5	DI3-1
6	DI3-2
7	COM DI
8	GND
9	Analog input 2
10	+10V
11	GND
12	Analog input 1

8.1.2 Terminal block M2

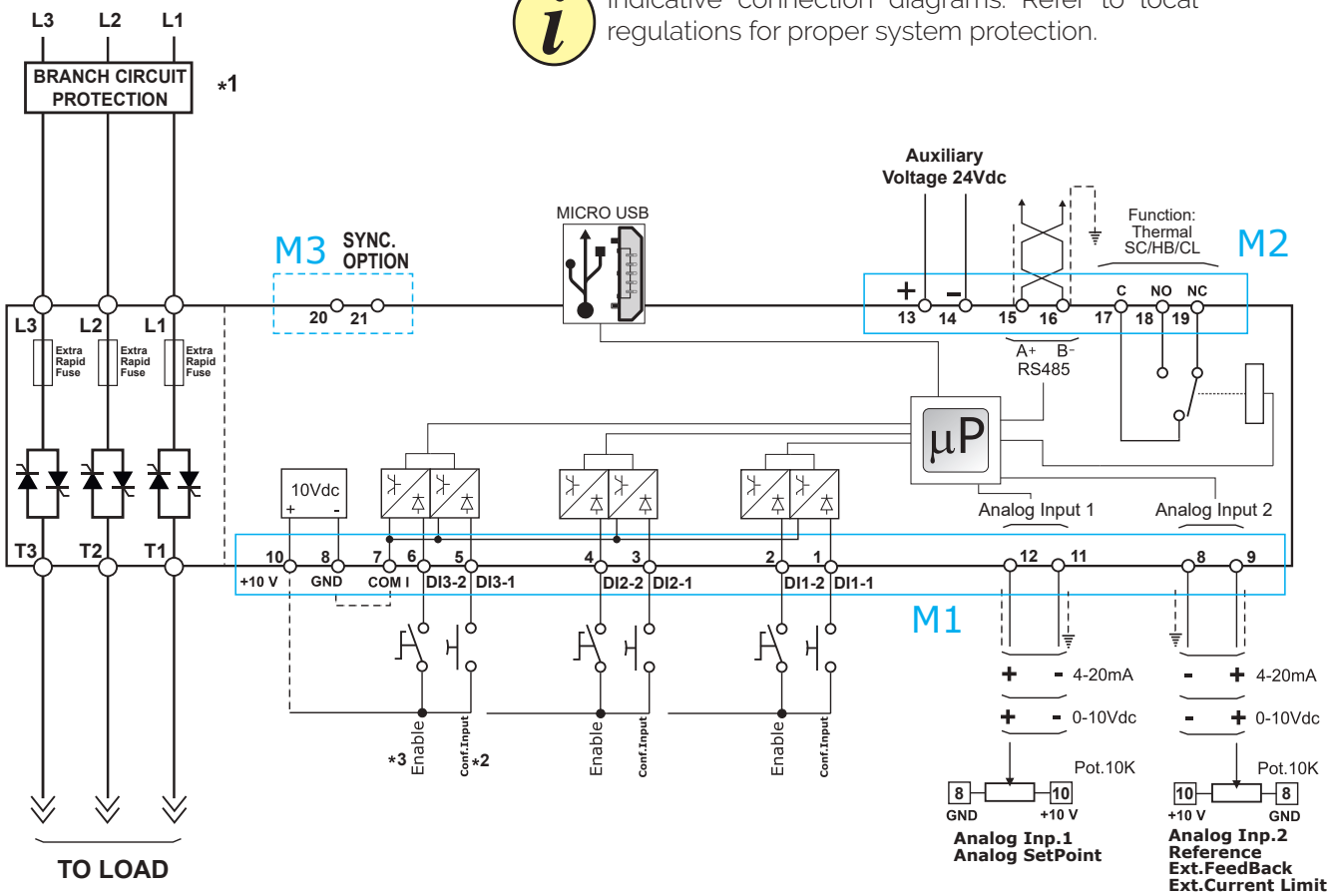
Terminal	Description
13	+ 24V
14	GND
15	RS485 A+
16	RS485 B-
17	C - Common contact alarm relay output
18	NO - Normally Open contact alarm relay
19	NC - Normally Closed contact alarm relay

8.1.3 Terminal block M3 (Option)

Terminal	Description
20	Sync (Option)
21	Sync (Option)

8.2 Schematic

Indicative connection diagrams. Refer to local regulations for proper system protection.



NOTE:

***1** The user installation must be protecting by electromagnetic circuit breaker or by fuse isolator. The Fuse must be branch circuit protection.

***2** For SSR input connection follow next page schematic.

***3** **IMPORTANT! Starting Strategy (Enable)**:

1: Feed the unit with L1-L2-L3 power voltage supply

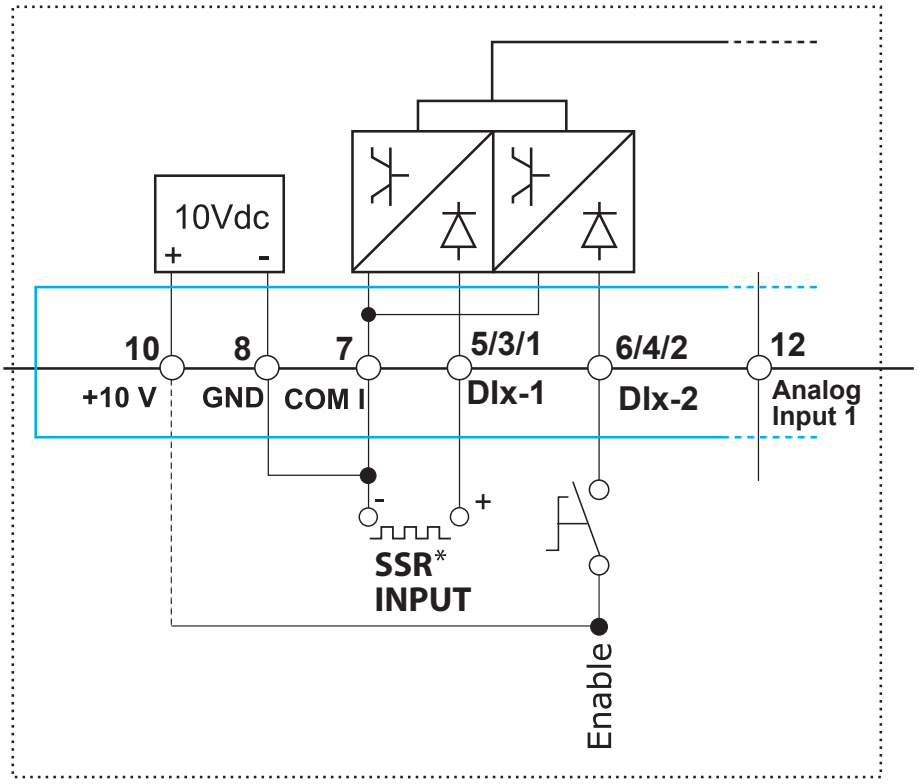
2: Feed the auxiliary supply

3: Close the Enable contact to start with the regulation.

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

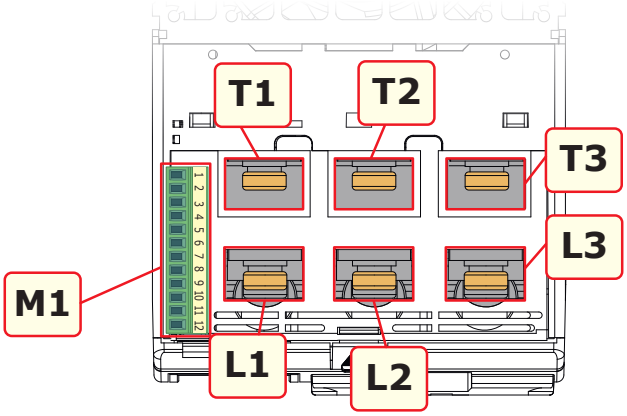
8.2.1 SSR Control Input schematic

For SSR input use follow the schematic below and configure Digital Input 1 as Fast Enable.

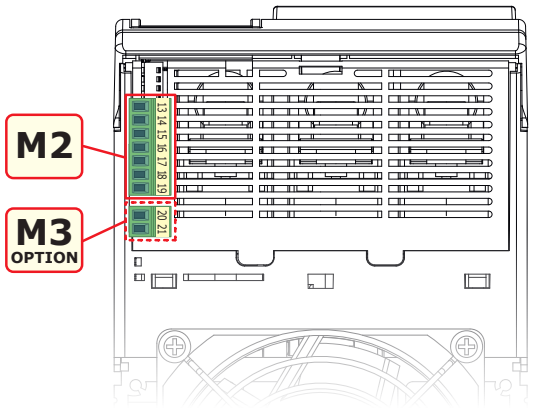


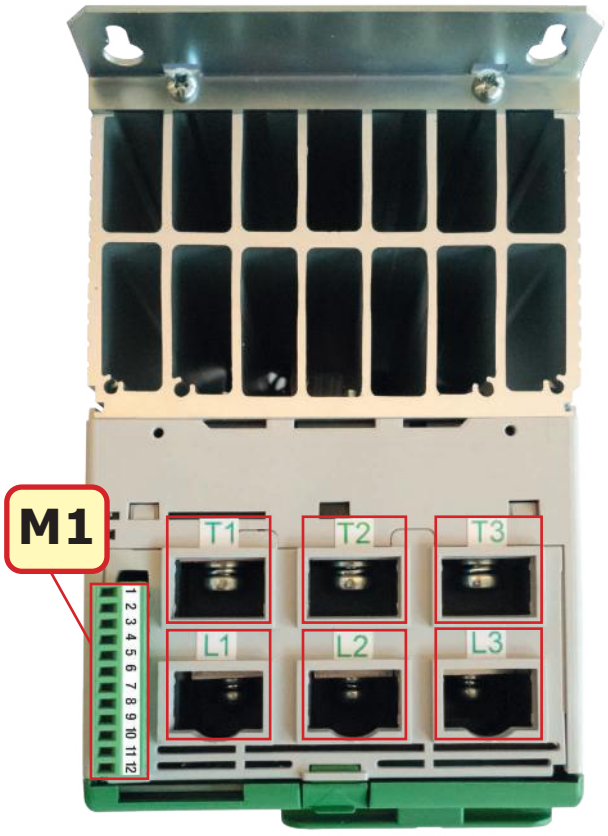
*** SSR Input:** 4 ÷ 30Vdc 5mA Max (ON ≥4Vdc OFF <1Vdc)
3HZ Max on time min. 100 ms

Top view



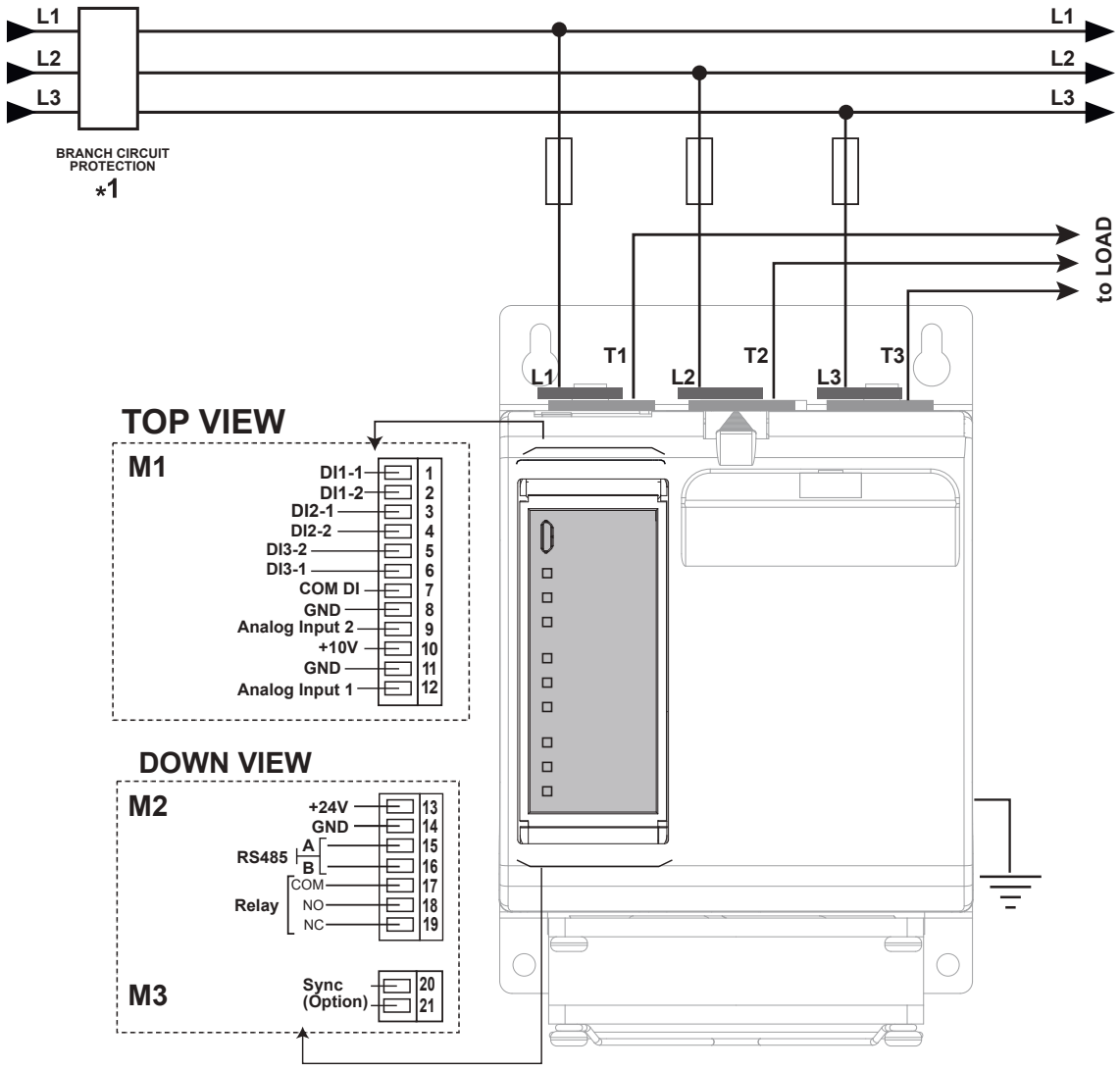
Down view





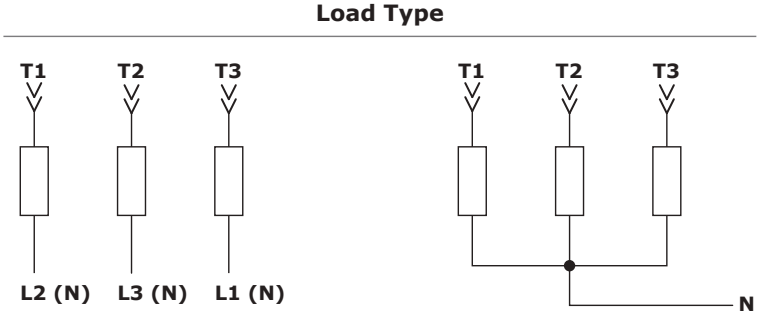
8.3 Connection Diagram

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



NOTE:

*1 The user installation must be protecting by electromagnetic circuit breaker or by fuse isolator. The Fuse must be branch circuit protection.



9 Control panel

	LED	
1	Green ON	Enable
	Red ON	Short Circuit SCR
	Red Flashing	Termic Alarm
	Off	No Alarm
2	Yellow ON	HB Alarm
	Yellow Flashing	Current Limit Alarm
	Off	No Alarm
3	Green ON	Firing on
	Off	Firing off
1-1-2	On/Off in sequence	HB calibration
4	Green ON	Enable
	Red ON	Short Circuit SCR
	Red Flashing	Termic Alarm
	Off	No Alarm
5	Yellow ON	HB Alarm
	Yellow Flashing	Current Limit Alarm
	Off	No Alarm
6	Green ON	Firing on
	Off	Firing off
4-4-5	On/Off in sequence	HB calibration
7	Green ON	Enable
	Red ON	Short Circuit SCR
	Red Flashing	Termic Alarm
	Off	No Alarm
8	Yellow ON	HB Alarm
	Yellow Flashing	Current Limit Alarm
	Off	No Alarm
9	Green ON	Firing on
	Off	Firing off
7-7-8	On/Off in sequence	HB calibration

Point or click on the QR code to see the animated table online

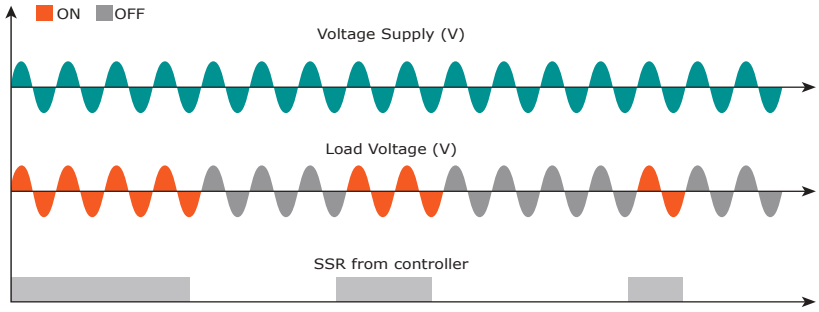
10 Firing type

Choose a correct firing type allows to optimize the thyristor unit for the installed load.
The firing type has already configured in line with customer requirements that are defined in the Order Code.
The Order Code is written on the identification label.
However, if you wish to change the firing type you can use the software configurator or the Control Panel.

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

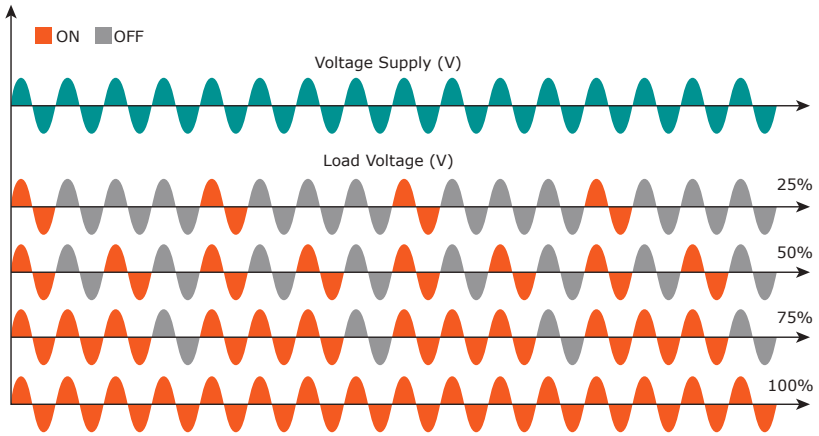
10.1 Zero Crossing (ZC)

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.



10.2 Single Cycle

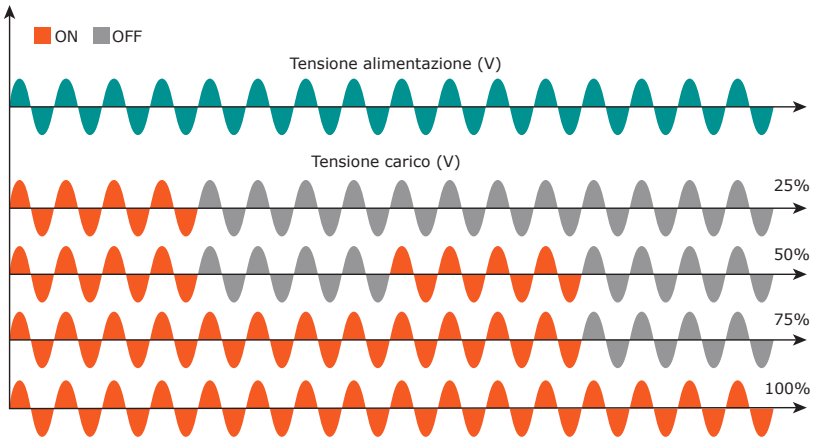
Single Cycle it's the faster zero crossing switching method in relationship of the power demand from a temperature regulator or from an external signal.
With input signal at 25% the output is one cycle ON and three cycles OFF.
With input signal at 50% the output is one cycle ON and one cycle OFF.
With input signal at 75% the output is three cycles ON and one cycle OFF.
With input signal at 76% the output is the same of 75% but for each ON cycle the microprocessor divides 76/75, and when the sum of rests is one, the unit does one more cycle ON. For this firing is necessary to have analog input.



The Single Cycle is used to control the loads with low inertia or for infrared lamps to short wave.

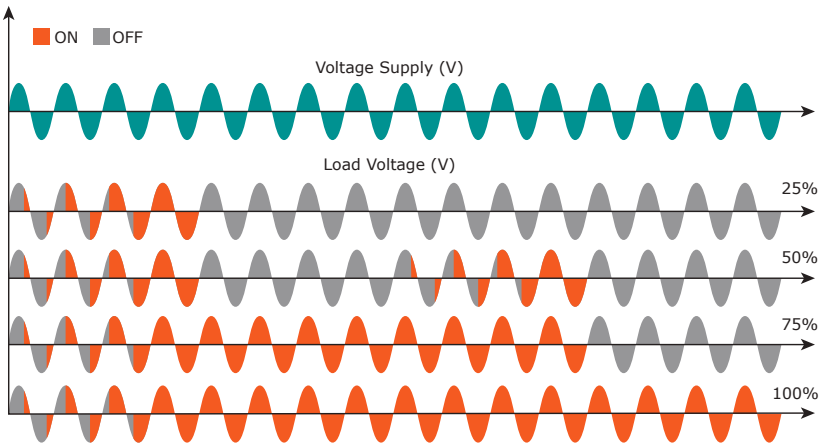
10.3 Burst Firing

The Burst Firing is similar to the Single Cycle, but consecutive cycles ON are selectable between 1 and 255, with input signal equal at 50%. When is specified 1 the firing type is Single Cycle.
Burst Firing is a method zero crossing that it reduces the electromagnetic interferences because the thyristor switches at zero voltage crossing.
The example show the Burst Firing with Burst cycles=4.



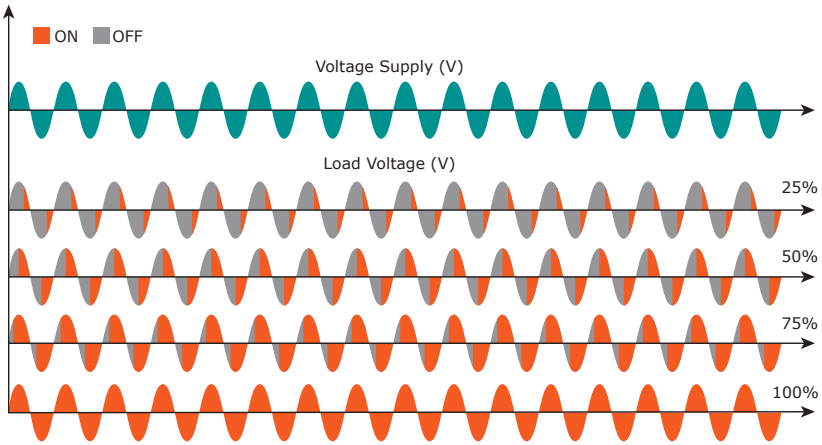
10.4 Soft Start with Burst Firing

This is an additional function to the Burst Firing. The unit start in phase angle mode with a ramp starting from zero up to the full tension in the cycles number set in the parameter.
When the ramp is over, the thyristor unit will stay in conduction at full voltage up to the end of cycles of burst. The S+BF firing is used to control small inductive loads to avoid inrush surge current and to reduce the electromagnetic interferences.
The example show the firing with Burst cycles =4 and start ramp half cycles=3.



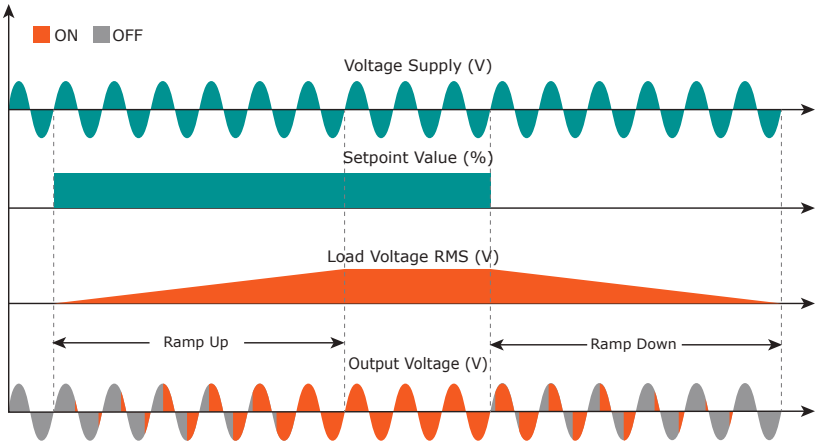
10.5 Phase Angle

The Phase Angle firing allow the control of the power on the load, for this firing the thyristor can be in conduction only for a part of the voltage cycle.
This part of the voltage cycle is adjustable in function of the input signal from 0 at 100%.
The PA firing is normally used for control the inductive loads, and is also possible control a primary of transformer coupled with the cold resistances like: Superkanthal, Molybdenum, Platinum, Tungsten or Quartz Lamp. The only disadvantage with phase angle is the possible generation of interferences that however can be reduced with opportune filters.



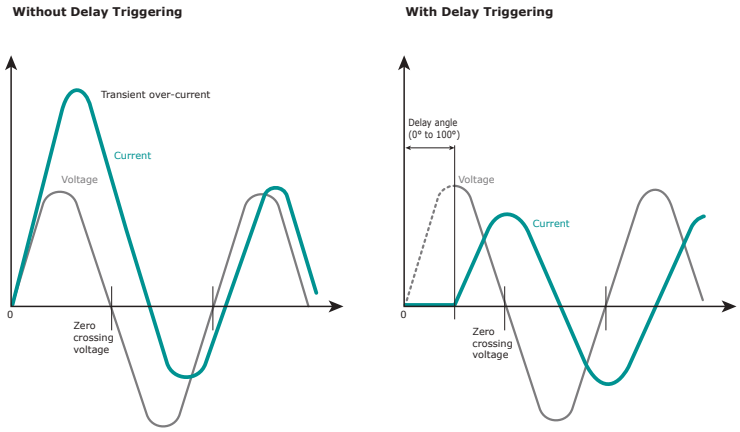
10.6 Soft Start with Phase Angle

This is an additional function to the Phase Angle. The firing angle of the thyristor increase or decrease up to the final setpoint value.
The Soft start ramp is an important feature to reduce the inrush current with transformers during the cycle of magnetization or with cold resistance that are near to the short circuit when they are supplied.
Setpoint Ramp Up / Setpoint Ramp Down.

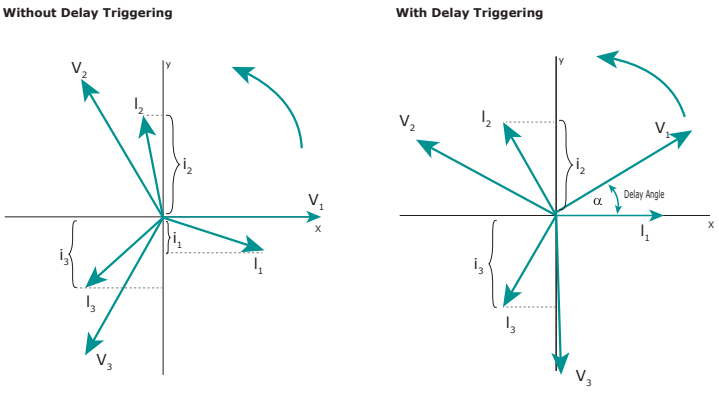


10.7 Delay Triggering with Burst Firing

The Delay Triggering firing is used the control a primary of transformer coupled with the normal resistances on the secondary (N.B. don't connect cold resistances on the secondary like: Superkanthal, Molybdenum, Platinum, Tungsten, Quartz Lamp).
For an inductive load (ex transformer), switching the thyristors at zero crossing can generates transient over currents that can blow the fuses, to avoid this problem you must use the Delay Triggering. This firing delay the first half cycle of Burst for an angle from 0 to 100° relative to the zero.
For understand the Delay Triggering firing, we have represented the waves generate by vectors that rotates in counterclockwise:



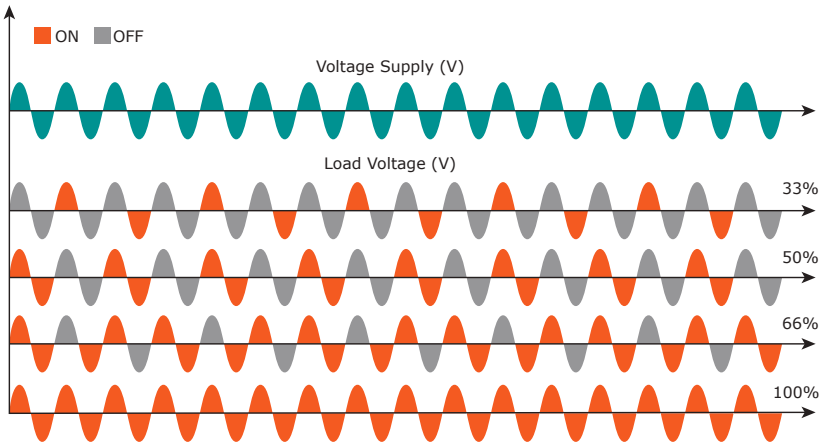
Without delay at zero crossing when V1 is to zero (projected on the X axis) the unit switch On.



In this case the instantaneous value of the currents are i1, i2 and i3 and this condition, for the curve of magnetization, could generate transient over currents that can blow the fuses.
With Delay Triggering the firing of the thyristor are triggered with a delay until the instantaneous value of the current i1=0, i2 positive and i3 negative like represented.
In this case the risk of transient over currents is reduced and the fuses don't blow.
The angle alpha is the delay to have i1=0 and this angle depends on the power factor.
The delay angle suggest for most applications is 80°.

10.8 Half Cycle

To reduce the power fluctuations on the ignition period, the half cycle mode use the half periods as periods on / off.
Positive cycles and negatives are balanced to ensure that there are no DC components.
This firing mode is suggested for shortwave infrared lamp.
The following example describe the mode at 33%, 50% and 66%.



11 Control Mode (feed-back)

The Control Mode (feed-back) type has already configured in line with customer requirements that are defined in the Order Code. The Order Code is written on the identification label.
However, if you wish to change the Control Mode (feed-back) type you can use the software configurator or the Control Panel.

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

The Control Mode (feed-back) type is defined by the parameter Control Mode (feed-back) in setup menu.
If the configurable digital input has set like feed-back Selection, it's possible to change the select feed-back with the Voltage feed-back (V) simply activating the input.
It's possible to have:

V2 = Square Voltage feed-back.

The input signal is proportional to the output square voltage. This means that input signal becomes a power demand. The power remains constant if the load impedance doesn't change.

V = Voltage feed-back.

The input signal is proportional to the output voltage. This means that input signal becomes a voltage demand. This control mode compensates the voltage fluctuation of the incoming line supply.

I = Current feed-back.

The input signal is proportional to the current output. This means that input signal becomes a current demand. This control mode maintain the current also if the load impedance changes.

P(VxI) = Power feed-back.

The input signal is proportional to the power output. This means that input signal becomes a power demand. The power remains constant also if voltage and load impedance change. This control mode is used with silicon carbide elements that change its resistive value with temperature and with age. In addition it compensates the voltage fluctuation of the incoming line supply.

I2 = Square Current feed-back.

The input signal is proportional to the output square current. This kind of feed-back is suggested for cold resistance applications.

None = No feed-back Open Loop. The input is proportional to the firing angle (α).

External = External feed-back (0÷10V, 4÷20mA, 0÷20mA).

The input signal is proportional to an external signal. This means that input signal becomes a demand to maintain this signal always constant. This control mode is used for example with galvanic systems, where it's necessary to control the current value through the electrodes.

12 Electronic boards

12.1 Supply the Electronic Board

The thyristor unit, to work, requires a voltage supply for the electronic boards of 24Vdc 1A on terminal M2 (13+; 14-).

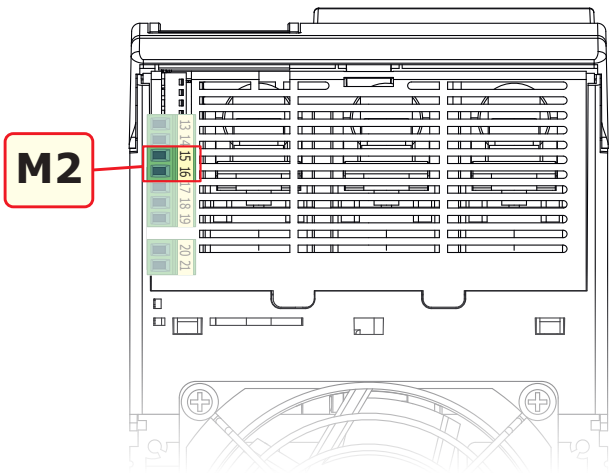
Warning: Before connecting or disconnecting the unit check that power and control cables are isolated from voltage sources.

13 RS485 Serial port

Terminal M2	Description
15	RS485 A+
16	RS485 B-

The serial communication port RS485 is available on the Command Terminals.
On this port may be done a network up to 127 REVO.

Vista sotto



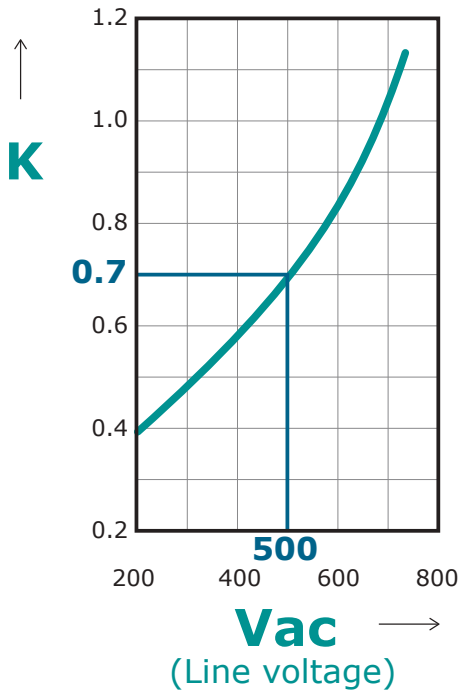
14 Internal Fuse

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.

Type	Fuse Code Spare Part	Current (A_{RMS})	Vac	FUSE I^2T value Suggested A2s (at 500V)*	FUSE I^2T value Suggested A2s (at 690V)	Qty for each phase
035	FU5007306.50	50	690	546	780	1
050	FU5007306.80	80	690	1750	2500	1
075	FU5007306.100	100	690	2170	3100	1
090	FU5007306.100	100	690	2170	3100	1

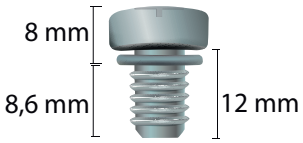
*I^2T are multiplied for K value in function of Vac at 500V K is equal to 0,7 (es:3100 X 0,7 = 2170).
At 690Vac K is equal to 1.

Fuses replacement:



Open the cover and remove the screws, then replace it with the correct fuse, use the screws with a proper suggested torque indicated below.
Use correct screws M6 x 12 mm.

N° 2 M6x12mm for each fuse



Type	Screw	Torque Lb-in (N-m)
60A-90A	M6	44.2 (5.0)

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 powered, the thyristor unit is subject to dangerous voltages; disconnect from the power supply before opening the fuse box and touching electrical equipments.

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