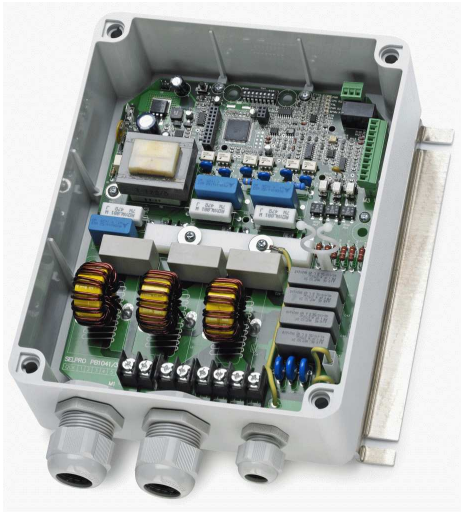
EVDFAN3000

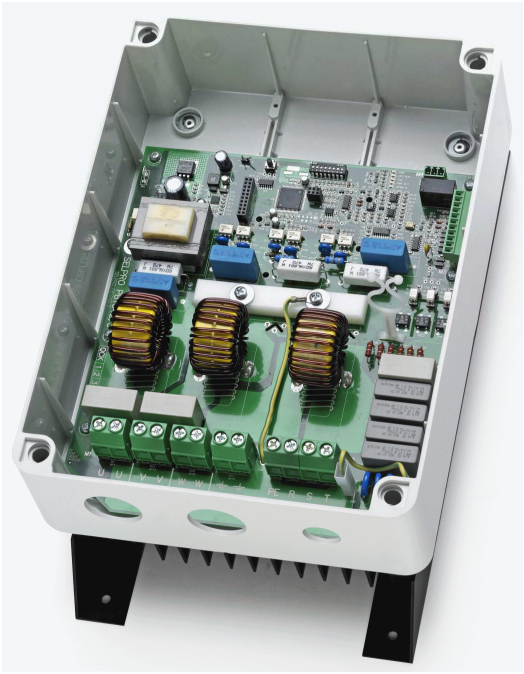
3 – PHASE VOLTAGE REGULATOR

WITH PHASE – CUT MODULATION

FOR AXIAL FANS

ASINCRONOUS MOTORS





HARDWARE MANUAL

CODICE 114EVDF30E00

Important Notice

This Instruction Manual should be read carefully before installation and before use, and all warnings relating to installation and electrical connections should be observed; the Manual should then be kept for future reference.

The device must be disposed of in accordance with local regulations governing the disposal of electrical and electronic devices.

Table of contents

Safety warnings

Follow the instructions in this manual exactly and observe all safety measures in force. Always keep the present documentation close to the control device.
The purchaser must previously ascertain the suitability of the product for the use it is intended for and assume all consequent risks and responsibility.
This product has been designed to be used only as an operational control device. In the event delicate or great value products should be held within specific working limits, it is recommended to install a separated control device, equipped with alarm contacts.
The commissioning, start-up and operation of the present device must be performed by qualified technicians with knowledge of the technical regulations in force, in compliance with all the safety standards and able to understand the indications of danger.
The regulator must be installed by qualified personnel who will connect the electric supply, attach the cables in their permanent positions and commission the plant. Incorrect installation of the DRV300 voltage regulator or the fan connected to it may cause damage to objects or people.
Before supplying power to the unit, make sure that the regulator is correctly connected to the power supply and to earth.
The information provided in the present manual consent to install and control correctly the fan speed regulator EVDFAN3000.
Do NOT tamper with or disassemble the regulator internal components; doing so will INVALIDATE THE GUARANTEE and may cause unnecessary damage.
The regulator does not contain components that can be repaired by the user.
The regulator must be suitably and effectively earthed by the installer according to the standards in force; Earth is essential for the EMC filter to operate correctly.
The user must be protected from the electric supply and the motor must be protected from possible overloads in compliance with the standards in force.
DO NOT supply the regulator without the external protection cover.
DO NOT touch any electrical parts of the circuit when the power supply is connected under any circumstances.
Before supplying power to the unit, make sure that the regulator is correctly connected to the power supply and to earth;
If the mains supply is "disturbed", which may be due to other electrical power components causing irregularities in the supply (power contactors), it is recommended that supplementary three phase 'SURGE ARRESTER' filters are installed directly on the regulator supply.
Avoid repeatedly connecting and disconnecting the power supply to the regulator; a constant supply keeps the regulator at working temperature and eliminates problems caused by condensate inside the protection case.
Alternatively, use the remote terminal board contact 'M3' S2 = ON/OFF.
The S2 = ON/OFF contact on the terminal card M3 does not cut the mains supply and therefore cannot be used as a safety switch.
Install the regulator out of direct sunlight, in order to protect the case from overheating.
The appliance can operate at environmental temperatures up to 50°C. Do not install it where this temperature may exceed, otherwise the integrity of the regulator will be compromised, since the controller may make the user appliance operate at full load (100%) with all consequent effects.
The equipment must be placed vertically, in order to encourage heat dissipation and to ensure sufficient air circulation in a free space measuring at least 150 mm above and below the regulator. If several regulators are to be grouped together on a single electric board, please provide forced air circulation with a fan or with a sufficiently powerful cooling unit.
Use the holes on the lower and power terminal board sides of the appliance, for entrance of the connection cables. This will prevent water, dust etc. from getting in and will ensure the IP55 protection level is maintained using adequately sized cables and sheaths of suitable quality.
Reassemble and check the cover of the external protection panel is properly closed.
DO NOT alter or damage the identification stickers on the equipment.

Terms of use

The **EVDFAN3000** series devices are designed to vary the three-phase AC voltage thanks to the phase cutting principle, in order to regulate the rotational speed of three-phase asynchronous high-slip motors, to be used with axial and centrifugal fans in Air-Conditioning, Refrigeration, Ventilation and Air Treatment Systems. **Any different use of the equipment is strictly FORBIDDEN.**

Manufacturer Declaration

REGOLAZIONE ELETTRONICA DEI VENTILATORI NEL PIENO RISPETTO DELL'AMBIENTE

This series is manufactured for the employment into the industrial environments and responds the following communitarian directives:

- Machine Directive **2006/42/EC** and following amendments
- Low Voltage Directive (LVD) **2006/95/EC**
- EMC Directive **2004/108/EC**

(*) ELECTRONIC FANS REGULATION - FULL ENVIRONMENTAL RESPECT

Thanks to the electronic solutions used, the device responds totally to the emission limits required from the European Directives for Residential, Commercial and Light Industrial environments (EMC and PDS applications), and can therefore be installed without particular precautions (ex.: shielded cables).
The equipment does NOT contain filters for the suppression of harmonic distortions.

EC Directives & Technical Standards

Like all of our products, the **EVDFAN3000** series has obtained the **CE** mark in compliance with the EMC (Electromagnetic Compatibility) directive **2004/108/EC**.
The essential requirements of the directive are satisfied by the conformity to the "**generic standards**" for industrial environments.

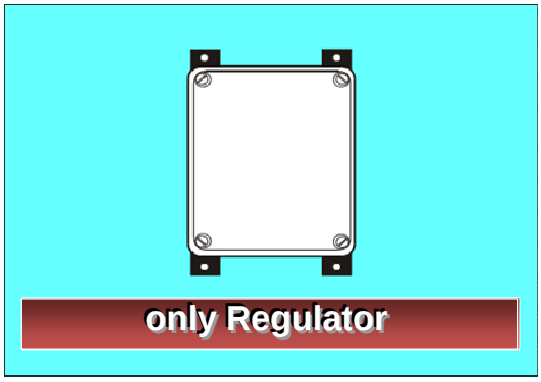
Directive	Standard code	Description
2006/42/EC	**EN 60204-1**	Safety of machinery. Electrical equipment of machines.
2006/95/EC	**EN 60204-1**	Safety of machinery. Electrical equipment of machines.
	EN 50178	Electronic equipment for use in power installations.
2004/108/EC	**EN 61800-3**	Adjustable speed electrical power drive systems. Part 3: EMC product standard including specific test methods.

All products have been tested in accordance with the procedures and test conditions laid down in the standards specified in the product technical file.
Since these products are destined to be used not only as "**stand alone**" systems, but also as components of other machines or plants, all compatibility tests to the standards have been performed under typical conditions of use.
In particular, the tests have been performed in a system consisting of a voltage controller **EVDFAN3000**, a control cable and relative commands, a supply cable, a motor cable and a group of fans with an equivalent power to the value of the nominal current of the controller.

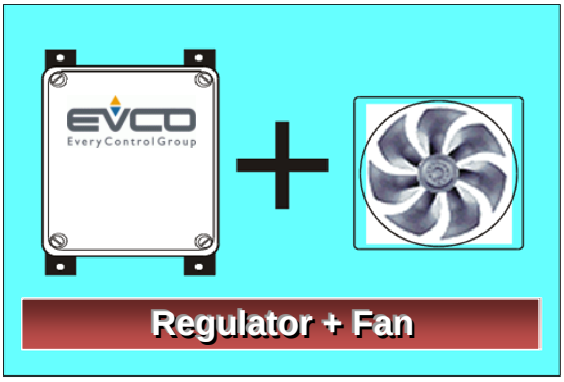
With reference to EMC Compatibility, according to the Marking

CE EMC LVD

with CDM System

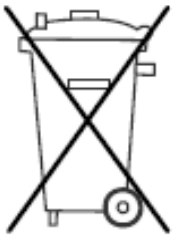


with PDS System



All EVCO controllers are suitable for the installation in PDS systems (Power Drive System = Controller with connected fan/s), which guarantee the EMC compliance of the System "Controller + Fan/s".
The final specifications of the system or plant, in compliance with the EMC directive, are in any case the responsibility of the installer, who must put the system into operation carefully, according to the rules in force and following the information provided by the present manual.

PRODUCT end of life EU 2002/96/EC



The device must be disposed separately, according to the local authority advice.

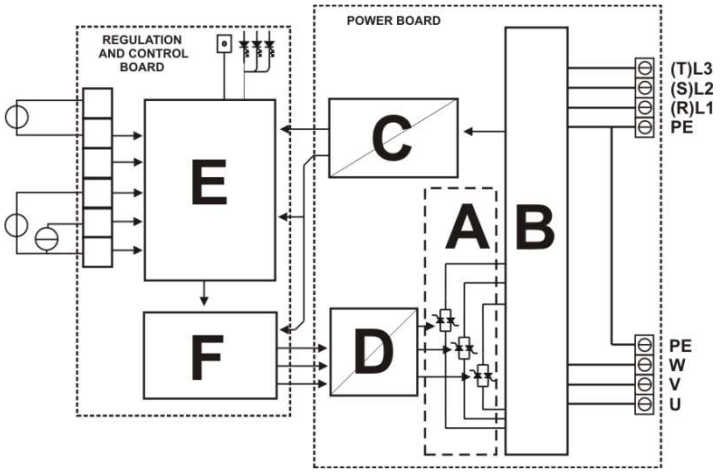
1 INTRODUCTION

The devices of the **EVDFAN3000** series are phase-cut voltage regulators, completely controlled on the 3 phases, for RMS voltage connected to the load modulation without neutral cable connection.
The device is suited for working as power stage SLAVE with function selection by DIP-Switched:

- Power stage SLAVE: the output AC voltage varies depending on the command signal (PWM, VDC, mA) increasing/decreasing its amplitude depending on the DSW 2 setting (Direct/Reverse).

The voltage regulators are designed for varying the AC voltage RMS value depending on the command signal for 3-phase asynchronous motors coupled with axial fans, pumps, mixers
The voltage control is carried out partializing the sinus wave voltage input, it does not generate torque pulses, is particularly silent and the voltage loss is limited to maximum 1% of the supply voltage.

The picture below shows the block diagram of the EVDFAN3000 voltage regulator



A – Power circuit
B – Network filter and EMC protections
C – Power supply and syncronism signals
D – Insulators for power board command signals
E – Control and regulation circuit
F – Power board controller

The voltage regulators are sized for standing an in rush current about double the rated one, during selection of device is critical to take into consideration the motor inrush current besides its type.
In fact, while for the axial fans motors the inrush current is 2-3 times the rated ones, for the centrifugal fans motors the inrush current could be up to 7-8 times the rated one.
Concerning the motor type is critical to select a model suitable for this type of control.
As guideline is preferable to use motors with:

- **Silumin high slipping resistive rotor**
- **Defluxed**
- **Tropicalized**
- **CLASS H**

since they give better performances in speed variation, are quieter and need lower inrush currents.
When choosing the motor, it is always recommended to contact your equipment supplier and order a motor suitable for voltage variation (**ADJUSTABLE**) and perform practical tests of the motors or prototype machines, in order to verify their proper operation.
Once chosen the motor the voltage regulator should be selected according to:

- The **rated voltage**
- The **maximum current load** (load Ampere) taking into account the **inrush current.**

Before installing the EVDFAN3000 regulator, you are invited to read this manual which describes the necessary procedures for correct installation and commissioning of the controller EVDFAN3000

2 EVDFAN3000 FUNCTIONING

The EVDFAN3000 series has been specifically developed to offer a digital UNIVERSAL controller for the regulation of three-phase asynchronous motors, with dedicated software for applications on Air-cooled Heat Exchangers used in Air Conditioning and Refrigeration Systems.
Such kind of digital regulation optimizes the application-specific performance of ventilation control; it is based on a simple and yet innovative technology, one hundred percent ITALIAN as it has been conceived and developed in EVCO labs, and it fully satisfies the following requirements:

SIMPLICITY	**USER FRIENDLY**	**- NO need of special cables for the installation** **- NO need of trained operators for the startup procedure**
FUNCTIONALITY	**PLUG & PLAY**	**- all regulation parameters are already default preset**
COMPLETENESS	**ALL in ONE**	**- all regulation modes with PWM–VDC–mA signals are already default preset,**
SAFETY	**ALL ROUND PROTECTION**	**- the software supervises the operation of regulator and connected fans,**
CONFORMITY	**COMPLIANCE**	**- the system "Controller + Fan/s" is guaranteed for all PDS applications**

As a consequence, the digital **EVDFAN3000** regulators are:
-**SIMPLE,** what concerns electrical connections and programming,
-**FLEXIBLE** and ready to be used, as it is already preprogrammed for all SLAVE applications,
-**COMPLIANT,** in conformity to the strictest standards concerning power drive systems, with special attention to the EMC Directive (EMC-EN61800-3): since it refers to NON tangible protection requirements, the relative Standards are only partially followed by many manufacturers of electronic power devices, and they are ignored especially by final users, which are the contact persons responsible for the CE certification and compliance of the System "Controller + Fan/s".
Like all EVCO products the EVDFAN3000 series has been built to the very highest quality standards using electronic components of the utmost reliability, which have undergone functional tests that guarantee the use of the product for at least **60,000 hours** of continuous operation without problem.
Thanks to the specialized software for applications on fan motors, it is possible to avoid typical problems with the modulation of oscillation, to reduce the mains current distortion and to limit the magnetic noise of the regulated motor by means of the **Soft-Power** technology, which manages power regulated in 0-cross mode.
The extended range microprocessor, which performs every control function, is also responsible for monitoring the safety conditions of the regulator by checking its proper operation, the lack of one phase toward the power supply, the connection of sensors and all other possible electrical situations that could damage the connected air-cooled system or the controller, and by simultaneously informing the operator about the regulation status and operating conditions through the LEDs.

The controllers are preprogrammed for operation with **SLAVE** (3 modes) configurations: EVDFAN3000 operates as a power unit, driven by a remote controller, through a **PWM, VDC** or **mA** control signals.

The **EVDFAN3000** series offers 4 standard rated current values:

8 A / 12 A / 18 A / 28 A, with standard power supply **400VAC +20/-10% 50/60Hz** (the controller recognizes and manages automatically the frequency variation).

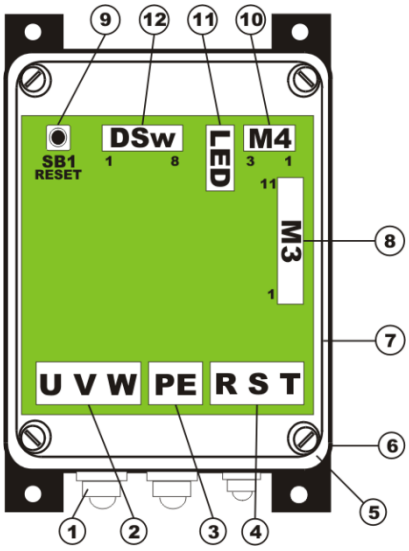
Electronic regulations of motors, phase cutting regulation of AC voltage, SCR and TRIAC power drive systems: they all have collateral effects, which require the use of additional technical protection measures especially with applications in residential environments or technological plants; the acoustic noise - generated by the fan because of the magnetization of the motor itself – arises discontinuously within the main speed ranges of the fan speed regulation, and can be **only partially reduced** by means of expensive and bulky acoustic screens installed around the machinery.

The regulator does NOT have any internal filter for the suppression of harmonic distortions (EN-61000-3-2 & 3-12)

CAUTION

The EVCO product is technologically advanced and its working modes are specified in the tecnical literature supplied along with the device or can be downloaded from the company web page www.evco.it.
The customer (manufacturer, designer or installer of the final equipment) takes all the responsibility and risks related to the configuration of the device concerning the achievement of the expected results for the specific final equipment/plant. The lack of an appropriate evaluation stage, which is required/pointed out in the user manual, can prevent the correct working of the final product which EVCO cannot be considered responsible for.
The customer have to use the device only in the modes described in the technical literature relevant for the device itself. The EVCO responsibility related to its product is ruled by the EVCO *"GENERAL CONDITIONS OF SALE"* which can be downloaded from the company web page www.evco.it and/or by specific agreements with the customer

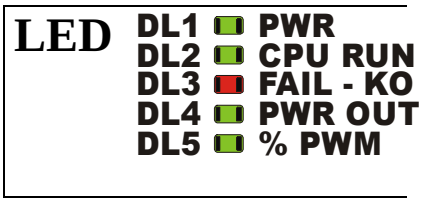
In the picture is shown EVDFAN3000 with the description of its various parts



EVDFAN3000 LEGEND	
1	Gland for connecting cable way out
2	3-phase load connection (**U-V-W**) + Ground
3	Power supply PE connection and Motor/s GND
4	3-Phase **(R-S-T)** power supply connection
5	**TPN** closing screw (**CEI 23-58**) Max. torque 2,5Nm
6	Bracket with holes for regulator wall mounting
7	**GW plast 120°C** housing
8	Command analogue inputs switchboard
9	Reset pushbutton
10	Alarm relays switchboard
11	Status LEDs
12	Programming DIP-Switches

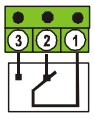
2.1 EVDFAN3000 voltage regulator description

The 3-phase voltage regulators of the **EVDFAN3000** series are realized in a single PCB board on a fiberglass support mounted inside a **IP55 GW plast 120°C** housing. The PCB board has the **control** circuit in the upper zone and the **power** circuit in the bottom zone.
The below regulation, connecting and signalling parts are present in the **control circuit:**



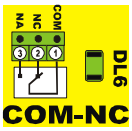
green	Power supply connected and OK
green	Microprocessor working correctly (blinking)
red	Phase sequence/loss or undervoltage alarm
green	Regulated voltage to load
green	% of PWM input signal

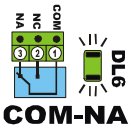
green	Status of **ALARM relay – RL1**

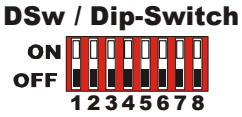


RL1

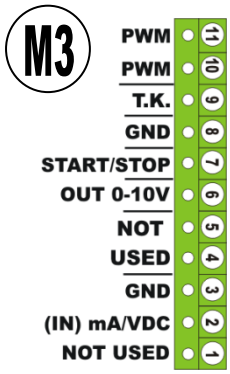
48 Vac 5 Amp	**DL6=OFF**	**1-3=OFF 1-2=ON**
	DL6=ON	**1-3=ON 1-2=OFF**



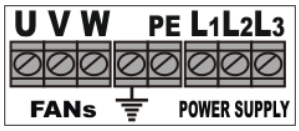




DSw Dip-Switch DSw1- DSw8	All OFF : standard configuration **ON** position: regulation options functions enabling
Morsettiera M3	Command and auxiliary signals connection
Morsettiera M4	Connection to (changeover) alarm relay RL1



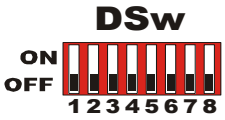
The below switchboard for connection of the power cables is placed in the **power circuit**



Power **SWITCHBOARD**

- 3-Phase power supply voltage
  L1-L2-L3 (RST)+PE
- 3-Phase load **U, V, W + GND**

2.2 EVDFAN3000: Technical Features

Power supply	Voltage	**400VAC** Three-phase - (on request **230VAC / 500 VAC**)			
	Voltage limits	Lower: 380 VAC – 10% (below this limit DL4 is ON)			
		Upper: 440 VAC + 10% (over 500 VAC SURGE FILTERS should be ON)			
	Frequency	50 / 60 Hz automatic selection			
	Overvoltage Protection	For Installation Category **II** (**4 KV**)			
	Mains monitoring	Monitoring of the presence of all 3 phases. The lack of one phase causes the device stop with DL4 active and activation of alarm and relevant relay			
Operating principle	Electronic three-phase voltage regulators for the phase-cutting regulation (through SCR, total control on the three phases) of the active voltage applied to the load; compensation for inductive loads and motors. The phase sequence is automatic and the load can be connected either star or delta.				
Current	Rated RMS current @ 50°C ambient temperature	**EVDFAN3080**	**8 A** up to **50°C** ambient; if over, decrease **0,6 A/°C**		
		EVDFAN3120	**12 A** up to **50°C** ambient; if over, decrease **0,6 A/°C**		
		EVDFAN3180	**18 A** up to **50°C** ambient; if over, decrease **0,6 A/°C**		
		EVDFAN3280	**28 A** up to **50°C** ambient; if over, decrease **1,0 A/°C**		
	Overload	**150%** of the rated current (max. **10"** every **3'**)			
Power	Control circuits	**5VA**			
	Thermally dissipated 4W/A	**EVDFAN3080**	**32 W @ 8A**	**EVDFAN3180**	**72 W @ 18A**
		EVDFAN3120	**48 W @ 12A**	**EVDFAN3280**	**112 W @ 18A**
Operating characteristics	**SLAVE CONTROLLERS rS**	The output voltage varies according to the value of the remote control signal **DIRECT:** the output increases as the input increases, **REVERSE:** the output decreases as the input increases. **Default:** the VAC output increases as the controlled variable increases			
INPUT Signals & Contacts	Analog control signals	The controller can be preset through DIP switches for working with any combination of the following operating modes: **0 – 10 Vdc (*)** — **Ri = 10 kOhm** **4 – 20 mA** — **Ri = 100 Ohm**			
	Logic control signal	**PWM** digital signal, from 3V to 30V, insulated and <u>not polarized</u>.			
		PWM	**3 to 30 V**		
	Start-Stop	Programmable voltage free "ON/OFF" contact: with Sw4 (for NO or NC)			
	T.K. motor	Voltage Free "ON/OFF" contact (NC)			
OUTPUT Signals & Contacts	Analog control signal	Slave Unit control signal : **0-10 VDC -** max **30mA**			
	Auxiliary Supply	**+20V +/- 20% ,** max **40mA** not stabilized, protected from short-circuit			
	RL1 Relay	Contact COM , NC, NA for Alarm relay **RL1**			
Available functions selections	Dip Swicht 	**DSw**	**1**	Select the regulation 0-10VDC or 4-20mA	
		DSw	**2**	Select the regulation mode: Direct / Reverse	
		DSw	**3**	Select the regulation: Linear / Quadratic	
		DSw	**4**	Select the NO/NC function mode of the Start-Stop	
		DSw	**5**	Select the RL1 alarm mode (bit 1)	
		DSw	**6**	Select the RL1 alarm mode (bit 2)	
		DSw	**7**	Enable the CosPhi adjust	
		DSw	**8**	Available for CUSTOMER custom, on request	

Visualisation Leds	**PWR**	**DL1**	**Green**	Power supply ON	
	CPU RUN	**DL2**	**Green**	Regulation O.K. : blinking DC 50%, frequency 0,5 Hz Regulation CosPhi ON : blinking DC 50%, frequency 2 Hz	
	Alarm **FAIL**	**DL3**	**Red**	**1** blink	Board overtemperature (>85°C)
				2 blinks	VAC power supply phase loss
				3 blinks	Thermal protection open
				4 blinks	Over range signal : 4-20mA : < 2mA ; > 24mA 0-10VDC : > 11,0 VDC
	PWR OUT	**DL4**	**Green**	Running: VAC output on work	
	%PWM IN	**DL5**	**Green**	PWM % on input (M3: 8/9)	
	RL1	**DL6**	**Green**	**RL1** relay (active if relay is energized)	
Predispositions	Starter			Fixed, 5”	
	Cut-Off			The regulation is set at the 25% of the VAC power supply	
Alarms	Input command			Verify the input signal range : - **0-10 VDC** > max value under **11Vdc** - **4-20 mADC** > min value **2mA** and max value **24mA**	
	Power supply			Phase loss – Power supply under range **(less 20% VAC supply)**	
	Mains phases monitoring			Verify the phase sequence and phase-loss and stops the regulation if the AC voltage is 20% below the rated one or in case of phase loss/incorrect phase sequence. Alarm ON with **Led DL4 (red) & relay RL1 (OFF)**	
	Working controller			Verify the working °C with internal probe (max 85°C)	
Protections	Overvoltage protection			Complying with **EN 61000-4-5**: Overvoltage Category **II** (**4 KV**)	
	Auxiliary supply voltage			With PTC for preventing failures due to short-circuits	
	Internal temperature			Internal thermal protection	
Case	Available cases			**IP55**	
	Materials			**GW-Plast 120°C** (max. temperature 120°C) and aluminum	
	Locking screws			**TPN** series with max. tightness **2,5 Nm**. (according to **CEI 23-58**)	
	Protection degree			IP 55 using Gland KIT	
	Environmental pollution			High pollution	
	Fire resistance			**D** Category	
Insulation	Case			Class **I** (use of protective earthing conductor)	
	Control circuits			**4000VAC** between control input and mains voltage components	
Environmental conditions	Working temperature			**-20 T 50** (–20°C to + 50°C) for temp < -10°C , use **Start Stop contact**	
	Storage temperature			**-30 T 85** (–30°C to + 85°C)	
	Humidity			**RH < 85% non condensing**	
	Vibrations			Lower than 1G (9.8 m/s^2)	
Installation	Wall mounting ONLY in vertical position, with **N° 4** holes **Ø 6** mm.				
Electrical Connections	Signal connections			Flexible cable, rated cross section **1,5 mmq / 15 AWG**	
	Power connections			**EVDFAN3080**	Flexible cable, rated cross section min. **2,5 mmq / 13 AWG**
				EVDFAN3120	Flexible cable, rated cross section min. **2,5 mmq / 13 AWG**
				EVDFAN3180	Flexible cable, rated cross section min. **6.0 mmq / 9 AWG**
				EVDFAN3280	Flexible cable, rated cross section min. **10.0 mmq / 7 AWG**
Compliance	**2006/42CE**			**2006/95CE**	**2004/108CE**

2.3 Installation and Mechanical Dimensions

The **EVDFAN3000** regulator have to be always stably mounted and fixed throughout the four (4) fixing holes suited on the lateral brackets, before its electrical connection.
The **EVDFAN3000** is always available in the **IP55** version for indoor or outdoor installation. The **IP20** and **IP00** versions for installation inside an electrical cabinet are available upon request only for some models (see mechanical dimension table below). The device is cooled for natural convention therefore there must be enough clearance above and below. Therefore ensure to have at least 150 mm clearance above and below the device

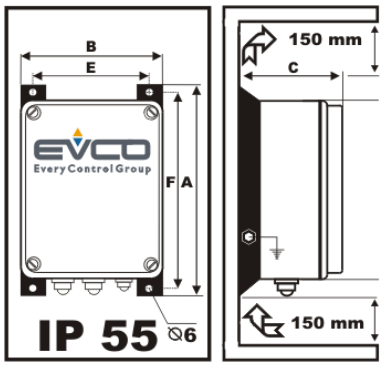
These versions have a high resistance (IK degree = 08) GW-plast 120°C case. The holes on the bottom part are intended for the electrical power cables entrance:

- Regulator power supply 4 poles line (**3-phases + PE**)
- Load power supply 4 poles line (**3-phases + PE**)
- Signal cables for analogue and digital inputs/outputs

In order to simplify the installation all the regulators are equipped with a standard set of polyamide glands (PA6 – class V2 – IP68) suitable for power and signal cables passage.

Model	Rated Current RMS	
	Ampere	kVA
EVDFAN3080	8	5,5
EVDFAN3120	12	8,0
EVDFAN3180	18	12,0
EVDFAN3280	28	18,6

DIMENSIONS (mm)							
IP	A	B	C	E	F	WEIGHT	Ø FIXING
55	253	234	116	210	200	2,5	6,0 mm.
55	285	201	130	153	255	3,8	6,0 mm.
55	285	201	162	173	255	4,5	6,0 mm.
55	350	235	204	173	320	7,5	6,0 mm.

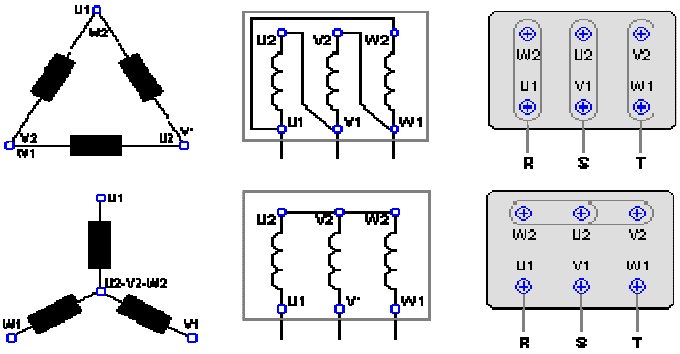


IP55

3 ELECTRICAL CONNECTIONS

The regulator **EVDFAN3000** allows the connection of three-phase asynchronous motors, in applications whose motor torque-speed characteristic IS quadratic. Thus it is especially suitable with axial fans, while centrifugal fans can be connected only if purposely specialized for the phase-cutting regulation.
The correct electrical connection and the supply voltage are reported on the motor data plate; the direction of rotation of the motor can be changed by swapping two of the three supply cables.
It is important to keep the power supply cable as short as possible, so as to minimize interferences and leakage (10 / 15 mt); otherwise it is recommended to install an auxiliary three-phase filter on the controller's output.

DELTA for High speed connection	
The windings voltage is:	$V_{ph} = V_n$
The windings current is:	$I_{ph} = I_n/\sqrt{3}$



STAR for Low speed connection	
The windings voltage is:	$V_{ph} = V_n/\sqrt{3}$
The windings current is:	$I_{ph} = I_n$

For the connection use rubber (FG7) or PVC cables taking into consideration the rubber insulation, which allows a limited cable cooling, stands higher temperature. In fact the PVC cables temperature cannot exceed 70°C whereas the rubber insulated cables can stand up to 90°C temperature. For this reason the cables working temperature should be referred to the insulation material. There could be some problem close to the connecting terminals where the temperature variation could cause the loosening of the fixing screws and the terminal overheating due to electrical resistance increasing. For this reason is critical that the insulation is NOT inserted into the terminal reducing the contact surface.

Cable size	**Max. Ampere (In *)**
1,5 mmq	**6 A / 10 A**
2,5 mmq	**10 A / 16 A**
4,0 mmq	**16 A**
10,0 mmq	**32 A**

(*) If the total ampere are equal to the nominal current, use the upper size cable; For the right connection, see the figure

The EVDFAN3000 regulator can control several motors connected in parallel, assuming that the absorption of their total current does not exceed the rated current indicated on the EVDFAN3000 data plate.
The speeds of the motors vary at the same time; variances in behaviour during start up and at low speeds are due to slight differences between the motors, even if they are of the same type;
However, if the required motor speeds have to be different, motors with different rated speeds must be used. Bear in mind that motors with very different characteristics create heterogeneous electrical situations, which may show problems on start up and at low speeds because of different resistances of the stators which require different voltages on start up and at low speeds.

3.1 Magneto thermal protection

The **EVDFAN3000** devices must be protected by a magneto thermal switch for preventing short-circuits and/or overload fitted upstream of the regulators; **Installation of magneto thermal protections is the responsibility of the installer** and consist of:

- 3 ultra speed fuses, suitable for semi conductors protection, able to protect against short circuit load side the power components (SCR) used for the regulation
- 3 phase magneto thermal switch with 'C' intervention curve

The installation of those protection devices ensures the electrical integrity of the regulator. Below the model/ratings of the recommended protections:

Model	**Magneto thermal Switch (max rating recommended)**	**Specialized Protection FUSE for SCR (*)**			
		Size	**Vac**	**Amp**	**Reference**
EVDFAN3080	**16 A**	**10 x 38**	**690 V**	**12**	**FR10GB69V16**
EVDFAN3120	**20 A**			**16**	**FR10GB69V16**
EVDFAN3180	**32 A**			**25**	**FR10GB69V25**
EVDFAN3280	**40 A**	**14 x 51**		**32**	**FR14GC69V32**

(*) to protect SCR-Power-Semiconductor of the EVDFAN3000 regulator, use Ferraz-Shawmut (or similar) specialized fuse for electronic power applications.

3.2 Connection of power supply and load

Connect the power supply and the load as shown in the figure below, being careful to employ conductors with a cross section suitable to the connected load.
The power cables (power supply and load), must be installed separately from the control cables (analog inputs and **ON-OFF** input/outputs), keeping the maximum possible distance between the power and signal conductors.
Do not place power cables with signal cables in the same raceway. In case the cables cross one another, ensure it is at 90°.

SURGE ARRESTER: electric protection placed between the regulator supply and the earth, meant to protect the device from transient overvoltage.

WARNING: disconnect the faston contact from the PE earth reference, before making the "ELECTRIC STRENGTH TEST".

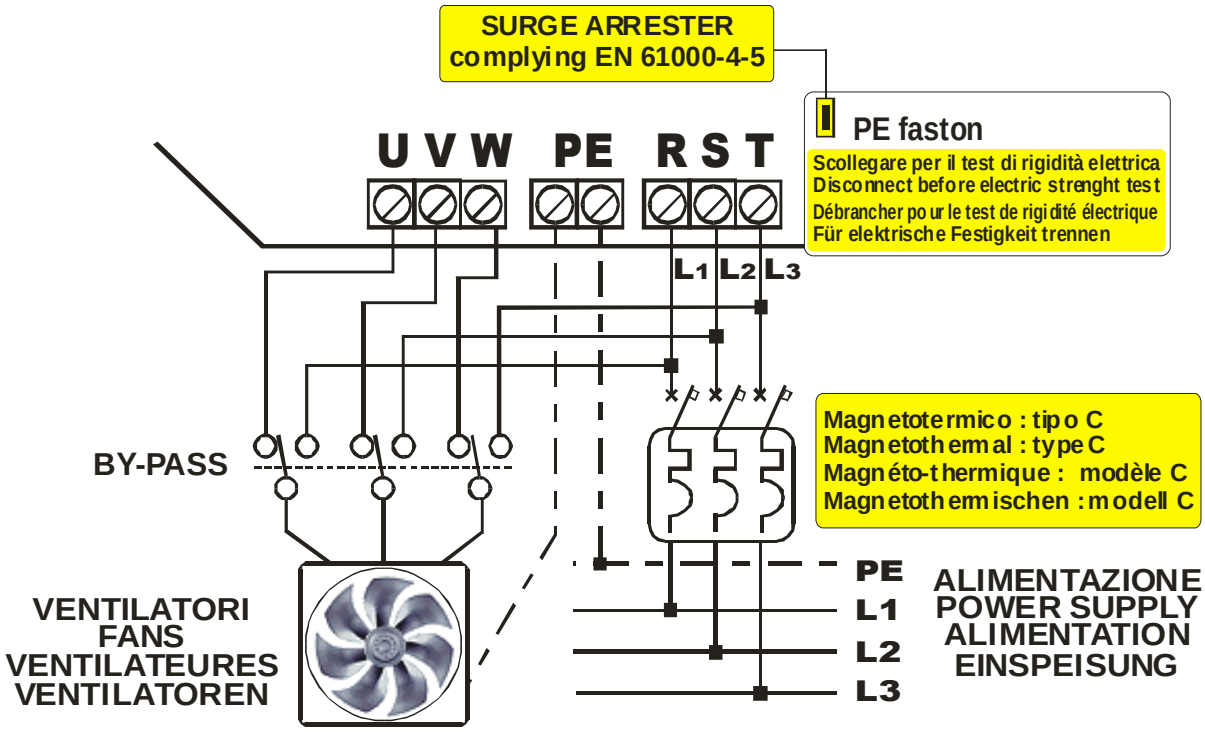
WARNING: In presence of a protection with DIFFERENTIAL SYSTEM, use switches with leakage current to earth ≥ 100 mA)

The **EVDFAN3000** regulators allow the connection of three-phase loads ***without requiring the connection of the neutral***.
This simplifies installation and facilitates the STAR or DELTA load configuration.
It is advisable to provide a Bypass Switch to allow the load activation, even when the cutting regulator is faulty
(**emergency by-pass**).

When connecting the Bypass, the following precautions should be taken into consideration:

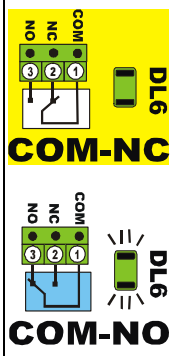
- ✓ **The connection through the Bypass Switch must keep the phase correspondence unaltered so as to avoid destructive short-circuits and maintain the sense of rotation of the motor.**
- ✓ **Before supplying the load with maximum voltage, the supply should be disconnected from the Regulator. Therefore:**
  - **It is advisable to use a three-position manual switch as a commutation device**

- **If automatic commutation is performed by means of contactors, make sure there is some delay (at least 2 seconds) between regulator disconnection and load activation**



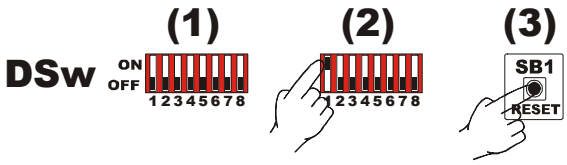
3.3 DIP-Switch (DSw1 … DSw8)

On the upper side of the regulator card there is an 8 positions DIP-Switch array (DSw1 a DSw8) which allows the easy modification of the EVDFAN3000 settings at any time.
The below table describes the standard functions available and their possible modifications.

<table>
<tr><th colspan="2">Dip Swicht (DSw)</th><th>Description</th></tr>
<tr><td rowspan="2">1</td><td>ON</td><td>Selection for 4-20 mA control signal on inputs</td></tr>
<tr><td>OFF</td><td>Selection for 0-10VDC control signal on inputs</td></tr>
<tr><td rowspan="2">2</td><td>ON</td><td>Reverse mode : the VAC output increases as the input command increases</td></tr>
<tr><td>OFF</td><td>Direct mode : the VAC output decreases as the input command increases</td></tr>
<tr><td rowspan="2">3</td><td>ON</td><td>Quadratic function mode</td></tr>
<tr><td>OFF</td><td>Linear function mode</td></tr>
<tr><td rowspan="2">4</td><td>ON</td><td>Start/Stop :for NC external contact (ON = run ; OFF = Stop)</td></tr>
<tr><td>OFF</td><td>Start/Stop: for NO external contact (OFF = run ; ON = Stop)</td></tr>
<tr><td>5&6</td><td> 
</td><td>Available Alarm relay setting functions: see the table and watch on the display
<table>
<tr><th colspan="2">DSw selection</th><th colspan="2" rowspan="2">With ALL O.K. >>> RL1 = ON >>> led DL6 = ON</th></tr>
<tr><th>DSw 5</th><th>DSw 6</th></tr>
<tr><td>OFF</td><td>OFF</td><td>RL1 = OFF</td><td>With ONE or more activated Allarms</td></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">OFF</td><td rowspan="2">RL1 = OFF</td><td>With ONE or more activated Allarms</td></tr>
<tr><td>With remote contact STOP = ON (S2 Stop/Start)</td></tr>
<tr><td rowspan="3">OFF</td><td rowspan="3">ON</td><td rowspan="3">RL1 = OFF</td><td>With ONE or more activated Allarms</td></tr>
<tr><td>With remote contact STOP = ON (S2 Stop/Start)</td></tr>
<tr><td>With VAC output = 0% (Fans OFF)</td></tr>
<tr><td>ON</td><td>ON</td><td>RL1 = OFF</td><td>With Power Supply OFF</td></tr>
</table></td></tr>
<tr><td rowspan="2">7</td><td>ON</td><td>Activation of the Cos-Phi setting modification (only factory procedure)</td></tr>
<tr><td>OFF</td><td>Normal function (factory Cos-Phi)</td></tr>
<tr><td rowspan="2">8</td><td>ON</td><td>Available custom function on request</td></tr>
<tr><td>OFF</td><td>OFF</td></tr>
</table>

N.B. After the Dip-Swicht (DSw) selection, press **RESET : SB1**; the controller restart with the new selected function

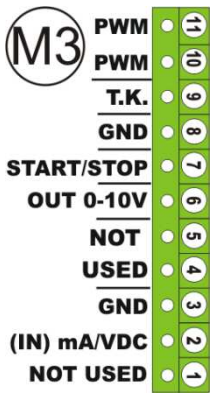
With DSw 5&6 = ON/ON, the alarm relay change to COM-NC position only with the OFF of the Power Supply



3.4 Control signals & Auxiliary contacts connection

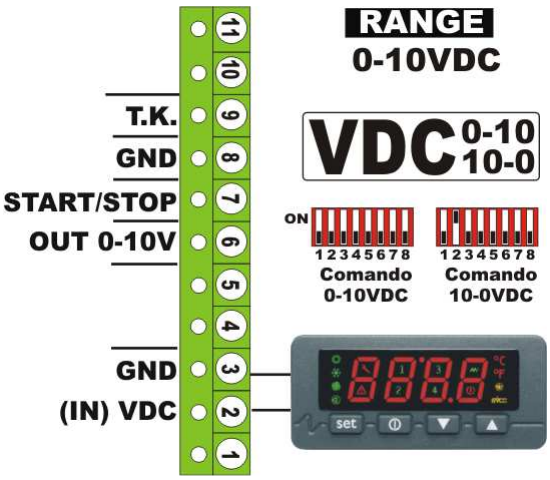
The figure below shows the label placed inside the regulator, which reproduces the electrical connections of control sensors/signals and of the available auxiliary contacts.

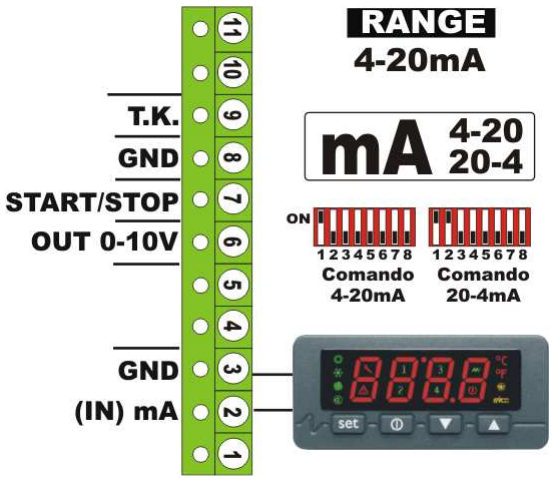
11	**PWM**	**PWM** digital signal, from 3 to 30V (10 mA max), insulated and not polarized
10	**PWM**	
9	**T.K.**	Connection of the thermal contact (NC)
8	**GND**	Ground Referenced
7	**Start/Stop**	NO/NC contact (Sw4 selection) for regulation Stop/Start
6	**OUT 0-10V**	0-10VDC (max 20mA) output, for SLAVE extra power unit
5	**NOT USED**	
4	**NOT USED**	
3	**GND**	Ground Referenced
2	**IN**	**Input for 4-20 mA 0-10VDC**
1	**NOT USED**	



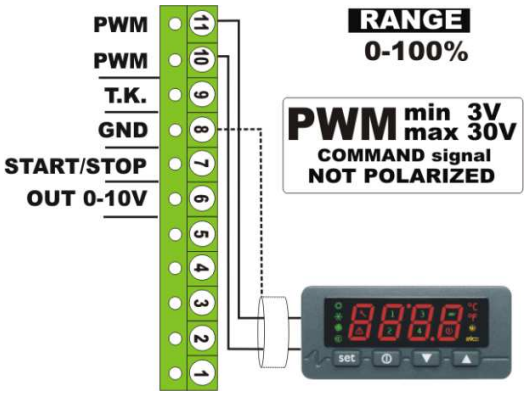
4 REMOTE CONTROL SIGNALS 0-10 Vdc / 4-20 mA / PWM

Below are represented the connections for the remote control regulations : **0-10Vdc, 4-20 mA e PWM,** coming from remote control unit, for Automatic regulation or Manual regulation (with Potentiometer);
with **DSw2=ON**, the controller work on **Reverse** mode: **10-0Vdc or 20-4mA (**for **rS** selection**)**



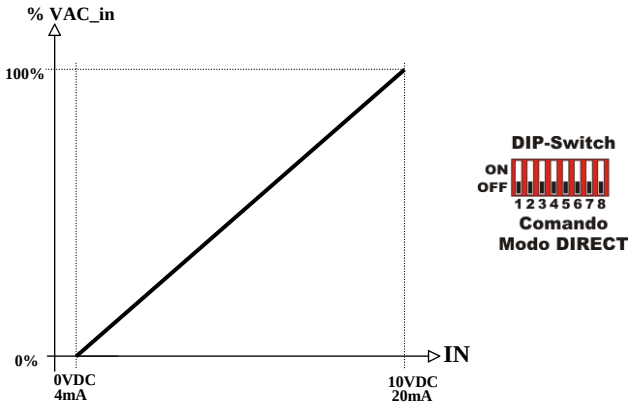


For REVERSE mode (input: 10-0V or 20-4mA): shift DSw/2 to ON position

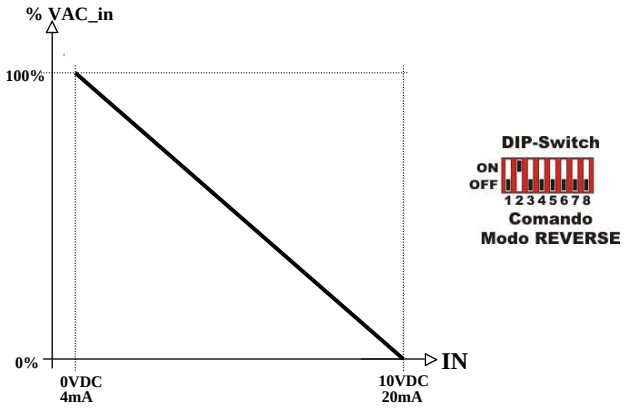


Input	IN min	Output MIN VAC	IN max	Output MAX VAC
0-10VDC	0,9 VDC	140 VAC	9,5 VDC	100% VAC
4-20mA	4,5 mA	130 VAC	19,0 mA	100% VAC

DIRECT mode

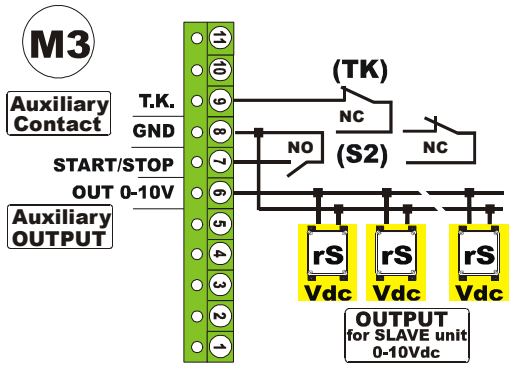


REVERSE mode



4.1 AUXILIARY CONTACTS & SIGNALS terminal block (M3)

On the M3 signals connections, there are available:
- START/STOP (S2) : contact NO/NC (Dsw4 selection);
- T.K. : contact NC, for thermal protection
- 0-10Vdc output, for extra power (SLAVE units)



OUTPUT (0-10V max 20mA): this output is available for the regulation of other SLAVE units and follows the regulated AC voltage output (U-V-W) depending on the DSw2 settings. The DC voltage signal is proportional to the input command

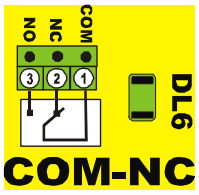
SIGNAL & ON-OFF contacts	**OUT**	**8 – 6**	**0-10VDC output signal for other SLAVE units**	
	S2	**8 – 7**	**Remote contact**	**DSw4=OFF**
				DSw4=ON
	TK	**8 – 9**	**Thermal contact**	

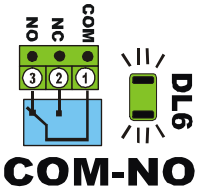
DSw2 = ON	0-10 VDC out	DSw2 = OFF	10-0 VDC out
S2=OFF	Working Enabled	**S2=ON**	Stop
S2=ON	Working Enabled	**S2=OFF**	Stop
TK=ON	Working Enabled	**TK=OFF**	Thermal Alarm

4.2 RL1 Alarm relay terminal block (M4)

On the upper side of the controller card, there is the RL1 Alarm relay, with programmable function for different level of warning.
With the factory selection, RL1 switch from NC position (1&2) to NO position (1&3).
Different alarm levels are selectable with the DSw 4&5 selection.

N.B. Aftyer the DSw selection, to confirm the change, press the **RESET : SB1** button.
With DSw 5&6 on position ON/ON, the alarm relay switch from NC position only with the Power Supply OFF.





Available Alarm relay setting functions: depending on device status as shown in the below table

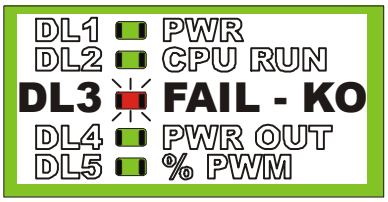
DSw selection		**with RL1 = ON >>> led DL6 = ON**	
DSw 5	**DSw 6**		
OFF	OFF	RL1 = OFF	In case of 1 or more active alarms
ON	OFF	RL1 = OFF	In case of 1 or more active alarms
			With device in STOP mode (from S2 contact)
OFF	ON	RL1 = OFF	In case of 1 or more active alarms
			With device in STOP mode (from S2 contact)
			With VAC output = 0% (fans OFF)
ON	ON	RL1 = OFF	With Power supply voltage OFF

DSw 5 & 6 **ALARM mode Selection for RL1 function**	ALARM selection table for relay RL1 function			
	ALL-1 (COM-NC)	**ALL-2 (COM-NC)**	**ALL-3 (COM-NC)**	**ALL-4 (COM-NC)**
	Power Supply OFF	Power Supply OFF	Power Supply OFF	**RL1= COM-NC** only with **Power Supply=OFF**
	Power S. under range	Power S. under range	Power S. under range	
	Controller K.O.	Controller K.O.	Controller K.O.	
	Phase loss	Phase loss	Phase loss	
		Remote STOP active	Remote STOP active	
			VAC output = 0%	

5 ALARMS

Alarm Led DL3

The alarms are displayed also by DL3 Alarm LED “FAIL”
The number of blinks indicates the type of alarm.

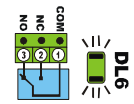
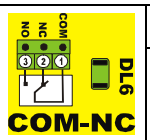


1 blink	Overtemperature Control card (>85°C)
2 blinks	Phase loss on power supply
3 blinks	T.K. contact OPEN
4 blinks	Input signal **(IN)** over range (*)

In case more alarms are present at the same time, the one with higher priority is indicated (corresponding to a lower number of blinking). In normal condition (no active alarms) the LED DL3 “Fail” remains OFF

(*) Input signal Minimum and Maximum limit for the possible configurations

Command signal	**Minimum value**	**Maximum value**
4 – 20 mA	2,0 mA	24 mA
0 – 10 VDC	---	11 VDC

	**DL6**	**green**	Indicates the state of the **ALARM** relay		
	48 Vac **5 Amp**		**DL6=ON** **1-3=OFF** **2-3=ON**		**DL6=OFF** **1-3=ON** **2-3=OFF**

The alarms are not memorized; Once the alarm cause runs out the corresponding signal is disabled and the units starts again the normal working mode

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